UNIVERSITY OF CAPE COAST

FOOD SAFETY KNOWLEDGE AND PRACTICES OF FOOD HANDLERS IN RESTAURANTS IN THE TAMALE METROPOLIS, GHANA

JUDITH AMMA SEIDU

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BY

JUDITH AMMA SEIDU

Thesis submitted to the Department of Hospitality and Tourism Management, Faculty of Social Sciences, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Doctor of Philosophy in Hospitality Management

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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: Judith Amma Seidu

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: Professor Francis Eric Amuquandoh

Co-Supervisor's Signature…….Date……

Name: Professor Ishmael Mensah

ABSTRACT

This study assessed the food safety knowledge and practices of food handlers in restaurants in the Tamale Metropolis. A descriptive research design was employed for the study. Data were collected from 214 food handlers in 23 restaurants within Tamale Metropolis through a multi-stage sampling method. Data were analyzed, using STATA version 15. Frequency, percentage, means, independent sample t-test, chi square and one-way ANOVA were the main tools used for the analysis. The results showed that the 77% of the food handlers in the restaurants were knowledgeable in food safety issues but this did not translate into food safety practices. Thus, there exist a gap between knowledge and practice. They were found to be more knowledgeable in environmental hygiene issues but fell short in some food hygiene issues such as knowledge on thawing frozen foods and storage of food items under appropriate refrigeration temperatures. The study also identified five major barriers to food safety practices such as time constraint and busy work schedule, lack or inadequate knowledge, lack of enforcement of food safety rules and regulations, inadequate resources or supplies and forgetfulness or lack of reminders. Based on these findings, it was concluded that, food handlers were knowledgeable about food safety issues, but did not put the knowledge into practice. It was therefore recommended that, facility managers in collaboration with the environmental health officers, and Food and Drugs Authority (FDA) put in place more stringent monitoring and supervision measures to improve on the food safety practices of food handlers in restaurants. More practical work be included in the curriculum for training manpower for the hospitality industry.

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DEDICATION

My family and children; Ivy A. Kpebu, Sophia A. Kpebu and Jude-Dan Kodje Kpebu.

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LIST OF ABBREVIATIONS

CODEX	–	Latin for "Book of Food"
CDC	-	Centre for Disease Control Prevention
EFSA	-	European Food Safety Authority
EHD	-	Environmental Health Department
EPA	–	Environmental Protection Agency
FAO	–	Food and Agriculture Organization
FDA	–	Food and Drugs Authority
FSK	–	Food Safety Knowledge
FSB	-	Food Safety Behaviour
FSMS	-	Food Safety Management System
GTA	–	Ghana Tourism Authority
GSA	-	Ghana Standards Authority
HACCP	-	Hazard Analysis Critical Control Point
HBM	–	Health Belief Model
KAP	–	Knowledge, Attitude and Practice
MOH	-	Ministry of Health
NRA	–	National Restaurant Association
PHU	–	Public Health Unit
TCH	–	Tamale Central Hospital
TRA	–	Theory of Reasoned Action
TPB	–	Theory of Planned Behaviour
TTH	–	Tamale Teaching Hospital
VSD	-	Veterinary Services Department
WHO	-	World Health Organization

CHAPTER ONE

INTRODUCTION

Background to the Study

The World Health Organization [WHO] (2006) defines food safety as the conditions and measures that are necessary during the production, processing, storage, distribution and preparation of food with the aim of ensuring that it is safe, sound, wholesome and fit for human consumption. In other words, it is a situation that gives an assurance that when food is eaten, it will not affect the health and well-being of the individual. For food to be considered safe, it should be devoid of any biological, chemical or physical hazards capable of causing food borne illness.

In the United States of America (USA), the Centre for Disease Control and Prevention (CDC), (2011) reported that about 48 million food-borne illnesses occur yearly; with over 128,000 individuals hospitalized and 3,000 resulting in death. According to the WHO (2015) report, approximately two million deadly cases of food poisoning occur in developing countries every year. The Ministry of Health (MOH, 2014) indicated that Malaysia recorded about 49.8 cases of food poisoning per every 10,000 population. In Ghana, Ababio and Adi (2012), Mahami and Odonkor (2012), and Salas, (2011) found that about 420,000 cases of food borne illnesses occur every year with an annual death rate of about 65,000 which was projected to cost 69 million US dollars to the Ghanaian economy.

It is noted from the foregoing that unsafe food has become a human health problem and the frequency of the outbreak of food-borne illness is a worldwide public health concern. This has led to the need to ensure food

safety in food service establishments and institutions (Sanlier & Konaklioglu, 2012; Lues & Van-Tonder, 2007). Consequently, governments, international organizations and local authorities have intensified their efforts to ensure food safety in the food chain process (Sanlier, 2010; Sanlier & Turkmen, 2010).

The strategies used included the adoption and enforcement of food safety laws and regulations, health education for food service employees and consumers as well as the adoption and implementation of food safety management systems (FSMS) and good hygiene practice standards (Moreaux, 2014). WHO (2010) suggested that raw foods be separated from cooked ones, separate equipment and utensils be used for different categories of food, foods be stored in separate containers to avoid cross contamination. Other recommendations indicate that fruits and vegetables that are eaten raw be thoroughly washed, cooking and reheating of foods be thoroughly done and promptly refrigerating all foods that will not be used immediately.

Based on the developments in the global market, the Government of Ghana also established regulatory bodies such as Environmental Protection Agency (EPA); Food and Drugs Authority (FDA); Ghana Tourism Authority (GTA); Ghana Standards Authority (GSA), Veterinary Services Department (VSD), Metropolitan, Municipal and District Assemblies (MMDAs) and the Public Health Units (PHU) of the Environmental Health Department (EHD) to enforce rules and regulations enacted by the government. This is intended to control or regulate the activities of food handlers to ensure the production and service of safe food.

Nevertheless, cases of food-borne illnesses continue to be on the increase especially in developing countries, serving as a threat to public

health globally (Tieyiri, 2008; Panchal, Bonhote, & Dworkin, 2013). This could be attributed to the presence of microbes, parasites, physical hazardous materials, and chemicals which are intentionally or unintentionally added to food or might occur naturally in the food or found in the environment (World Bank, 2000). These risk factors could be as a result of improper handling of food, inadequate cooking, addition of additives, the use of food and water from unsafe sources, improper holding temperatures, cross contamination between raw and cooked foods, as well as unclean equipment, poor sanitation and personal hygiene practices and ineffective food handling training (Askarian, Kabir, Aminbaig, Meish & Jafari, 2004; Barrabeig et al., 2010; Beatty et al., (2009) cited in Thelwell-Reid, 2014; Bryan, (1988) as cited in Brar, 2016; Coleman & Roberts, 2005; Grintzali & Babatsikou, 2010; MOH, 2012; WHO, 2010).

The MOH (2007) annual report confirmed this with the indication that more than 50% of all food poisoning cases were as a result of improper food handling by food handlers. Bolton et al. (2008) and Sanlier and Turkmen, (2010) also reported that poor food handling practices contribute to 97% of food borne illnesses during food preparation in food service establishments. Beatty et al., (2009) as cited in Thelwell-Reid (2014) linked food-borne disease outbreaks in US to the mishandling of food by food handlers as eleven food handlers were found to have positive stool cultures for *Samonella enteritidis.* The World Health Organization (WHO) also established that both food-borne and water-borne illnesses, jointly cause 2.2 million deaths every year; including the deaths of 1.9 million children (WHO, 2012).

Adams and Moss, (2008) explained that food handlers carry food borne pathogens in their hands, mouths, cuts, skins and hair which are transferred into foods during preparation. It was noted that infected food handlers were able to spread agents of gastrointestinal infectious diseases to consumers (Abdalla, Suliman, & Bakhier, 2009; Micheals et al., 2004). Thus, a single food safety error by an employee in any food service establishment has the tendency of affecting many consumers (Knight, Worosz & Todd, 2007).

Also, in Malaysia, the MOH (2012) found ineffective food handling training, the use of untreated water, and poor sanitation and hygiene as the main causes (risk factors) of food poisoning. Newman, (2005) indicated that even the way farming is done has a distinct effect on the quality of food items, especially vegetables, which makes them unsafe for consumption. This suggests that food contaminants can be introduced into different areas of the food supply chain from the farm to the table.

The foregoing implies that by the time any food item arrives at any food service establishment, it might be carrying some load of contaminants. It is therefore incumbent on food handlers to either control the load of contaminants that already exist in the food or prevent any further contamination. For this to be possible, it is very important that food handlers have very good knowledge of food safety issues and practices as well as understand the risks involved in serving unsafe food to the public.

Knowledge can be explained as the possession of factual information, experiences and know-how on some phenomena. It connotes the ability to acquire, retain and use information as well as a blend of understanding,

experiences, discernment and skill. Food safety knowledge refers to the level of awareness of food safety issues and practices. It is associated with the application of rules, knowledge and skills that lead to action (Kaliyaperumal, 2004). As indicated by a Chinese philosopher, knowledge is the beginning of practice and practice is the end of knowledge (Yambo, 2016). Thus it is anticipated that individuals will put their food safety knowledge into practice to reduce incidence of food borne illnesses. In this regard, food handlers' knowledge is regarded as a fundamental and most important factor in the production of quality food throughout the food chain (Joseph, 2018; Panchal, Carli & Dworkin, 2014). Thus, food handlers with good knowledge on the hazards capable of contaminating food as well as appropriate food handling practices could be in the position of controlling or preventing food borne illnesses (Angelillo, Viggiani, Rizzo & Bianco, 2000).

However, researchers have identified inadequate or lack of food hygiene knowledge, poor food handling practices, non-compliance to food safety rules and regulations coupled with non-enforcement of food safety laws and regulations by the enforment agencies as factors contributing to food borne infections (Askarian, Kabir, Aminbaig, Meish & Jafari, 2004; Coleman & Roberts, 2005; Grintzali & Babatsikou, 2010).

In addition to lack of knowledge and supervision, Yatsco (2000) as cited in Paez and Ortiz (2011), identified lack of food safety training and certification; problems with equipment and layout of facilities as factors that affect the possibility of offering safe food in Costa Rica. Consequently, a number of researches have identified training as a way of improving food handlers' food safety knowledge and a means of reducing the risk of food

borne diseases (Averett, Nazir & Neuberger, 2011; Finch & Daniel, 2005; Lynch et al., 2005; Roberts et al., 2008). Thus, it is highly important that food handlers receive appropriate training on food safety issues to help in the prevention food borne illnesses.

Universally, it has been noted that institutional food service and catering establishments are major sources of food-borne outbreaks in both developed and developing countries (EFSA, 2010). CDCP (2010) reported that about 41% out of 1,097 food borne illness outbreaks in the United States of America (USA), were specifically linked to restaurants.

In an attempt to prevent or reduce incidences of food-borne diseases, restaurants are an important setting to target since they have been identified as one of the most frequent outlets for food-borne illness outbreaks (CDC, 2013; Knight, Worosz & Todd, 2007). One of such instances is the Jack in the Box *E. coli* outbreak in the US where about 700 people fell ill and four children died after the consumption of contaminated meat purchased from the 73 Jack in the Box restaurants (Golan et al., 2004).

Similarly, Barnes, (2005) reported that over 400 suspected cases of food poisoning were traced to two Turkish restaurants in Melbourne, Australia; which resulted in at least seven people being hospitalized. In addition, it was noted that over 600 consumers were infected with norovirus after eating in two Lansing restaurants in Michigan, US, (Clark, 2010).

According to Charnley, (2008). Frederict Accum (a German chemist) investigated into the usage of adulterants and identified many toxic colouring in foods and drinks. The study indicated that in 2003 Sudan dye (industrial dye) was found in foods such as chilli powder and foods containing chilli

powder in the European Union. This led to the issuance of notification by several EU member states on the presence of Sudan IV and Sudan I in foods like curry powder, chilli powder, sumac, curcuma, processed products containing chilli and palm oil (RASFF, 2005).

In Ghana, Amoako-Mensah (2016) assessed the prevalence of palm oil adulteration with Sudan IV dye in the Greater Accra Region. The study revealed that 96% of sampled palm oil drawn from the open market tested positive for Sudan IV dye. Thus adulteration of food poses a risk to food safety.

Also, it was reported that due to poor sanitary conditions, the occurrence of cholera outbreak in Accra claimed about 130 lives and more than 12,000 people were hospitalized. The report added that the cases increased to as high as 17,000 with 150 deaths (Myjoyonline, 2014). It is worth noting that there have been reported cases of foodborne illnesses including food poisoning (a kind of food borne illness); where the affected people show syptoms such as abdominal cramps, diarrhea, cholera, vomiting, loss of appetite, mild fever and nausea in Tamale metropolis.

The results from an enquiry made into the situation of food borne illnesses in two public hospitals (Tamale Teaching Hospital- TTH and Tamale Central Hospital-TCH) in the metropolis are presented in Figures 1 &2. The graphical representations show fluctuating (rise, fall and rise) trends in both diarrhea and food poisoning cases in the metropolis over a three year period (2014 - 2016). This means that issues on food borne diseases in Ghana is not a sectorial but national issue.

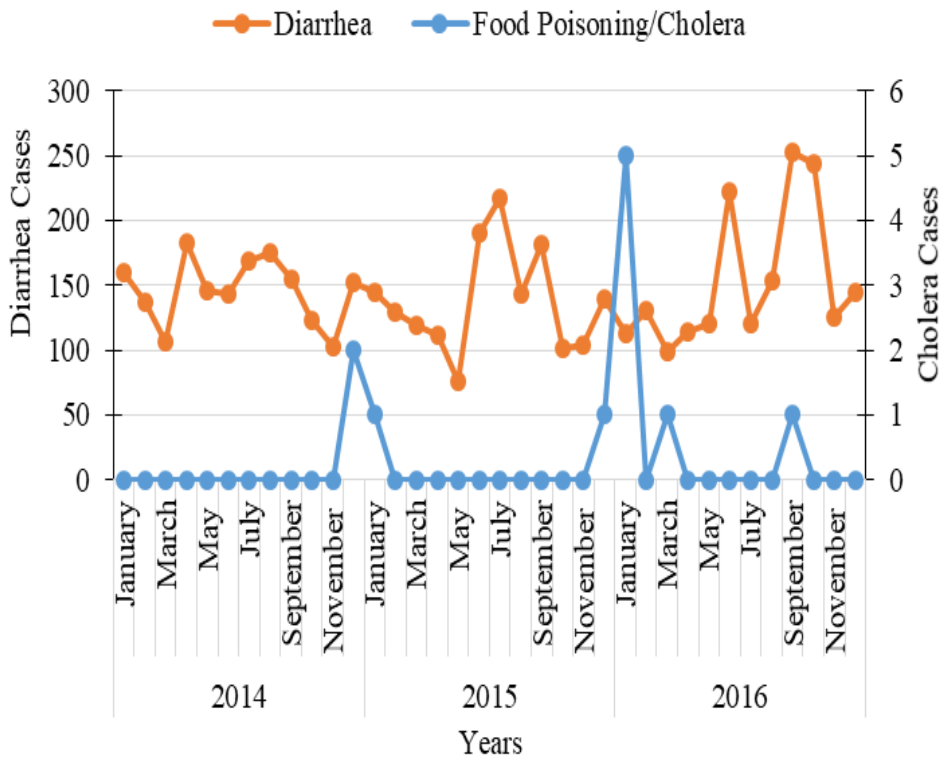


Figure 1: Out Patient Cases of diarrhea and food poisoning in TTH
Source: Hospital records (2017)

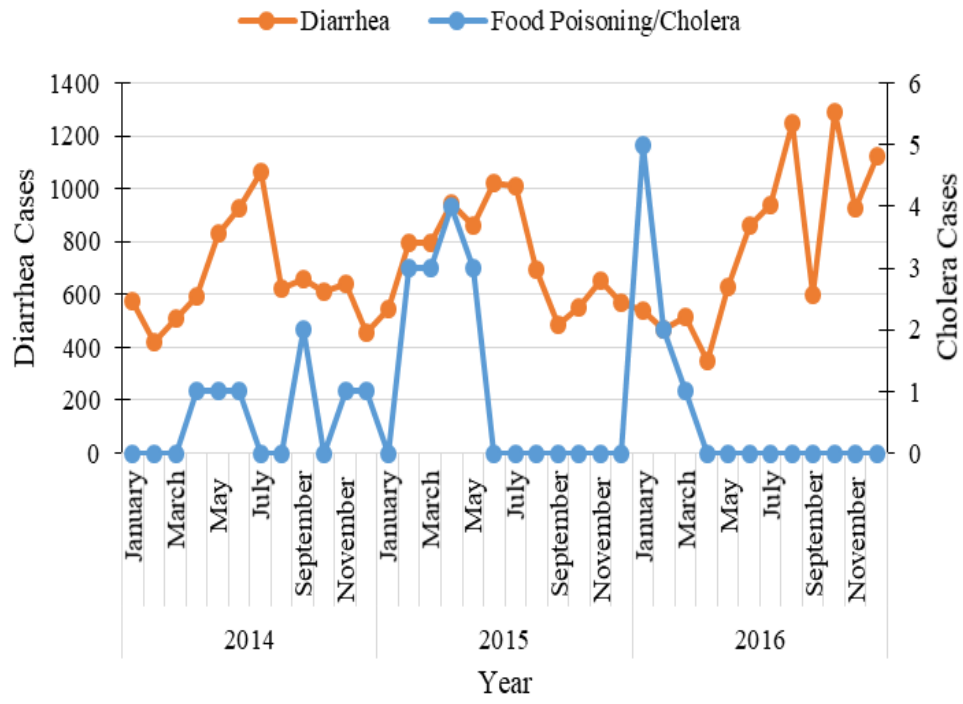


Figure 2: Out Patient Cases of diarrhea and food poisoning in TCH
Source: Hospital records, (2017)

Existing studies such as those by Alqurashi, Priyadarshini and Jaiswal (2019), FAO, (2012), Glanz, et al., (2002) and Onyango, Kieti, and Mapelu (2016) suggest that good levels of knowledge on food safety among food handlers and effective application of such knowledge to food handling are vital in ensuring safe food production in any catering operations. It is therefore very important that food handlers have knowledge on food safety issues either through education/training, experiences and research information which could go a long way to influence their practices and minimize food-borne disease outbreaks. In other words, there is the need for restaurant operators and their employees to appreciate the interaction of prevalent food safety beliefs, knowledge and practices. Onyango et al. (2016), through the use of self-administered questionnaires and observation checklist, found that high food safety knowledge impacted positively on attitudes towards temperature control and personal hygiene.

Statement of the Problem

As a result of rapid urbanization many people eat outside the home; and this has made food establishments to become more important than ever (Feldman, 2015). Unfortunately, the increase dependence on food from food establishments including restaurants has been linked to a number of health challenges including typhoid, cholera, diarrhea in several countries including United States of America (Cates et al., 2009; Howells, 2005; Jones & Angulo, 2006), United Kingdom, Canada (Mathias et al., 1995), Australia (Morrison, 1998), Nigeria (Onyeneho & Hedberg, 2013) and Ghana (Salas, 2011). Studies on the outbreak of food borne diseases indicate that eating food

prepared in food establishments continues to be a major source of infection (Jones & Angulo, 2006).

Specifically, food handlers' failure to follow acceptable food safety standards in the preparation, processing, cooling and storing of food (Tomohide, 2010) causes food borne illnesses. Other common food safety breeches that have been identified to characterize their operations are obtaining food from unsafe sources, inadequate cooking, improper temperature holdings, and the use of contaminated equipment (Adams & Moss, 2008; EFSA, 2009; WHO, 2002).

Since eating out, including eating in restaurants, is associated with ill-health and frequent outbreak of foodborne illnesses, it is required that attention be paid to food safety training, knowledge and practices of all individuals who prepare food for public consumption on regular basis. This is premised on the fact that health education for food service employees and consumers has been found to be central in the prevention of frequent outbreak of foodborne illnesses. (Alqurashi, Priyadarshini & Jaiswal, 2019; FAO, 2012; Glanz et al. 2002; Onyango, Kieti, & Mapelu, 2016).

Unfortunately, in Ghana researchers have paid much attention to food safety knowledge and related issues among street food vendors, traditional caterers and chopbars with little attention on food safety in restaurants. In their review of literature on food safety issues in Ghana, Ababio & Lovatt (2015) indicated that most of the research efforts on commercial food operations have focused on street foods and microbiological safety with limited information from institutional catering and other forms of food hazards. For instance, King, Awumbila, Canacoo, and Ofosu-Amaah, (2000)

assessed the safety of street foods in five sub-districts in the city of Accra while Mensah et al. (2002) investigated into microbial quality of foods sold on the streets of Accra and factors predisposing them to contamination. Again, Ayeh-Kumi et al. (2009) through screening assessed the prevalence of intestinal parasitic infections among 204 food vendors from seven metropolitan areas of Accra. Similarly, Ackah et al. (2011) carried out a study to determine the hygienic knowledge and food safety practices among street food vendors in Accra.

With the influx of non-governmental organizations (NGOs) and the adoption of tourism as a development option by Ghana in 1983 there has been an increasing popularity of tourism in the northern half of the country; particularly in the Tamale Metropolis. As a result a number of restaurants have sprung up to meet the food needs of guests that visit the area. Despite the increase in the number of restaurants and their potential health threats to the public, no detailed studies have been conducted into the food safety knowledge and practices of this group of food handlers.

In Ghana most researchers have focused on food safety issues in the southern sector of the country at the expense of the northern half. This is against the background that the occurrence of food borne illnesses remains a significant health issue in the entire country including the northern region. Outpatients records compiled by the two main hospitals in the Tamale Metropolis from 2014-2016 indicate that diarrhoea and food poisoning are common in the area (Fig. 1 & 2). Accordingly, for the knowledge base on food safety in Ghana to be complete there is the need to have a comprehensive information on food safety knowledge of food service

operators including restaurant operators in the northern region. It is on these grounds that this study sought to explore the food safety knowledge and practices of food handlers in restaurants in the Tamale metropolis in the Northern region of Ghana.

Research Questions

The research questions that guided the study were;

1. What are the food safety knowledge dimensions of food handlers in restaurants in the Tamale metropolis?
2. Which sources do food handlers obtain food safety information from?
3. What are the food safety practices of food handlers in the restaurants? and
4. How is food safety knowledge related to practices of food handlers in restaurants?
5. What are the barriers to food safety practices in restaurants?

Objectives of the Study

The main aim of the study was to assess the food safety knowledge and practices of food handlers in restaurants in the Tamale Metropolis. The specific objectives were to:

1. assess the food safety knowledge of food handlers in restaurants
2. identify the sources from which food handlers obtain food safety information
3. examine the food safety practices of food handlers in the restaurants
4. analyze the relationship between food safety knowledge and practices of food handlers in restaurants

5. find out the barriers to food safety practices in restaurants

Hypotheses of the Study

$H_{1:}$ There will be a significant difference in the personal hygiene knowledge by the sex of the food handlers.

H_o: There will be no significant difference in the personal hygiene knowledge by the sex of the food handlers.

$H_{1:}$ There will be a significant difference in the food hygiene knowledge by the religion of the food handlers.

H_o: There will be no significant difference in the food hygiene knowledge by the religion of the food handlers.

$H_{1:}$ There will be a significant difference in the environmental hygiene knowledge by the educational status of the food handlers.

H_o: There will be no significant difference in the environmental hygiene knowledge by the educational status of the food handlers.

$H_{1:}$ There will be a significant difference between food safety knowledge and food safety practices of the food handlers.

H_o: There will be no significant difference between food safety knowledge and food safety practices of the food handlers.

Significance of the Study

The study will contribute both to theory and practice. In terms of theory this study will address the imbalances in food safety research which focused on the food safety knowledge of street food vendors at the expense of food handlers in restaurants.

The study will also address the concentration of research efforts on food safety knowledge and practices in Southern Ghana especially the capital city of the country, thus, addressing the gaps in the available literature on food safety knowledge and practices in restaurants.

With reference to practice, the study provides valuable information to policy makers and planners to design and introduce appropriate food safety interventions to address the factors mitigating against the food safety practices of food handlers in restaurants. This would enable them to design and modify their plans and policies towards effective regulation and monitoring of activities.

It is anticipated that the findings of the study will inform the facility managers of their employees' level of food safety knowledge and practices to enable them to take steps to address or overcome shortfalls.

In addition, the study would help in identifying the training needs of food handlers which will help managers and stakeholders to initiate suitable food safety interventions including health education programmes to improve upon the food safety knowledge and practices in restaurants.

Finally, the results of the study will be a source of valuable information to the Ghana Tourism Authority, Foods and Drugs Authority and Health and Sanitation officers to redesign or modify their regulatory and monitoring strategies and schedules to bring about effective monitoring to ensure appropriate food safety practices.

Delimitation of the Study

Though there are different categories of hotels and restaurants, the study focused on grades 1-2 independent restaurants and 1-2 star hotel

restaurants in the Tamale Metropolis to ensure effective work within the time available. In all, eleven independent restaurants and 12 hotel restaurants were used for the study. Nevertheless, the findings may be adapted to other facilities with similar characteristics as well as other districts, municipalities and metropolises.

Definition of Terms

Food handlers: refers to all persons who work in the facilities' kitchens and have access to or come into contact with the food, equipment or utensils and food contact surfaces as well as those involved in packaging or un-packaging foods.

Food hygiene practice: Activities carried out by food handlers to protect foods from contamination.

Qualified food handlers: for the purpose of this study refers to employees in a restaurant who handled, prepared and served food; especially potentially hazardous foods.

Limitations of the Study

The study concentrated on the food safety knowledge and practices of food handlers leaving out their attitudes which is an important variable highlighted in all the theories and models associated with the study. Also, purposive and accidental sampling was used to select the respondents and the restaurants. This excluded the knowledge and practices of workers who were not carrying out activities that were not directly linked to food preparation and service. In other words workers such as bar operators, cashiers, grocery shop attendants and all other workers who were not handling food and equipment

in the kitchen and restuarant at the time of visit were not included in the study. These limitations prevent the generalization of the findings of the study beyond the food handlers in the restaurants who have direct link with the processing and cooking and serving of food.

Organization of the Study

The study is organized into seven chapters. The first chapter which introduces the study covers the background of the study, the statement of the problem, the research questions, the objectives of the study, significance of the study, delimitations, limitations of the study, and the definition of terms.The second chapter focuses on related theories, models and conceptual framework guiding the study. The theories and models discussed included the Theory of Reasoned Action, Theory of Planned Behaviour, the Health Belief Model and the KAP model.

The third chapter discusses relevant literature on food safety knowledge and practices of food handlers. The areas of attention were the concepts related to food safety and empirical findings on food safety standards and regulations, food safety knowledge and practices in restaurants, sources of information on food safety, effects of knowledge on food safety practices and barriers to food safety practices.

Chapter four covers the research methodology adopted for the study which includes the profile of the study area, research design, population, sample and sampling procedure, data collection and data analysis procedures.

Even though the objectives of the study presented in chapter one did not focus on the socio-demographic characteristics of the respondents, they emerged as an opportunistic data relevant to the study. Consequently, Chapter

five presents the socio-demographic analysis of the respondents as well as the theoretical approaches to the study and food safety knowledge of the respondents.

Chapter Six deals with the findings and discussion in relation to the food safety practices of the respondents and the barriers to the respondents' food safety practices. Chapter Seven covers the summary, conclusions and recommendations based on the findings and suggestions for further studies to be conducted.

CHAPTER TWO

THEORETICAL APPROACHES TO FOOD SAFETY KNOWLEDGE AND PRACTICE

Introduction

This chapter discusses relevant theoretical issues and models underpinning the study. According to Denison (1996) as cited in Amuquandoh, (2006) it is common for researchers to merge components from various theories to enable them get a better understanding of how behaviour change occurs. Consequently, a variety of theories and models have been discussed to help explain a multiplicity of human behaviours and how human actions are guided (Rennie, 1995) as well as the relationship between food safety knowledge and practices of food handlers. Thus, some of the theories that informed this study include the Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB), the Health Belief Model (HBM), and the Knowledge, Attitude and Practice (KAP) model.

Theory of Reasoned Action (TRA)

This theory was first presented by Fishbein (1967) in an attempt to understand the relationship between attitude and behaviour. McKemey & Sakyi-Dawson (2000) as cited in Rehman et al., (2003) described TRA as an important sequence of related concepts and assumptions developed by social psychologists to understand and predict human behaviours as displayed in Figure 3. According to Ajzen (1988), the theory is based on the assumption that human beings are rational and so they conduct themselves in a sensible way taking into account the availability of logical information as well as the implications of their behaviour. This suggests that individuals consider the repercussions of their actions before they decide whether or not to behave in a

given way. In other words, food handlers will have to consider the consequences or effects of their actions in relation to food safety measures before they decide to obey or not to obey food safety rules and regulations.

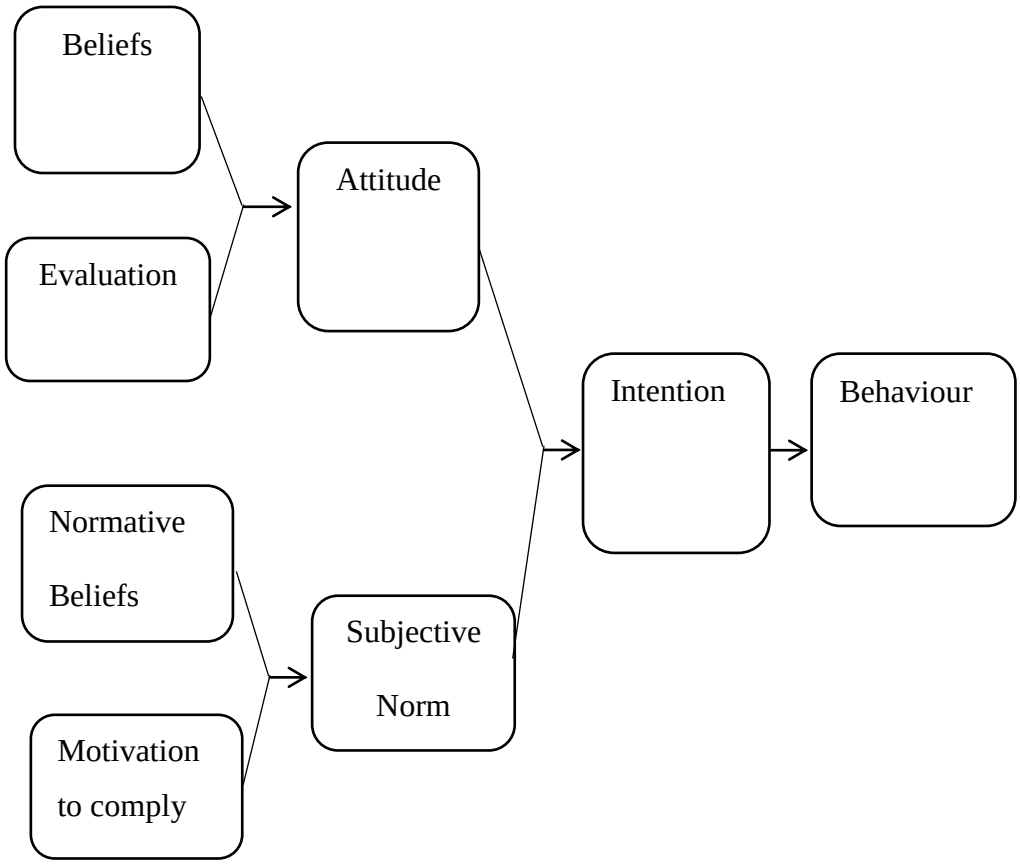


Figure 3: Theory of reasoned action
Source: Ajzen & Fishbein (1980)

According to Tlou (2009), the precise determinant of an individual's behaviour in the TRA is considered as the individual's behavioural intention and the condition most likely to predict behaviour will be provided when appropriate measures of behaviour have been obtained. The theory endeavours to explain the relationship between beliefs, attitudes, intentions and behaviour as indicated in the figure. Nevertheless, the extent of the individual's intension will not always be an accurate predictor of behaviour. To buttress this assertion, Ajzen and Fishbein (1980) indicated that the intention-behaviour relationship is important in the prediction of outcomes, as

the desire for a specific outcome will determine whether or not a person engages in a particular behaviour. Thus, in relation to food safety, it is what the food handler is aware of or the goal or name the facility wants to attain that motivates the employees to take action in an expected manner.

Tlou (2009) is of the view that the immediate determinants of an individual's behavioural intentions are his or her attitudes towards performing the behaviour and the subjective norms associated with the behaviour. In other words the food handlers' attitude to food safety practice is determined by their expected outcomes as well as whether the people who matter (managers, facility owners) support or do not support the action. For instance if a food handler has a positive attitude towards the use of hand gloves or food thermometers to check temperatures of incoming foods before storage and the facility owner or manager does not see the need, the item will not be provided and the intention of the food handlers will not be fulfilled. Thus, attitude is determined by one's belief about the consequences or attributes of performing a specific behaviour while a person's subjective norm is determined by whether important people support or do not support the behaviour coupled with the person's motivation to comply with what they suggest (Montano & Kasprzyk, 2002).

In effect, the theory assumed a fundamental linkage that associates behavioural and normative beliefs to behavioural intention and behaviour through attitude and subjective norm. This means that food handlers will put food safety measures into practice when they evaluate them positively and believe that significant others (facility managers and owners, chefs, regulatory agencies) think they should execute them. Montano and Kasprzyk

(2002) indicated that the TRA is appropriate in explaining behaviour when there is high control over the individual's freedom to choose something or make own decisions.

The implication is that, in this situation of food safety knowledge and practices, there is a high degree of perceived and actual control over the internal and external factors that may get in the way of the performance of the intended action. For instance, coupled with the dictates of significant others, barriers such as inadequate supplies, busy work schedules, working within time limits and work culture could support or defeat the intended action.

The limitation associated with this theory is that, it tends to eliminate human nature, which also plays a role in decision making processes and focuses on only the strong cognitive orientation (Dutta-Bergman, 2005). The theory assumes that human intentions exclusively influence their behaviours. It looses sight of the fact that past behaviour can also best predict future behaviour based on the reason that environmental stimuli may habitually trigger a behavioural response (Sutton, McVey & Glarz, 1999).

Another setback of the theory is that it assumes that when an individual forms an intention to act, he or she will be free to act without restrictions; whereas in reality, conditions such as rigid ability, time, environmental, organizational limits and lack of awareness will restrict the individual from acting or behaving in a specific planned manner or way.

Theory of Planned Behaviour (TPB)

According to Armitage and Conner (2001), the theory of planned behaviour (TPB) was developed by Ajzen and Fishbein (1980) out of the theory of reasoned action. Ajzen & Fishbein modified the TRA to include

perceived behavioural control. Thus, the TPB describes how attitude, subjective norms and perceived behavioural control could influence behavioural intentions as well as guide actual behaviour outcomes (Park & Levine, 1999) as illustrated in Figure 4.

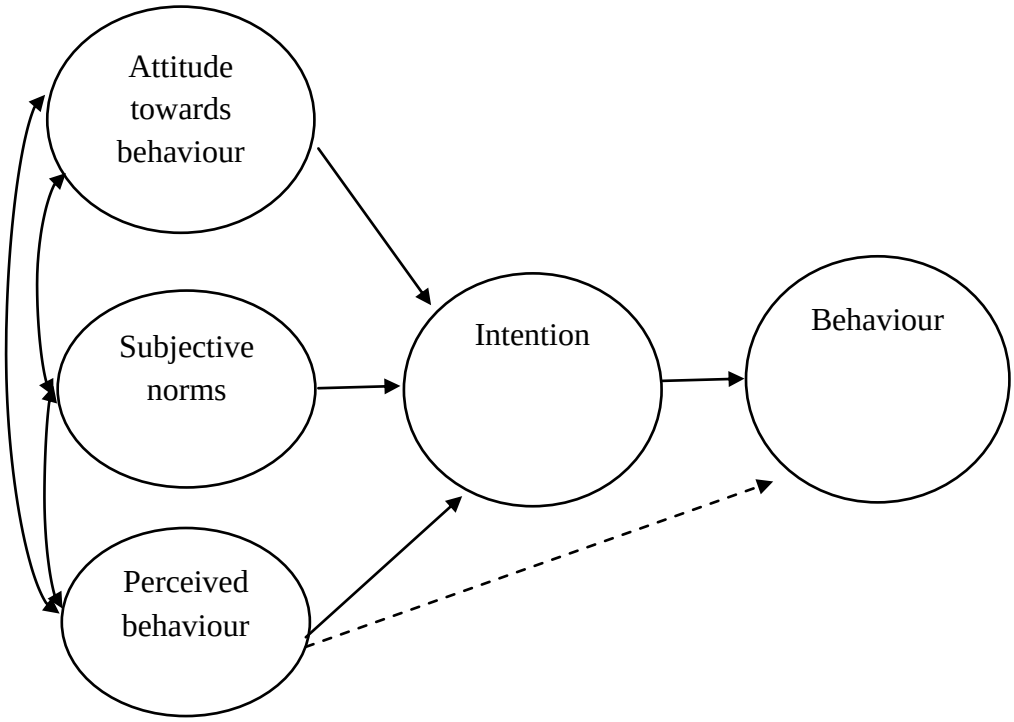


Figure 4: Theory of Planned Behaviour
Source: Ajzen (1991)

The underlying principle of including perceived behavioural control in the theory was that it will allow the prediction of behaviours that were not under complete authority to make decisions that affect intention towards behaviour (Armitage & Conner, 200I). This means that the theory of planned behaviour is more appropriate to explain behaviour in conditions where power to choose or volitional control is low (Ajzen, 1991). Thus, the perceived behavioural control is determined by control beliefs concerning the presence or absence of facilitators and barriers to behavioural performance, influenced by the perceived power or input of each factor to facilitate or inhibit behaviour.

The perceived behavioural control is likened to Bandura's concept of self-efficacy which refers to one's belief in his or her ability to perform a particular action under different conditions (Montana & Kasprzyk, 2002). This indicates that perceived behavioural control can be considered as an individual's perception of his or her ability to perform or not to perform an action. Ajzen (1991) and Montana & Kasprzyk (2002) further explained that the perceived behavioural control is determined by control beliefs in relation to the power of both situational and internal factors as inhibitors, barriers, or facilitators to the performance of the behaviour. Thus, it can be concluded that persons with strong control beliefs about factors that assist behaviour will have high perceived control which in turn translates into an increased intention to perform the behaviour.

According to Fishbein and Ajzen (l975), attitudes toward behaviour involves individual's assessment of how positive or negative performing the behaviour would be and how subjective norms reflect individual's perceptions of social pressure to either perform or not to perform an action. They indicated that both attitudes and subjective norms are based on beliefs and that the individual's intentions serve as mediation point for behaviour to be carried out. Consequently, Ajzen (1991) conceptualized subjective norms as an individual's perception about a given behaviour which is influenced by the judgment of significant others, such as facility owners, managers, restaurant and hoteliers' association, GTA, FDA and other regulatory agencies. Therefore, the fundamental feature in the TPB is the individual's intention to execute a given behaviour such as putting food safety rules and regulations into practice. In his opinion, intentions are supposed to cover the motivational

issues that influence behaviour; their indications of how hard individuals are ready to try, how much effort they are prepared to exert, in order to perform the behaviour. Therefore, the individual is motivated to behave in a way based on the benefits he or she is likely to derive from it; coupled with the social pressure to act.

In terms of food safety practices, the theory suggests that the food handler's personal attitude towards food safety would determine the hygiene practices adopted. 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 hygienic quality of the food. Moreover, the ease with which the food handler can practice food safety measures is also a determinant of intended or actual food safety practices.

The intended action articulates the nature 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 & Nichols, 2012).

In this sense, the practice of food safety measures by food handlers could also be conditioned by the availability of effective monitoring institutions, official standards of operating food service outlets and facilities

as well as effective information dissemination and communication channels for educating food vendors on food safety practices. .

Importantly, the theory of planned behaviour takes care of the weakness in the previous theory to deal with incomplete volitional control and indicates that individuals perform certain acts under the assumption that people behave rationally (Ajzen, 1991), considering the ramification of their actions (Ramayah, Lee & Lin, 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 served would also be associated with the unintended actions of the food handlers. For example, the food handler might use vegetables that were sprayed with insecticides a few days back for food, which might lead to food poisoning. It might be argued that the sourcing of the vegetables and ingredients are planned and rationalized by the food handler, although the farmer is more likely to be responsible for the contaminated state of the vegetables. This means that not all behaviours and actions can be planned.

The questions that come to mind based on the theory of planned behaviour in relation to food safety practice are: does the intention to maintain safe hygienic conditions actually lead to how well food handlers practice food

safety measures? Will attitudes, subjective norms and perceived behavioural control account for the challenges or barriers to the hygienic practices among food handlers? It was noted that 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) maintain that some health behaviours may be largely influenced by emotions. Strong emotions are relevant to this model because they can influence beliefs and other constructs, such as attitudes and perceptions.

TPB is also limited by the fact that it did not consider demographic factors and at the same time failed to clearly outline the perceived behavioural control, thus making it difficult to measure. Like the theory of reasoned action, the theory of planned behaviour assumes that people are rational and make systematic decisions based on available information and ignores unconscious motives. The theory did not consider the fact that the more the time between behavioural intent and actually exhibiting the behaviour, the less likely the behaviour will happen.The theory is also criticized for its failure to fully mediate the influence of past behaviour, particularly when a meta-analysis conducted by Conner and Armitage (2003) revealed that past behaviour accounts for an additional 13% of variance in behaviour.

The implication is that as rational human beings, food handlers are required to make decisions on food safety practices bearing in mind available information (both internal and external factors) and the time within which to carry out the action or behaviour. If the interval between the plan or intention to act and the time of action is too long, there is the likelihood that the action

may not come on. Thus, there is the need for food handlers to act promptly when the intention is formed otherwise the action is less likely to take place. The emotional influence of past experiences and practices as well as the approval of certain food safety practices were considered in this study.

The Health Belief Model (HBM)

The Health Belief Model (HBM) was developed in the 1950 by a group of social psychologists in United States (Hochbaum, Rosenstock and Kegels) to explain and predict health behaviours (Glanz et al., 2002). It was meant to address the failure to free tuberculosis (TB) health screening programme in the USA. The model has since, then, been adopted to explore a variety of health behaviours such as sexual risk behaviour and transmission of HIV and AIDS (Hanson & Benedict, 2002) as well as in the identification of the attitudes of older adults towards the adoption of safe food-handling practices.

The original goal for developing the HBM was to focus the efforts of researchers who aimed at improving public health by understanding why people do not take preventive measures to health promotion. It is based on the assumption that health behaviour is more likely to occur when the following are present: someone perceives that failure to act will make the individual vulnerable to illness or disease; the consequences of failure to act will be serious; there are perceived benefits to taking actions; the perceived benefits outweigh the perceived cost. There is the belief that the action will be successful in achieving the desired outcome.

According to Denison (1996) as cited in Amuquandoh, (2006), the HBM explains and predicts people's health behaviours by focusing on their

attitudes and beliefs. The model illustrates that a person's behaviour and attitudes are influenced by his or her background such as education, sex, age, race and tribe or ethnicity and that the background has an impact on one's perceptions and attitudes which result in practice or action. Denison (1996) cited in Amuquandoh, (2006) indicated that external motivators such as public education; seeing an image of a person dying from AIDS or informal support groups may cause individuals to examine and possibly change their sexual actions.

Similarly, Abraham and Sheeran (2005) said the HBM postulates that an individual is likely to engage in a health related behaviour based on perceived susceptibility, perceived severity, perceived benefit and perceived barrier which have been categorized as perceived threat and behavioural evaluation. The model consists of variables that explain why some people who are healthy adopt health protective behaviours while others are not prepared to do so.

It is based on the assumption that an individual is likely to adopt health behaviour when he or she perceives that his or her failure to act will make him or her susceptible to an illness or a disease, the outcome of failing to act will be serious, as well as the perceived benefits for taking actions. Also, when the individual knows that the perceived benefits out-weigh the perceived cost, there is the belief that the action taken will bring about success in achieving the desired results (Abraham and Sheeran, 2005). Thus, in HBM, human behaviour is seen to be dependent on two variables such as the value an individual places on a particular outcome and the person's estimate of likelihood that a given behaviour will result in that outcome.

The HBM is adopted due to its simplified health related concepts that make it easy to implement, apply and test (Conner, 2010). At the same time has provided a useful framework for investigating the intellectual basis for a wide range of behaviours. The model has also created awareness among researchers and health professionals on changeable situations that are prerequisites for health behaviour. It has no strict laid down rules for combining variables which makes it flexible to be adaptable and applicable to many different health behaviours and groups.

For this reason, the model is considered appropriate for this study because unsafe food handling practices expose both the food handlers and the customers to food borne illnesses which represents the perceived threts outlined in the model; such as threat to individual, customers and the food service business. On the contrary, if food handlers employ hygienic practices, customers may be saved from food borne illness, the business is saved from court suits, food spoilage, and help to earn a good reputation. However, some factors such as inadequate knowledge, time constraint, and limited resource supplies may militate against the compliance with hygiene practices.

Nevertheless, a limitation of this model is that it does not clearly show the relationships between the variables and there are no strong rules for combining the formulated variables (Armitage & Conner, 2000). Another short fall is its predictive capability; which suggests that the primary variables (severity, vulnerability, benefits and barriers) were significant predictors of health-related behaviour in most cases but their effects are usually insignificant (Abraham and Sheeran, 2005). The implication is that there are

other important variables that determine healthy behaviour which the model has not accounted for; which means that the model is not complete.

Knowledge, Attitude and HACCP Practice Model

A number of models from the behavioural sciences have been projected to improve the understanding or explain how human behaviour or actions are guided as well as the relationship between food handlers' food safety knowledge and practice (Rennie, 1995). Nevertheless, this study was guided by the knowledge, attitude and hazard analysis and critical control point (HACCP) practice model developed by Ko (2013). This has been identified as a model often used to explain the relationship between knowledge, attitude and practice (Simelane, 2005) as envisaged in Figure 5. The model describes the interrelationship between knowledge, attitude and HACCP practices among food handlers in food service establishments and assumes that there is a strong inter-relationship between food safety knowledge, attitude and HACCP practices. Rennie (1995), postulated that the knowledge, attitude and practice (KAP) model is built on the notion that an individual's behaviour or practice depends on his or her knowledge and that simply providing information will lead directly to a change in attitude and subsequently a change in behaviour.

The assumption drawn from this model is that practice can be changed when the individual's knowledge increases it is anticipated to change attitude so that an individual is more inclined to performing the expected behaviour. Thus, the higher or the more the individuals' knowledge increases the better their attitudes and practice. It has been noted that the knowledge, attitude and practice model (KAP) is based on four relationships that exist between the

main variables such as knowledge, attitude and behaviour inherent in the model. The four relationships identified by Schwardtz (1975) as cited in Ko, (2011: 744-745) include:

a. a relationship that exists where knowledge can directly influence attitude but not directly influence behaviour;
b. a relationship where knowledge and attitude influence each other concurrently;
c. a relationship where knowledge and attitude independently influence behaviour; and
d. a type of relationship that exists where knowledge shared direct and indirect influences on behavoiur.

In all the relationships outlined, attitude was identified as a mediating variable between knowledge and behaviour. Consequently, the food safety knowledge, attitude and HACCP practice model is meant to find inter-relationship among knowledge, attitudes and HACCP practices of food handlers in restaurants. The model specified that food safety knowledge, attitude and HACCP practice have a strong correlation with each other. Accordingly, attitude is regarded as an important supplementary factor to knowledge and practice; this is essential to reduce the risk of food-borne illnesses. In this fashion, food handlers' attitude to food safety practices mediates the relationship between knowledge and HACCP practices.

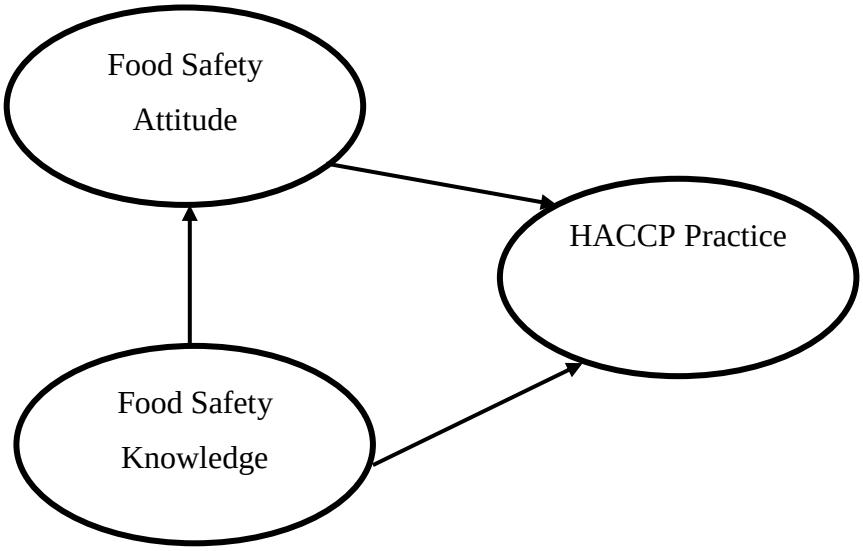


Figure 5: Model of Food Safety Knowledge, Attitude and HACCP Practice
Source: Ko (2013)

Lin and Chen (2004) found out that the factors interacted with each in a positive manner. However, a flaw identified in the model is its assumption that knowledge is the main antecedent to behavioural change (Ehiri, Morris, and McEwen, 1997). The model also failed to anticipate that there could be barriers or challenges that can militate against practice.

Conceptual Framework of the Study

After assessing the various theories and models based on their strengths and weaknesses, Ko's (2013) food safety knowledge, attitude and HACCP practice (KAP) model was selected and modified as the framework for the study (see Fig 6). As indicated earlier, the model was modified to make it more suitable for this study. The modification included the introduction of barriers to food safety practices and the exclusion of attitudes to limit the scope for the study. The modified framework therefore focused on food handlers' knowledge of food safety issues in the three domains, their food safety practices observed during food preparation and service as well as

the barriers militating against their food safety practices. Thus, the framework dwelt on the fourth relationship identified by Schwardz (1975) as cited in Ko (2013) which indicates that there exists a relationship where knowledge shared direct and indirect influences on behaviour.

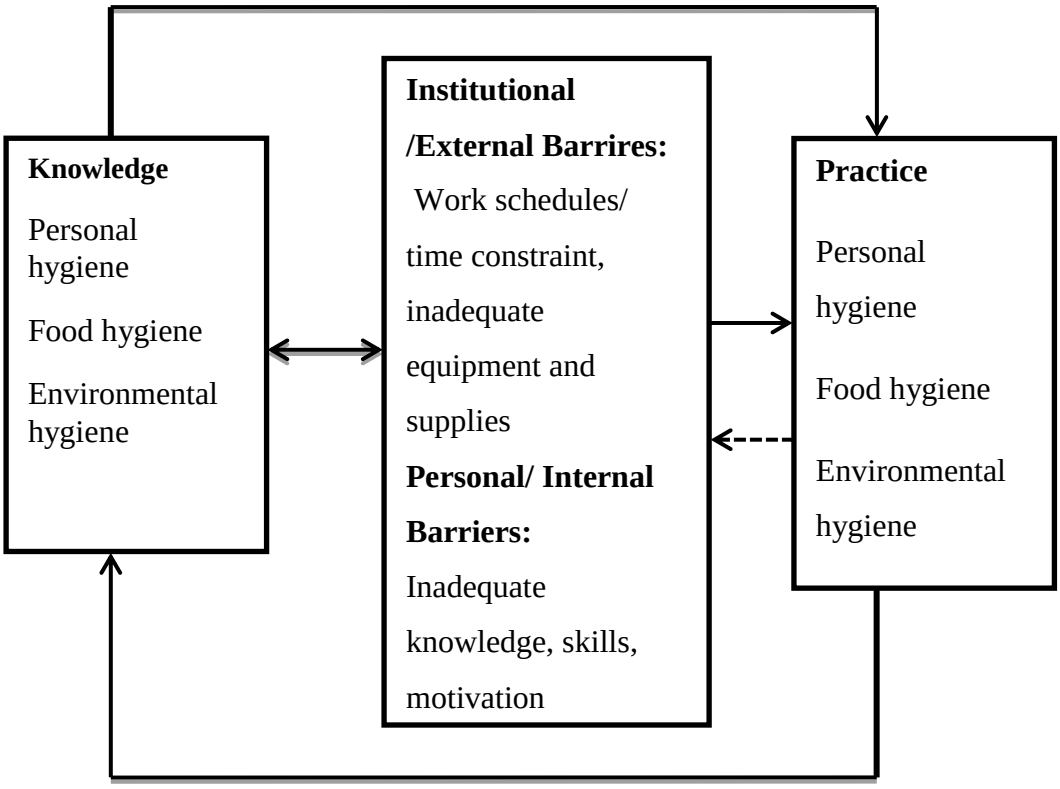


Figure 6: Conceptual Framework of the Study
Source: Adapted from Ko's (2013) KAP model

The variables (Knowledge and Practice) in the framework were measured in relation to the food safety domains such as personal hygiene, environmental hygiene and food hygiene, and showed the interrelatedness of the variables that could result in the production of safe or unsafe foods. In other words, the framework looked at the relationship between food handlers' knowledge of food safety based on the three domains in relation to their food safety practices. The relationship was also considered in the area of the barriers that impeded food safety knowledge and practices of food handlers.

In the knowledge area it was anticipated that the respondents' sources of food safety information, including education, training, experiences and subjective norms from the theory of planned action will supply the knowledge required. Based on normal thinking, the knowledge is supposed to move the food handler into action and continuous practice is expected to improve on knowledge through the experience gained. However, personal barriers such as inadequate knowledge and skills, as well as facility or institutional barriers includings time constraint due to busy work schedules, inadequate equipment and supplies, inadequate training, lack of motivation and nature of work place could prevent expected practice and even knowledge. Nevertheless it is assumed that practice can have a weak influence on barriers. For instance, when the individual is able to put knowledge into practice a number of times inadequate knowledge as a barrier will be reduced.

In a nutshell, the framework assumes that knowledge which is acquired through training and experiences is supposed to influence or translate into practice directly while practice also influences food handlers' knowledge. Nevertheless, barriers could serve as obstacles to putting knowledge into practice as well as obtaining more knowledge. It also shows that barriers impede food safety practice whereas constant practice could cause individuals to overcome some barriers. The broken lines indicate a weak influence of practice on barriers.

Chapter Summary

This chapter discussed relevant theories and models as well as the conceptual framework guiding the study. The chapter highlighted related theoretical approaches and models related to food safety knowledge and practice and the conceptual frame work guiding the study. Relevant theories such as the theory of reasoned action (TRA) and theory of planned behaviour (TPB) were explained in relation to food safety knowledge and practices of food handlers.

The relevant models used to explain how human actions are guided include the health belief model (HBM), the food safety knowledge, attitude, and HACCP practice model (KAP) and the conceptual framework underpinning the study were also discussed. These theories and models were considered appropriate to enhance ones understanding, and possibly the explanation of the potential results and findings that may emerge from the study. The next chapter focuses on related literature on food safety concepts and empirical review on food handlers' food safety knowledge and practice.

CHAPTER THREE

FOOD SAFETY KNOWLEDGE, PRACTICES AND STANDARDS

Introduction

This chapter presents relevant literature on food safety knowledge, practices of food safety and rules and regulations governing food service establishments. The relevant areas covered were organized into two sections. The first part focuses on empirical information on food safety situation in food service establishments including restaurants, the role of food handlers in food borne disease outbreaks, food safety knowledge of food handlers in restaurants and the sources of food handlers' information on food safety in restaurants.

The second section discusses relevant food safety practices, empirical issues in relation to appropriate food safety practices of food handlers in food service facilities, especially restaurants, relevant literature on food safety standards, related barriers or factors that hinder compliance with appropriate food safety practices and the conceptual framework underpinning the study.

Global Situation on Food-borne Illness Outbreaks

The outbreak of food-borne illnesses has become a global issue. According to Mahami and Odonkor (2012) food borne diseases are possibly the most prevalent health problem in contemporary world. It was noted that about 30% of the population in industrialized countries suffer from food borne diseases each year (WHO, 2007). The WHO, (2014) shared that globally the burden of infectious diarrhea involves 3-5 billion cases and about 1.8 million deaths annually as a result of contaminated food and water. In a further study, WHO (2015) reported that approximately two million fatal cases of food poisoning occur yearly; especially in developing countries. For instance, the

MOH health facts (2014) showed that in 2014, Malaysia recorded about 49.8 thousand cases of food poisoning per every 100,000 population.

According to the CDC update in 2017 about 50 million people are prone to food-borne ailments which leads to about 3,000 deaths. The WHO (2017) report indicated that one in every ten people in the world gets sick after eating contaminated food and 420,000 people die every year out of food borne illness with children aged five years and below representing 40% of the foodborne ailment burden. In Ghana, Salas (2011) also shared that the incidence of food poisoning is estimated to be 5.8million annually.

The issue of food borne illness outbreaks is prominent in Africa where a deeper gap in education, poverty, public health policies and financing health system exits (Ferron et al., 2000 and Ferron et al., 2007). Studies conducted to inspect facilities and practices of food vendors in Africa revealed that unclean or inadequately cleaned cooking equipment have been known as a source of bacterial contamination in processed foods (Boateng, 2014; Nigusse & Kumie, 2012; Rane, 2011). It has been noted that containers, pumps or tanks used for holding or transporting unprocessed raw food items, have occasionally been used for processed products without any cleaning and disinfection (Rane, 2011). This scenario could be associated with the poor state of food safety and hygiene in the countries.

Restaurants and Food-borne Disease Outbreaks

Food contamination is a widespread issue in both industrialized and developing countries. Currently, due to urbanization, majority of people all over the world spend huge sums of money purchasing food from various food service establishments including restaurants (National Restaurant Association

(NRA), 2010). For instance, in the United States people spend approximately $580 million on food (NRA, 2010) from food service establishments and an estimated 46 % of Americans patronize a restaurant each day.

In Ghana a great variety of foods are prepared and served in varied food service facilities including restaurants, which are often formal and regulated (Boateng, 2014). However, restaurants have consistently been implicated in the outbreak of food borne illnesses and have been identified as one of the most frequent supports for food-borne illness outbreaks (CDC, 2013; Knight, Worosz & Todd, 2007). Wheeler et al. (2005) reported a food borne outbreak at a restaurant in Pennsylvania, US, where 601 customers were found to have contracted Hepatitis A; out of which 124 were hospitalized and three died. Barnes (2005), identified over 400 suspected cases of food poisoning in two Turkish restaurants in Australia; with at least seven people hospitalized. Also, over 600 patrons reported ill after eating in two Lansing restaurants in Michigan, US. The report indicated they were infected with norovirus (Clark, 2010). Clapham et al. (2006) also indicated that 324 consumers were noted to have *Salmonella enteritidis* after eating at an Asian restaurant in Bradford, UK.

It was observed that about 59% reported cases of food borne illness in Kansas State were associated with restaurants (Howells, 2005). It was aso noted that in the USA, 41% of the 1,097 food borne illness outbreaks reported to the Centers for Disease Control and Prevention were associated with restaurants (CDCP, 2010). Thus, restaurants were identified as an important source of infection (Jones and Angulo, 2006; Howells, 2005).

In all these, food handlers have been implicated in the outbreak of food borne illnesses by their actions and inactions. In a study conducted in a local Canadian jurisdictions using 141 representatives responsible for restaurant inspections, it was found that 41% of the inspected restaurants in 24 jurisdictions had one or more time and temperature violations, while the percentage was between 21% and 40% in 48 other jurisdictions. Additionally, 10% of restaurants in Canada were classified as having critical problems with another 21% classified as having moderately severe violations (Mathias et al., 1995). Though this study was carried out long ago, the researcher referred to it because the information is relevant to this study.

In another study of four restaurants in Australia, Morrison et al. (1998) observed that each restaurant had problems in relation to hygienic practices consistent with unnecessarily high risk to consumers. Furthermore, Walczak (2000) indicated that an investigative reporter at the Orlando Sentinel reviewed Florida state restaurant inspections in 1997, and found out that many restaurants routinely ignored rules for safe food preparation. The study found that 43% or 2,400 restaurants received violations for preparation temperature abuse or for inadequate refrigeration equipment.

Other common food safety breeches that were identified to characterize their operations are: obtaining food from unsafe sources, inadequate cooking, improper temperature holdings and the use of contaminated equipment (Adams & Moss, 2008; EFSA, 2009; WHO, 2002). Michaels et al., (2004) found out that infected food handlers were able to transmit agents of gastrointestinal infectious diseases through poor personal hygiene practices.

It has been reported that food handlers contaminated the foods they came in contact with through their digestive systems or respiratory tracts, skins, hair, hands, nose, ears and mouths where germs can readily accumulate to contaminate food (Aanisalo et al., 2006; Bas, Ersun & Kivanc, 2006; Dugassa, 2007 and Sprenger, 2010). Therefore, food handlers' poor personal hygiene practices such as ignoring the washing of hands during food preparation, touching parts of the body, clothing, money, contaminated equipment and work surfaces can be sure ways of contaminating food (Bas, Ersun & Kivanc, 2006; Taylor, 2001).

In Nigeria, Isara, Isah, Lofor, and Ojide (2009) conducted a study on the role of food handlers in food contamination in fast food restaurants using a semi-structured questionnaire, food sampling and stool analysis. The results showed that the food handlers reported lack of training in food hygiene (53%), no pre-employment medical examination (70.3%), and no knowledge that microbes can contaminate food (57.4%) as characteristics that could influence food contamination. This suggests the need for medical examination and pre-employment training of food handlers.

In another study that targeted food handlers using interviews and stool analyses in Spain, it was observed that an outbreak that was associated with food-borne norovirus in Barcelona in 2005 was linked to asymptomatic food handler (Barrabeig et al., 2010). This means that infectious agents are possible in asymptomatic food handlers, which demands the practicing of safe food handling techniques, especially hand washing at all times.

Consequently, several studies have associated the outbreak of food-borne diseases with a number of factors in relation to the food handlers in food

service establishments. Beatty et al. (2009) as cited in Thewell-Reid (2014) in a study to determine the cause of the largest *Salmonella* outbreak in Texas, found the mishandling of food by a food handler to be responsible for the outbreak. It was noted that the situation came to a halt only when policies to screen food handlers were implemented and those infested with *Salmonella* were excluded from handling food. Thus, it was noted that food handlers failed to follow acceptable food safety standards in the preparation, processing, cooling and storing of food (Tomohide, 2010).

The 2010 Ministry of Health (MOH) annual report, also identified ineffective food handling training, the use of untreated water for non-drinking purposes, and poor sanitation and hygiene as the primary risk factors of food poisoning in Malaysia (MOH, 2010). This implies that, food handlers are paramount in ensuring food safety and prevention of food poisoning.

Onyeneho and Hedberg, (2013) identified lack of current knowledge on food safety issues among restaurant staff to have highlighted increased risk of food borne illnesses associated with fast foods and restaurants in Owerri, Nigeria. For instance, an outbreak of food poisoning in Ibadan, Nigeria, claimed about 20 lives and a new phage type U282 of *Salmonella typhimurium* isolated from a sandwich filling was identified as the causative organism (Osagbemi, Abdullahi & Aderibigbe, 2010; Onyeneho & Hedberg, 2013).

In an attempt to find solution to the outbreak of foodborne diseases, the WHO identified five important practices of food handlers that could prevent foodborne illness. These include: keeping food clean, separating raw and cooked foods, cook foods thoroughly, keeping food at safe temperatures and

the use of safe water and raw materials (WHO, 2006). It is anticipated that when food handlers observe these rules the incidence of food borne illness will reduce.

Food Safety Knowledge of Food Handlers

According to Needham, (1959) as cited in Yambo (2016) a Chinese thinker said "knowledge is the beginning of practice and practice is the completion of knowledge." Thus, knowledge is linked to existing practices which go a long way to affect individual's readiness to change prevailing practices if they are known to be unsafe (McIntosh, Christensen & Acuff, 1994). Angelillo et al. (2000) indicated that food handlers with good knowledge of proper food handling practices could be in a position to control food poisoning cases. This suggests that food handlers ought to have requisite knowledge and skills in food safety practices as well as understanding the role of food in the spread of food borne illness (Glanz, Lewis & Rimer, 2002; Alqurashi, Priyadarshini and Jaiswal, 2019). Knowledge is gained through formal or informal learning processes, personal experiences, perceptions, reason and experiential sharing (Glanz, Lewis & Rimer, 2002).

Studies have been conducted in different countries to assess food handlers' food safety knowledge on areas such as hand washing, temperature control, cross contamination, food storage, and some aspects of food microbiology. In a study conducted to assess food safety knowledge of restaurant employees, Panchal, Bonhote and Dworkin (2013) observed that the overall food safety knowledge score of the food handlers was high (71%). They noted that no one scored above the maximum score of 37 points and that restaurant cuisine was the only characteristic significantly associated with the

knowledge score. It was noted that larger-sized restaurants had slightly higher knowledge scores than restaurants that were small or medium-sized.

In Edmonton, Canada, Hislop and Shaw (2009) conducted a study to determine the food safety knowledge of food handlers in the food service industry using both certified and noncertified food handlers. The results showed that 98% of the certified food handlers achieved scores higher than 50% and 94% had scores higher than 70%. They found that food handlers training (certified food handler) was significantly associated with passing at the 50% ($p = 0.007$) or 70% ($p = 0.015$) cut-off points.

It was however realized that, length of time since the certified or noncertified food handlers received training had no significant influence on their passing scores ($p = 0.821$, $p = 0.543$ respectively). Nevertheless, there was a significant difference of failure rates between certified and noncertified food handlers as the failure rates for the noncertified were between two to five times that of the certified food handler (Hislop and Shaw, 2009). The highest failure rates were for those with over 10 years of experience; which suggests that the higher the number of years at work, the lower the knowledge level. This could be associated with lack of in-service training. Thus the food handlers do not learn new things and they are not abreast with current food safety information. This implies that the food handlers are engrossed in work to meet targets as against building their capacities.

Jianu and Chis (2012) used a cross-sectional quantitative study to determine food hygiene knowledge levels of food handlers to provide baseline data for training programmes for food handlers in Romania. Structured, self-administered questionnaires were used to collect information on demographics

and level of knowledge concerning food poisoning, cross contamination, time temperature control, and personal hygiene. The findings indicated that there were no significant differences in level of food handlers' knowledge based on their socio-demographic characteristics or professional experience.

Nevertheless, their knowledge levels were significantly greater based on educational levels, with food handlers with higher education achieving higher knowledge scores ($F= 3.779$, $p = 0.011$) (Jianu & Chis, 2012). It was noticed that production staff displayed significantly higher levels of knowledge on food poisoning, cross-contamination and sanitation, time temperature control, and personal hygiene. However, there was a low-level of knowledge on the importance of good drainage systems and the best way of thawing frozen foods which implies that, there is the need to retrain food handlers using different methodologies.

In another cross-sectional study conducted to assess food hygiene knowledge of food handlers in a catering company in Portugal, Martins Martins, Hogg and Otero, (2012) found that the average score was 56.5%, with scores ranging from 87% to just over 4%. Knowledge level scores for temperature control questions were significantly lower than the average score for the full questionnaire ($p < 0.001$). Temperature control is vital in controlling microbial growth in food (Jay, Loessner, & Golden, 2005) and improper holding temperatures have been linked to food-borne disease outbreaks.

Furthermore, in assessing food safety knowledge in relation to socio-demographic characteristics of respondents, a number of studies found females to possess higher food safety knowledge as compared to their male

counterparts. (Byrd-Bredhenner et al., 2009; Sanlier & Konaklioglu, 2012). This could probably be because traditionally females are known to be involved in cooking than their male counterparts. However, Akonor and Akonor (2013) found that both male and female respondents were equally knowledgeable in terms of the food safety measures examined; thus they were statistically independent of food safety knowledge.

Age was noted to have a rippling relationship with food safety knowledge; but Sanlier and Konaklioglu, (2012) revealed that food safety knowledge tends to increase with age and younger respondents show the need for more training. On the contrary, Sun, Wang and Hang (2012) reported that younger respondents have higher food safety knowledge than their older counterparts; whereas Annor and Baiden, (2011), Martins, et al. (2012) reported that age had no influence on food safety knowledge.

Generally, it has been observed that the higher the individuals' educational attainment the more knowledgeable the person. For instance, a cross sectional study of women conducted by Farahat et al. (2015) in Saudi revealed that the respondents with high educational attainment showed higher mean knowledge scores in the overall food safety parameters measured than those with low educational attainment ($p < 0.05$).

Similarly, Martins et al. (2012) found a significant difference ($p<0.025$) between the educational levels of respondents and their food safety knowledge. This implies that the educational attainment of food handlers is an important prerequisite to the success of food safety practices.

Food Safety Practices of Food Handlers

According to Singh et al. (2011), practice refers to applied skills, techniques, methods or standard operating procedures. To assess food handling practices of food handlers, researchers employed the self-reported questionnaires and observation methods. In other words the self-reported practices were assessed using questionnaires and the actual practices were obtained through observation.

With respect to the self-reported aspect of assessing food safety practices, Green and Selman (2005) conducted a study among food service facility workers to gauge the self-reported occurrence of safe and unsafe food handling practices at nine Foodborne Active Surveillance Network (Food Net) sites. Data were collected in relation to four food handling practices such as hand washing, use of gloves when handling ready-to-eat foods, temperature assessment of prepared foods, and working in food preparation areas when ill.

The results showed that 40% of the workers handling ready-to-eat foods wore gloves and changed them on an average, about 15.6 times during an 8 hour shift. It was also noticed that food service workers washed hands on an average 15.7 times during the same time interval while 71% of the workers who handled both raw and ready-to-eat foods indicated that they always washed their hands, and 67% change gloves between touching foods to avoid cross contamination.

The results also indicated that about 47% of respondents used thermometers to check internal temperatures of food, while 5% never worked while ill. Green and Selman, (2005) shared that age, restaurant type, and work responsibilities brought about significant differences in food handling

practices. However, the weakness of Green and Selman's (2005) study was that self-reported data are prone to response/social desirability bias with individuals reporting desirable behavior rather than the actual behavior.

In South Africa, Van Tonder et al. (2007) carried out a study on personal and general hygiene practices and the level of training of food handlers in 35 food outlets using self-administered questionnaires. Data were collected from 50 randomly selected food handlers and it was found that most food handlers reported a satisfactory level of food handling practices such as washing hands after visiting the toilet or before each shift (100%), wearing and frequently changing protective clothing such as gloves (82%), never suffered cough or diarrhea on the job (92%), reported illness to management (82%), and cleaned work surfaces (92%).

Observed Food Safety Practices of Food Handlers

According to Clayton and Griffith, (2004) observations are more reliable in the collection of data on practice, as respondents tend to overestimate their actual behaviours in self-reported practice, thereby introducing social desirability bias. Thus, some researchers have used observational studies to determine food handling practices. For instance, Clayton and Griffith (2004) observed 29 catering establishments which had received some form of food hygiene training, for food safety practices. In that study, each food handler was observed on three separate occasions performing over 270 actions. The areas of observation focused on hand hygiene practices, cleaning of work surfaces and equipment, washing of utensils and use of different utensils for preparing raw and ready-to-eat foods.

The results revealed that hand hygiene malpractice was more frequent than the other two food hygiene behaviours observed. Correct hand hygiene practice was observed on only 31% of the required occasions and were not attempted on most of the required occasions, such as after touching potentially contaminated surfaces, after touching hair and face, as well as after handling potentially contaminated food (Clayton & Griffith, 2004). However, the respondents failed to use soap during hand washing and failed to dry hands. With respect to cleaning of food contact surfaces, 31% of caterers carried out this action adequately 33% of the time and failed to attempt cleaning in 60% of the required times (Clayton & Griffith, 2004).

Lubran et al. (2010) also conducted an observational study to examine the behaviour of food handlers in deli departments in nine stores in Maryland and Virginia, and to ascertain the level of compliance with the Food Code. The results revealed that all employees used gloves on all occasions when handling ready-to-eat foods but hand washing was observed in only17% of recommended times at the independent stores. It was noted that the majority of times the food handlers washed their hands were when gloves were changed and the food handlers cleaned and sanitized food contact surfaces throughout the (100%) recommended times (Lubran et al., 2010). The major limitation of this study was the use of one observer which limited ability to obtain a reliability estimate of the study.

Roberts et al. (2012) conducted a study in U.S. to assess the safety practices per the Food Code in ethnic and non-ethnic restaurants in Kansas. They used 424 ethnic and 500 non-ethnic restaurants which were further classified as independent or chain restaurants. A data collection form was

used to capture violation information from inspection reports done over a one year period (2007-2008). The results showed that, independent ethnic restaurants had the highest number of critical (4.52 ± 2.85) and noncritical (2.84 ± 2.85) violations ($p < 0.001$).

It was noted that critical violations are more likely to contribute to foodborne illnesses and independent restaurants were found to have a greater number of violations than chain restaurants. The violations were directly related to food handling practices, such as time and temperature abuse, personal hygiene, and cross-contamination. Independent ethnic restaurants also had a greater number of annual inspections (2.29 ± 1.63) ($p < 0.001$), indicating the presence of food safety problems within these facilities. While Roberts et al. (2012) did not explore the knowledge of food handlers with respect to food hygiene or the Food Code, it was expected that improved knowledge and culturally relevant training would improve food safety practices and reduce food violations.

This study included the use of observation as the preferred method for collecting practice data. Food handlers were not interviewed as it was not feasible to interview the numerous participants on their practices. The observation was performed on a limited number of variables within a particular time, while self-reported data captured more information on more variables.

It is assumed that individuals' level of knowledge can be influenced through education, training, experiences and subjective norms. Grujic et al. (2013) indicated that lack of knowledge in one of the stages of the food chain can compromise all the efforts made to improve the safety of food. It was

noted that food handlers with good knowledge of proper food handling practices could help control food poisoning cases (Angelillo et al., 2000).

In Owerri (Nigeria), Chukuezi, (2010) conducted a study on food safety and hygiene practices of street food vendors using interviews, semi-structured questionnaire and observations. The findings of the study showed that averagely, less than half of the food vendors put on protective clothing during food preparation and service. For instance, it was observed that about 43% and 53% of the vendors wore aprons and hair restraints respectively and 19% also put on jewelry during food preparation and service.

The study also revealed that majority (86%) of the food vendors did not clean work surfaces regularly during food preparation. They prepared food on the same surface more than twice without cleaning. It was also noted that 33% of the work surfaces were dirty which means that they did not pay attention to hygiene and sanitation practices during food preparation. In addition, it was realized that about 48% of the respondents handled food with bare hands while the majority (61-90%) handled money while serving food and 28.6% tried opening polythene bags for serving and storing food by blowing air into them. Generally it was noticed that about 24% of the vendors prepared food in unhygienic environments amidst poor food hygiene practices. They had poor storage facilities and about 48% of the respondents washed their utensils with recycled water which is used severally (Chukuezi, 2010).

Furthermore, in Ramallah and Al-Bireh (Palestine), Al-Khatib and Al-Mitwali (2009) examined food safety knowledge and practices in restaurants and found that the majority of food handlers indicated they always washed their hands with soap before beginning to work and in-between handling raw

and cooked foods. About 68% of the food handlers always washed their hands after coughing and sneezing, and 56% never reported for work when they were sick. Thus, they took precaution not to contaminate the food. However, 11% of the respondents never washed their hands with soap during food preparation.

On the contrary, 51% of the respondents said they never washed their hands even after touching body parts, handling money, garbage and unclean utensils while 19% never washed their hands at intervals of handling raw and cooked food (Zain & Naing, 2002). It was also noted in a study by Mukhopadhyay et al, (2012) that about 26% of the food handlers were seen wearing unclean clothing. Thus, a reasonable number of food handlers never paid much attention to food safety matters.

In Ghana, Ababio and Adi (2012) assessed some food handlers' knowledge and practices of food hygiene in the Kumasi metropolis. The results revealed that majority of the food handlers purchased and used meat daily while 11% reported storing uncooked meat in their kitchens. As regard the practice of temperature control, the results showed that about 83% and 11% of the food handlers served food hot and warm respectively. It was explained further that while 37% of the food handlers reheated food that had gone cold before serving; 38% of them served the food without reheating. Only a small percentage (1%) of the food handlers indicated they discarded any food that stayed within the danger zone beyond two hours. Thus, most of the food handlers violated the rule and served leftover foods to consumers which puts them at risk of contracting food borne illness.

In terms of routine medical examination or check-ups, a study carried out in secondary schools in Ilorin (Nigeria) to assess the practice among food vendors, showed that even though as many as 141 (76%) vendors went through initial medical examination, they never went back for the periodic checks. The report indicated that 23.8% of the vendors indicated they never had any medical examination (Musah & Akande, 2002); yet they were operating. This is risky for consumers and the industry and calls for managers and regulatory agencies to put in efforts to guarantee the safety of what customers eat. Zain and Naing (2002) also found out that about 62% of the food handlers went for routine medical examination. In India (Kolkata) it was noted that 22.4% of the respondents continued to work even when they were ill.

In terms of food storage as part of food hygiene practices, it is required that foods are kept at safe temperatures as microorganisms multiply very rapidly at room temperature (between 4.5^{o} C and 57^{o}C; food danger zone). Appropriate temperatures for freezing and cold food storage as well as hot food holding and cooking temperatures are between -18^{o} C and 4.5^{o} C and 60^{o} C to 100^{o}C for freezing and cold storage and hot holding and cooking respectively (Spears & Gregoire, 2007). WHO (2006) cautioned that foods should not be cooked and kept at room temperature for more than two hours before service. Perishable and cooked foods should be refrigerated promptly (especially below 5^{o}C) to slow down or stop the growth of microorganisms.

In addition, food handlers are warned not to store food for long even in the refrigerator since some dangerous microorganisms still grow below 5^{o}C. In storing leftover foods, they should be cooled quickly and stored. However,

they should not be stored beyond three days and they should not be reheated more than once (WHO, 2006). Hence, any cooked food stored for more than three days be discarded.

During storage, foods get frozen and they need to be thawed before use. McSwane, Rue and Linton (2003) indicated that frozen foods should be thawed slowly to retain moisture and original structure of food. Nevertheless, WHO (2006) is of the view that rapid thawing prevents the growth of microorganisms and suggested that food should be thawed either in a refrigerator, under cool running water or in a microwave oven followed by immediate cooking. Thawing can also be done as part of the cooking process (McSwane et al., 2003).

McSwane et al, (2003) suggested that, during the purchasing of food, there is the need to select fresh and wholesome foods as well as check the expiry dates of foods to prevent the use of foods beyond their expiry dates. It is also very important that food handlers take time to inspect incoming food supplies to make sure they are not spoilt and that they are at the right temperature.

Food Safety Knowledge Versus Practices

Conventionally, it is assumed that knowledge is automatically translated into behaviour (Glanz, Lewis & Rimer, 2002) which subsequently changes into practice. Nonetheless several studies reported that inspite of the fact that food handlers had correct scores for food safety related questions, in reality they did not usually translate their knowledge into practice (Clayton et al., 2001; Moreaux et al., 2018; Omemu & Aderoju, 2008; Sun, Wang & Huang, 2012; Zeru & Kumie, 2007).

In a study conducted by Kibret and Abera (2012) in Ethiopia on the sanitary conditions of food service establishments and food safety knowledge, and practices of food handlers, it was realized that most of the food handlers had good knowledge of food hygiene issues. They however, exhibited poor knowledge in practice as they handled raw food items without washing their hands (75%), wore hand jewelries and fondled parts of their bodies during food preparation and service (53%). Thus, the food handlers practice scores were lower than their knowledge scores.

A study conducted by Azanza, Gatchalian and Ortega (2005) in the Philipines, revealed that inspite of being knowledgeable in some aspects of food safety (personal hygiene, food contamination, food handling procedures), the food handlers did not put the food safety knowledge into practice, but compromised food safety for financial reasons. This shows that it is not only ignorance that causes food poisoning but also failure to apply the acquired knowledge (Bryan, 1988 as cited in Brar, 2016; Ehiri & Morris, 1996). Thus, it was established that a significant gap existed between the food providers' knowledge and practice which could be attributed to noncompliance to regulations and the tendencies of compromising food safety for financial issues.

Onyango et al. (2016) also assessed the relationship between knowledge and practice of food handlers in selected hotels in Kenya and it was observed that knowledge of double hand washing techniques was significantly related to practice of food safety management. For instance, they found that the food handlers' knowledge on the ways of contaminating food

and their knowledge of vehicles for food contamination were significantly related to the practice of temperature control.

Onyango et al. (2016) noted that knowledge of stages in food flow that are likely to cause contamination in food is significantly related to practice of food safety management in the areas of personal hygiene, cross contamination, purchasing and storage. Thus, the knowledge of the factors that cause food borne illnesses is significantly related to practice of personal hygiene and temperature control. In other words when the individual is aware of the factors that cause food borne illness, the individual takes precaution during practice.

Though there were significant relationships between specific food safety knowledge and specific practices of food safety management, in general terms, there was no significant relationship between food safety knowledge and practice (Onyango et al., 2016). Several other studies on knowledge and practice of food safety management came out with similar findings (Sneed, Strohbehn & Gilmore, 2004; Seaman & Eves, 2010; Howells et al., 2008; Roberts et al., 2008; Neal, Binkley, & Henroid, 2012) which are in consonance with Onyango et al,'s views.

According to Chapman et al, (2010), the influence of a food safety information sheet on practices within the food service environment showed that the information had a positive effect on food handlers' behaviours. In assessing food safety knowledge, attitudes and practices of food handlers in Bangkok, it was realized that only 13% of the food handlers had good knowledge, 19% had good attitude and 15% had good practice. Statistically, there was a significant relationship between food safety knowledge and food

safety practices as well as between food safety attitudes and food safety practice (Cuprasitrut, Srisorrachatr & Malai, 2011).

Schwardtz (1975) as cited in Ko (2011) identified four types of relationships between knowledge, attitude and behaviour or practice. It was found that, in some instances, knowledge could directly influence attitude but not directly influence behaviour; whilst in another instance knowledge and attitude influence each other at the same time. In a third relationship, knowledge and attitude independently influenced behaviour or practice whereas in the fourth relationship, knowledge had direct and indirect influences on behaviour with attitude acting as a mediating variable between knowledge and behaviour.

This could be associated with the training the workers received which has been found to improve food safety knowledge and hygienic practices that could have resulted in better food safety practices. For instance, Griffith and Clayton (2005) reported that improved knowledge leads to behavioural changes while staff attitudes can limit or prevent improvement in practices; but employee training has been found to improve food safety knowledge and hygienic awareness which could result in better food safety practices.

In order to improve on food safety situation, WHO (2007) identified training as one of the ways of equipping food handlers with knowledge and practices; and emphasized that training programmes that are linked to behaviour change theories are more effective in improving knowledge and practice. It has been found that, training helps food handlers to get familiar with work tasks, improve their professional and food safety knowledge, their skills and capabilities as well as increases their productivity (Ackah et al.,

2011; Afolarannie et al., 2014; Xiao, 2010). Thus, training is generally believed to help in reducing the occurrence of food-borne illnesses (Acikel et al, as cited in Alqurashi, Priyadarshini & Jaiswal, 2019).

Researchers such as Alqurashi et al (2019), Chapman et al. (2010), Glanz and Lewis (2002), and Xiao, (2010) shared that it is important for workers in the food industry to have the required skills and knowledge to ensure good hygiene practices and the safety of food within food service facilities. Nevertheless, studies on knowledge and practice of food safety management have shown that knowledge does not necessarily translate into practice (Howells et al. 2008; Neal, Binkley & Henroid, 2012; Onyango et al. 2016; Robert et al. 2008; Seaman & Eves, 2010; Sneed, Strohbehn & Gilmore, 2004). According to MacAuslan (2003) this is so because training in food safety relies heavily on attaining a certificate rather than paying attention to achieving competency in food hygiene practices. Egan et al. (2007) buttress this by indicating that the majority of food safety courses rely solely on the dissemination of information with very little emphasis on practice.

Furthermore, Panchal, Liu, and Dworkin (2012) conducted a survey to assess baseline food safety knowledge of 508 food handlers in 125 restaurants in Chicago and it was realized that the mean knowledge score was 71%. The results showed that, food handlers with training scored higher than those without training (76% versus 63%, $p < 0.05$). This is in consonance with the results of a study conducted by Joseph (2018) to assess food safety knowledge among restaurant workers in Chennai, India. The results indicated that, the respondents who received training were more knowledgeable than those who did not receive any training. Thus, food handlers need to be given some form

of education and practical training on food safety to prevent the spread of food borne diseases.

On the contrary, Clayton and Griffith (2008), were of the view that training alone cannot bring about behavioural changes in food safety. There is therefore the need to develop new behaviour-based strategies that include food safety education as part of the culture of the organization (Neal et al., 2012).

Sources of Contamination of Food

Food is supposed to be handled safely throughout the food chain, to avoid contamination which leads to food-borne illness (Moreaux, 2014). Food is considered wholesome or safe when it is free from any biological, chemical or physical hazards which cause food-borne illness (FDA, 2009; Kitagwa, 2005; McSwane, Rue & Linton, 2003). Getachew (2010) revealed that the presence of contaminants in food at unacceptable levels is likely to cause harm or illness.

Nigusse and Kumie (2012) reviewed literature on global outbreaks of food borne diseases and found that, in nearly all instances, food borne illnesses are caused by failure to observe satisfactory standards in the preparation, processing, cooking, storing or retailing of food. Disease causing organisms may be introduced into the food chain from a variety of sources and at different stages. For instance, it has been noted that gastrointestinal pathogens may be derived from animal sources, the environment or, occasionally, from humans (WHO, 2012; Lambrechts et al. 2014).

Biological hazards refer to living organisms (microorganisms) that can render food unsafe for consumption and lead to food-borne illnesses (USDA, 1997). According to McSwane et al. (2006), microorganisms are mostly found

in faeces, soil, water, rats, mice, insects and pests, domestic, marine and farm animals. They are also available in human bowels, mouth, nose, intestines, hands, fingernails and skin (WHO, 2006). When these hazards come into contact with food they cause foods to deteriorate, develop bad odour and cause food borne illness (Eubanks et al., 2009). This explains why food premises should be devoid of pests and animals. It is also important that food handlers avoid touching parts of the body while preparing and serving food.

Chemical hazards are substances or elements found or introduced into the food system which may cause illness in the consumer (ISO 22000:2005; FDA, 2002; WHO, 2002). They constitute agricultural chemicals (including pesticides, fungicides and veterinary drugs), plant chemicals, cleaning agents (soaps, sanitizers and oils), naturally occurring toxicants (mycotoxins, marine toxins, aflatoxins and histamine), food chemicals such as food additives and preservatives, chemicals from packaging materials (polymers, lacquers) and tar from wood used in the smoking of foods such as fish and meat (ISO 22000:2005; FDA, 2002; WHO, 2002; Smith, 2005; Grintzali & Babatsikou, 2010). Chemical hazards can also occur through the pollution of water, air and soil which render food unsafe for consumption.

According to Foskett, Ceserani and Kinton (2007) and McSwane, Rue, and Linton (2003) individuals get foodborne illnesses through poisonous chemicals which are naturally found in some foods including cassava and some mushrooms. For instance, natural toxins such as cyanide are found in some cassava and gyromitrin, coprine, and orellanine in some mushrooms have serious health effects such as gastrointestinal toxicity, neurotoxicity, nausea, headaches and death (Foskett et al., 2007).

Chemicals can also be applied to food intentionally or unintentionally, to a storage cabinet to ward off or kill pests /insects and when the contents of the cabinet (glass, utensils or cutlery) are unintentionally used during food preparation and service, they contaminate the food. Consequently, it is important that food handlers wash utensils before they are used for food preparation and service.

Similarly, nitrate can intentionally be added to meat or fish to inhibit the growth of microorganisms (*Clostridium botulinum*) as well as give the product colour. Nevertheless, the chemical reacts with the amines in the meat or fish to form nitrosamines which can harm the consumer (McSwane et al., 2003). Thus, when chemical compounds or substances are applied to food beyond acceptable dosage levels they may become hazardous.

However, when foods are well processed during preparation and cooking, the toxins become deactivated and harmless (Foskett et al. 2007). Simple measures such as washing and peeling may reduce the risk from chemicals that are found on the surface of foods. Appropriate storage can prevent or reduce the formation of some natural toxins. It is, therefore, imperative that food handlers understand this and take great care through all levels of food preparation and service to ensure safety.

Physical hazards refer to any foreign objects present or introduced into the food system during food preparation and handling processes which may cause illness or injury to the individual using the product (National Restaurant Association Educational Foundation (NRAEF), 2010; ISO, 22000, 2005). They include foreign objects in the form of glass fragments or chips, stones, wood, metals (jewelry), needles, pins, insects, bones, acrylic finger nails,

flakes of nail polish, human hair and insulation which accidentally get into food (ISO 22000, 2005; McSwane et al., 2003; Moreaux, 2014; Nyamari, 2013 and Tan et al., 2015).

The hazard may become part of food during harvesting, handling and processing. When these physical hazards are not noticed in food and they are consumed with the food, they can cause cuts in the mouth or throat, injure the intestines and the teeth or gums (Grintzali & Babatsikou, 2010; Musa et al., 2010; Jay, 2000).

According to Getachew (2010), food safety hazards are human and product induced and the most common sources of contamination are hazards caused by humans, which occur through poor food handling practices (such as unhygienic environment and poor personal hygiene practices) as well as obtaining food from unsafe sources (Fawzi, Gomaa & Bakr, 2009; FDA, 2008; Siddiqui et al., 2006). Thus, food service workers require conscious effort throughout the entire food chain to be able to produce safe food for consumers. They need to conform to acceptable food safety measures such as personal hygiene practices, environmental hygiene, food hygiene and HACCP practices. Any mishandling and disregard for these safety and hygiene measures can lead to contamination and food-borne illnesses.

Environmental hygiene is of great importance as unclean work surfaces and equipment can be sources of direct contamination of food (Evans, Rusell, James & Corry, 2004). For instance, it is reported that bacteria from dirty dish washing water and other sources adhere to the utensil surface and can constitute a risk during the food vending process (Rane, 2011). Thus,

standard requirements for food facility environment need to be followed with all seriousness.

According to Hutter (2011), unclean work surfaces and equipment can bring about food safety hazards resulting in food contamination, food poisoning, loss of product quality, increased food spoilage and waste as well as customer complaints, litigations, reduced customer patronage, loss of reputation and reduced sales. The underlying fact is that harmful microorganisms can be transmitted through hands, wiping cloths, utensils, and cutting boards into foods, which can cause food borne diseases.

Rane (2011) also found that serving utensils used at the vending sites are often contaminated with *Micrococcus spp.* and *Staphylococcus aureus spp.* which may have originated from the vendors hands, food preparation surfaces, dish cloths, or the water used for dish washing or hand washing. This suggests cross contamination between dish washing water, food preparation surfaces, and the food itself as bacteria from dirty dish washing water and other sources adhere to the utensil surface and can constitute a risk during the food vending process (Rane, 2011).

Another means of promoting food borne disease outbreak is ignoring food hygiene measures. Food hygiene is a practice that involves proper preparation, washing, cooking, storing and preservation of food in order to prevent cross contamination and spread of bacteria which could lead to food poisoning (Etim, et al. 2017). Good food hygiene is an important practice that needs to be observed by food handlers to ensure that food is safe for consumption. It is therefore the full responsibility of food handlers to keep to food hygiene rules on a daily basis (Etim et al. 2017).

Accordingly, Hayter (2006) is of the view that the hygiene standards and cleanliness in food preparation centers of any food services facility could be maintained if there are cleaning schedules in place with the cleaning protocols outlining the equipment, supplies and methods to be used in detail. This ensures that the various areas receive the necessary and adequate attention.

Food Safety Standards and Regulations

In the wake of frequent out-breaks of food borne illnesses, food safety has become a public health challenge which has made it necessary for governments to develop strategies to bring the situation under control (Sanlier, 2010; Sanlier & Turkmen, 2011). Among the strategies put in place are: the development and enforcement of safety standards and rules and regulations on food safety, adequate health education for both consumers and food handlers and ensuring the implementation of food safety management systems (FSMS) (Moreaux, 2014).

Consequently, regulatory agencies in Ghana (Ghana Standards Authority (GSA), Food and Drugs Authority (FDA), Ghana Tourism Authority (GTA), Environmental Protection Agency (EPA), Environmental Health Units (EHU) and the Districts, Metropolitan and Municipal Assemblies (DMMAs) have been mandated to carry out various responsibilities to ensure compliance with the food safety regulations. For example, GSA is charged to coordinate the development and implementation of all national standards while FDA is authorized to regulate foods, drugs, medical devices, cosmetics and household products. To intensify its activities

FDA is to collaborate with Environmental Health Officers to ensure food safety and quality.

Globally, WHO (2010) recommended hygienic practices in relation to food safety to be adopted for practice by all food handlers in food service facilities. For instance, in Australia, food safety standard sets out specific requirements for food businesses and food handlers with the belief that, if operators and workers comply food safety will be guaranteed.

WHO (2010) recommended the following measures of ensuring hygienic environment for safe food preparation and service:

- adequate drainage and waste disposal system in facilities;
- adequate supply of potable water and the construction of drainage systems that safeguard and avoid contamination of potable water;
- Washing and sanitizing all surfaces and equipment used for food preparation.

The standard requires that process control requirements be satisfied at each step of the food handling process (receipt, storage, processing, display, packaging, distribution, disposal and the recall of food). Other requirements relate to the knowledge and skills of food handlers and their supervisors, the health and hygiene of food handlers and the cleaning, sanitizing, and maintenance of premises and equipment.

Consequently, the key practices involved in ensuring food safety are: controlling time and temperature, practicing good personal hygiene, preventing cross-contamination and purchasing food supplies from approved dealers. In order to give attention to these areas, there is the need to follow established standard operation procedures.

According to Tieyiri (2008) and Amoako-Mensah (2016), it is mandatory for all food service establishments to adhere to food safety standards since they relate to the health and wellness of people and are backed by law; thus making compliance obligatory. In support of the foregoing, FDA (2013) demands that before a food service facility is established for preparation, packaging, distribution, storage or sale of food for human consumption, there is the need for a health permit in addition to Ghana Standards and Code of Hygienic practice. Thus, the health status of food handlers is of extreme importance in the food service industry as they could serve as carriers of organisms that cause food borne illnesses.

ISO 22000, (2005) requires that people who handle food in the food service facility should have a medical examination before they are employed and routine examination be carried out every six months. This is because medical examination is a way of regulating food providers in order to prevent and control the transfer of communicable diseases to customers (Musa & Akande, 2002). Thus, it is a public health requirement which is mandatory for all food handlers.

In Ghana, the food safety legislation in the Food and Drugs ACT, 1992 (PNDCL 305B), is classified as standards legislation, food and drugs legislation and legislation on the environment. Consequently, food handlers are required by law to keep clean work environment, protect food from contamination, and follow good personal hygiene practices as the most effective means of preventing the spread of micro-organisms and the contamination of food (Curtis & Cairncross, 2003; Green et al. 2007).

FDA (2001) and WHO (2006) also recommended that food service workers use fresh clean kitchen clothes or disposable towels to thoroughly dry their hands during each meal preparation process, and gloves to handle cooked foods and foods that are to be eaten raw. This is because they serve as a barrier between bare hand contacts and the foods to be served (Green & Selman, 2005; Green et al., 2007). The caution is that gloves be utilized by each person and per single use. In other words, one pair should not be used over and over again or given to another person to use; they are disposable items and should be used once.

Food handlers are also cautioned not to fondle with any part of the body such as their nostrils, ears, mouth or hair as well as spit, sneeze or cough over food as some bacteria that cause food poisoning have been found in the nose and throats of humans; therefore sneezing and coughing should be away from food into disposable napkins (Hayter, 2006 & McSwane et al., 2003).

Again, food handlers are expected to wear clean clothes and hair restraints to prevent hair from dropping into food. Clothing that cover body, hairs and beard restraints are recommended to prevent contamination of food (Simonne et al., 2008).

Knowles (2002) suggested the erection of a ventilation system by placing hoods over stoves and using extractor fans to suck out the fumes or stale air. However, Foskett, Ceserani and Kinton (2007) cautioned that hoods and fans in the kitchen be given constant cleaning as accumulated grease and dirt drawn by the fans can drop into foods to get them contaminated.

Good lighting in the kitchen is of equal importance to enable workers to see any physical contaminants in foods as well as work without straining

their eyes. Hence adequate natural or artificial lighting should be provided to enable staff to see even in corners and crevices in the kitchen (Foskett et al., 2007).

Some researchers are of the view that toilets, hand washing and drying facilities for both staff and customers, should be far away from food storage and preparation Centres or rooms and that workers who clean toilet rooms should not be allowed to clean the kitchen since micro-organisms can easily be transferred into food unknowingly (Cesserani, Kinton & Foskett, 2000; McSwane et al, 2003; Sprenger, 2009; Knowles, 2002;).

It is further recommended that the floors and walls in food service facilities should be waterproof, non-absorbent, washable and without crevices or cracks or opened joints and should be easy to clean and disinfect. Floors should be made of non-slip materials and should slope well for liquids to drain to trapped outlets (ISO 22000, 2005).

Another regulation is that the kitchen and restaurant environment should be clean and free from cobwebs and pests to prevent contamination and food borne illnesses. The floors and walls be cleaned with hot detergent solution and dried, the ceilings should be smooth (no cracks and flaking) to prevent concealing of dirt, doors and windows should fit well in place to prevent vermin in the kitchen (Knowles, 2002).

The food facility environment should be free from a wide range of pests by keeping the premises in good repair, scraps of food be removed promptly and rubbish not be left to accumulate outside the facility; so that there is no means for the pests to have access to the premises; especially the

kitchen and storerooms (Kibert & Abera, 2012; WHO, 2006; McSwane et al., 2000).

It is recommended that solid and liquid (water) waste materials are removed from processing areas without contaminating products and the environment. ISO 22000 (2005) & ISO 22000 (2015) suggested the use of waste bins with appropriate lids and that the re-usable containers should be cleaned and disinfected each time after use.

Kitchen equipment, utensils and dishes require constant cleaning. They should be washed and sanitized after each use and well stored to prevent contamination (Spears & Gregoire, 2007). It is required that different cutting boards of different colours be used for different foods and they are required to be washed properly between each use, as they are likely to harbour microorganisms. The caution is that as they age, they usually develop some cuts and nicks from knives. If the gouges become deep, it will be difficult to sanitize the boards properly and they will have to be replaced.

Due to the fact that kitchen cloths are one of the top causes of cross-contamination in the kitchen, Hill (2011) suggested that food handlers use different dish cloths and kitchen towels for different purposes. For instance, a cloth used to clean a work surface with fresh meat should not be used to wipe a plate for service. On the other hand, disposable cloths can be used for each task and re-usable cloths should be thoroughly washed, disinfected and dried properly between tasks; not just when they look dirty.

Hazard Analysis Critical Control Point (HACCP)

Hazard analysis critical control point is an internationally recognised food safety management system which focuses on the safety of food through

the analysis and control of biological, chemical and physical hazards from raw materials, production, procurement and handling, manufacturing, distribution and consumption of finished products (Saucer, 1998; Sohrab, 1999). It is a structured approach that is used in identifying these hazards and preventive methods and strategies to be used in controlling the hazards during food processing and preparation.

The HACCP system is based on seven standard risk management principles recommended by FDA Food Code (Taylor, 2008; McSwane et al., 2003). They include:

- Conduct a hazard analysis.
- Identify the critical control points (CCPs) at which contrpl can be applied to prevent, eliminate or reduce food safety hazards to acceptable levels during food preparation.
- Establish critical control limits (tresh holds) which must be met at each identified critical control point to prevent, eliminate or reduce to an acceptable level the occurrence of any food hazard.
- Establish procedures to monitor CCPs to assess whether they are under control
- Establish the corrective action to be taken when monitoring indicates that a critical limit has been exceeded.
- Establish procedures to verify that the HACCP system is working.
- Establish an effective record keeping and documentation procedures that will document the HACCP system.

According to McSwane et al. (2003), the HACCP system is required in every food service facility to enable food facility managers to identify foods

and processes that are likely to cause food borne illnesses, initiate procedures to reduce or eliminate the danger of food borne illness as well as monitor to ensure that procedures are followed. The system requires that food handlers go through the menu to check for hazardous foods (meat, poultry, eggs, dairy products and cooked foods like beans) so that their critical control points could be identified to prevent, eliminate or reduce hazards to acceptable levels (McSwane et al., 2003).

The critical control point could be measured on features such as time, temperature, moisture level and organoleptic parameters. The food handlers would have to list the various foods served, find the possible CCPs and the control limits, monitoring the CCPs, taking corrective actions if problems occur, validating the HACCP plan and keeping records accurately (Sun & Ockerman, 2005)

In order for the implementation of HACCP to be successful, the facility management must be committed to the application of the HACCP concept at each stage of food processing and production. This will afford the food handlers the sense of the importance of producing safe food.

Sources of Food Safety Information

Naturally, individuals obtain information or knowledge through formal training and observation. Omemu and Aderoj, (2008) found that 12% of their respondents acquired knowledge through training while 72% obtained knowledge through observation. Shelley (2015) identified a variety of sources of food safety knowledge such as food safety news, magazines, blogs for groups and individuals, FDA food safety alert and market withdrawals, food processing industry and food quality and safety units.

Similarly, Muinde and Kuria, (2005), indicated that a study conducted in Nairobi, Kenya revealed that 61% of food vendors acquired knowledge on cooking principles through observation while 33% were taught by parents and 6% learnt by trial and error.

A study conducted by Apanga, Addah and Sey (2014) on food safety knowledge and practice of street food vendors in the Nadowli district of the Upper West region of Ghana, revealed that their respondents obtained information on food safety practices through television, radio, their interaction with health officials, experience from family business and formal training. This shows that food handlers had limited sources of information or channels of obtaining food safety information which could limit their knowledge levels or amount of information they possess. It is surprising that there was not much emphasis on posters, internet and social media as sources of food safety information since these are the current sources of information most people are using. The implication is that the respondents in the previous studies were not familiar with them or were not aware that they could be possible sources of information on food safety issues.

Barriers to Food Safety Practices

In the midst of food safety standards and regulation as well as training and the activities of regulatory bodies, there are still reported cases of food borne illnesses in developed and developing countries. According to Ajzen (1991), the best predictor of a person's behaviour in a given situation is the person's behavioural intention which is based on the perceived behavioural control of the person. This means that a person puts up a behaviour based on a motivating factor or what he/she anticipates to gain from it. Thus, any

behaviour exhibited has a control point or a source and reason behind it. For this reason Layton, Griffith, Price and Peters (2002) are of the view that food handlers need to develop appropriate perception for food hygiene practices to be able to reduce the risk of food borne diseases. Consequently, people will not engage in behaviours they cannot perform but rather their perception of performing an action can be affected by lack of resources, time pressures, or competing job demands (Brannon et al., 2009).

Some researches have been carried out to delve into hindrances to food safety practices. For instance, in the US, Hertzman and Barrash (2007) evaluated the food safety knowledge, and practices of catering workers in Las Vegas city. The result showed that the workers engaged in inappropriate practices such as improper covering of foods when warming and refrigerating, not washing hands and not wearing gloves when it was required to do so. The workers argued that they had busy schedules in carrying out their paramount responsibility of food preparation and services. Thus, in trying to meet their target, they intentionally or unintentionally use inappropriate safety and sanitation practices (Hertzman and Barrash, 2007).

Still in USA, Arendt, Strohbehn and Jun (2015) tried using observation and interview to find out employees' motivators and barriers to following food safety practices in food service operations. It was observed that the employees attempted to follow proper hand hygiene but did not meet the 2005 food code requirements as their non-compliance rates with food safety practices ranged between 23% (personal hygiene practices) to 69.4% (cleaning and sanitizing procedures). The workers indicated that their reasons for complying with recommended practices were to avoid bacteria growth and cross-

contamination; not harming customers; satisfying requirement by law, regulations, and procedures. They also complied due to the knowledge and training they received; good practices/habits; rewards; culture of work place and satisfying customers (Arendt, Strohbehn and & 2015, p365).

Furthermore Arendt, Strohbehn and Jun (2015) identified six barriers to food safety practices such as forgetfulness, busy work schedules; inadequate or lack of knowledge; consequence of following safe food practices; unavailability and use of resources, and culture of the work place. This means that there is the need for managers to keep promoting safe food handling practices as well as apply identified motivators to address barriers to promoting work place culture to make food safety paramount.

Additionally, in trying to assess interventions that could improve restaurant employees' rate of compliance to food safety practices, a group of researchers (York et al., 2009) in Kansas, Missouri and Iowa (USA) identified lack of training on food safety guidelines and practices as a barrier to compliance to food safety regulations. Again, in discussing food handlers' views on hand washing behaviour in restaurants, the barriers identified were the unavailability of supplies and sinks; time pressure; high volume of work and stress; lack of accountability; type of establishment; and inadequate training on food handling and safety (Pragle, Harding & Mack, 2007).

In Ghana, Ackah et al (2011) realized that over half (60%) of respondents did not have certificates for medical examination due to lack of funds, unawareness and lack of strict enforcement of regulations by authorities. Still on the barriers to food safety practices, Green and Selman, (2005) buttress Ackah's views as they listed factors such as inadequate

provision of equipment and resources, lack or poor enforcement of law by management and lack of food safety education and training as barriers to food safety practices. Thus, the foregoing factors militate against appropriate food safety practices of food handlers.

Gaps in the Existing Literature

Existing literature on food safety issues in Ghana was mostly on street food vending and vendors. It was also realized that the literature was on studies conducted in the regional capital cities in the southern sector of the country. Additionally, the literature from both the international and local scenes shared the findings of researchers with scientific perceptions away from the practitioners' stance. Thus, there is limited food safety literature from the regions in the northern part of the country; especially the northern region.

Chapter Summary

This chapter discussed relevant food safety concepts, food safety knowledge and practice, empirical information on food safety knowledge and practices, sources of food safety information and barriers to food safety practices. The chapter started with global food safety situation, factors associated with food borne illnesses, food safety knowledge and practices, and sources of food safety information. The food safety standards and regulations and the barriers or challenges to food safety practices were also discussed. The next chapter covers a description of the study area and the methodology employed for the study.

CHAPTER FOUR

METHODOLOGY

Introduction

This chapter describes the various procedures employed and the methods used in conducting this research. The study sought to assess the food safety knowledge and practices of food handlers in restaurants in the Tamale metropolis in the Northern Region. The chapter presents an overview of the study area featuring the occupational and cultural environment, research design used, data sources, the target population and the sample and sampling procedure. Subsequently, the methods used for data collection, the research instruments used in collecting primary data, the approaches used for processing and analysing the data and presentation as well as ethical concerns are presented. Finally, the challenges encountered during the collection of data and how reliability and validity were ensured are discussed.

Profile of the Study Area

The study was conducted in the Tamale Metropolis, the capital city of the Northern Region of Ghana (Figure 7). According to the United Nations Settlement programme (UN-Habitat) (2009) the size of Tamale is approximately 922km^2 and has been identified as Ghana's fourth-largest city (Ghana-largest cities 2014; UN-Habitat, 2009). The Metropolis has an estimated total population of 371,351 people (185,995 males and 185,356 females); with about 74% of them in the urban area and 26% as rural dwellers (Ghana Statistical Service (GSS), 2013; Population and Housing Census (PHC), 2010).

Tamale Metropolis is bordered on the north by the Savelugu-Nanton district, on the south by Central and East Gonja districts, to the east by Yendi Municipality and to the west by Tolon and Kumbugu districts. Tamale is a cosmopolitan city with about 48% of the proportion of urban literate persons in the Northern Region.

In recent years, there has been an increase in human population, commercial activities, influx of foreign merchants, expansion of infrastructure, increase in number of vehicles, emergence of new human settlements among others in the metropolis (GSS, 2013). It has been noted that a total of about 39,248 non-Ghanaians were recorded in the northern region with the majority based in the metropolis (GSS, 2013; PHC, 2010). Due to the fact that Tamale has the highest population density as well as the most urbanized district in the Northern Region where economic opportunities abound, the metropolis has been identified to have the greatest proportion (14.3%) of economically active population in the region (GSS, 2013).

As a result of the central location of the Metropolis, the sprawling city serves as a hub for manufactured goods, all administrative and commercial activities as well as educational and medical center; thus doubling as the political, economic and financial capital of the Northern Region. The Centre of Tamale hosts regional branches of financial institutions and a considerable number of international non-governmental organizations (NGOs) (GSS, 2013; UN-habitat, 2009).

Though the Ghana Statistical Service (GSS) (2013) indicated that the 2010 population and housing census (PHC) shows that the local economy is predominantly agrarian, the major industry in the Tamale metropolis was

repair of motor vehicles and motorcycles (30.4%), followed by agriculture, forestry and fishery (19.6%), manufacturing (13.1%), education (7.6%) and hospitality (7.1%).

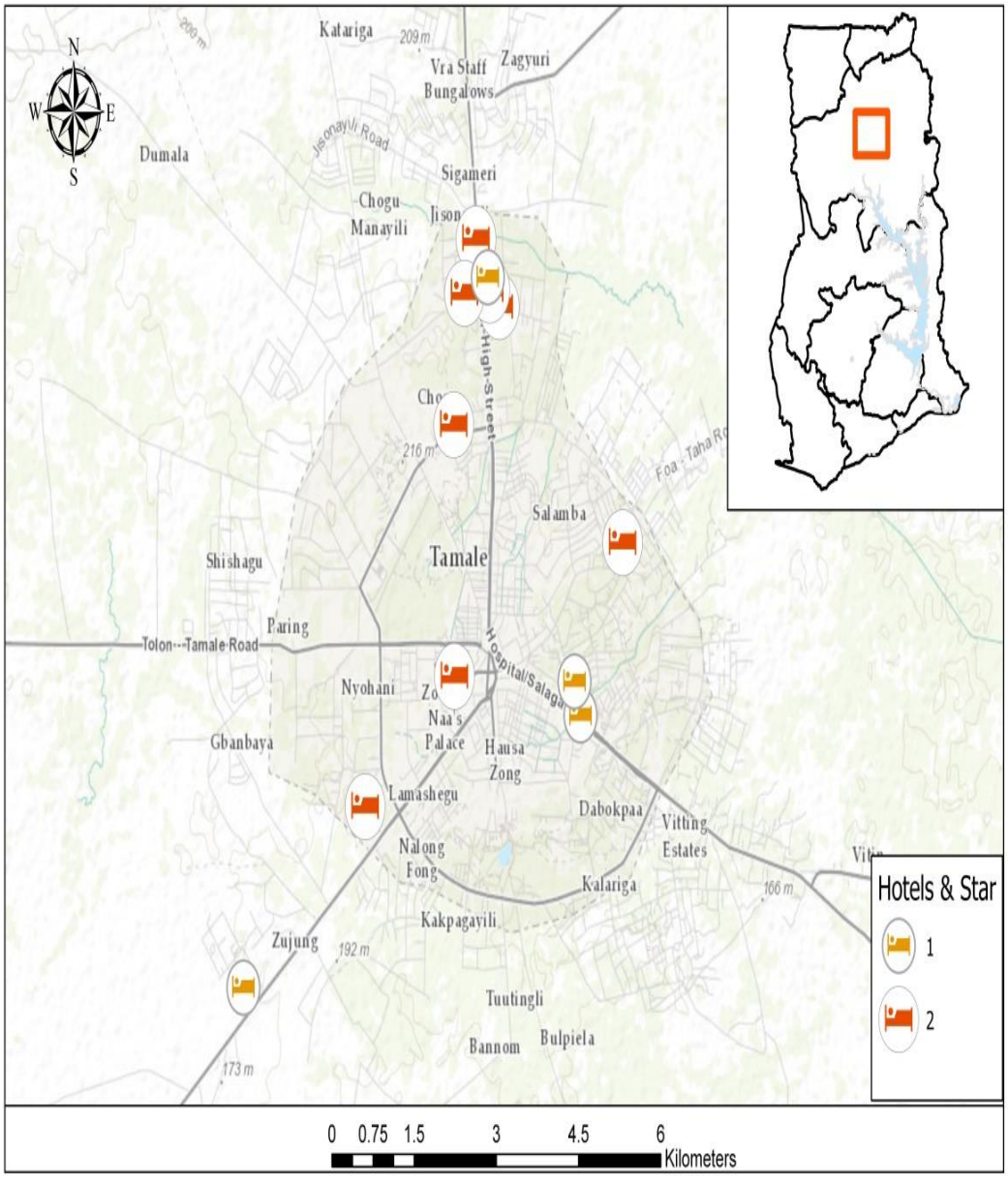


Figure 7: Map of Tamale Metropolis
Source: Department of Geography & Regional Planning, Remote Sensing and Cartography Unit, University of Cape Coast, 2017

Over the years, the hospitality industry has grown significantly, with new hotels, guest houses and restaurants springing up in the Metropolis. At the time of recognisance study there were 86 hotel facilties and 43 prominent restaurants in the metropolis that were serving meals to all categories of people.

The 2010 PHC report shows that Tamale metropolis recorded the largest proportion of persons working in the public sector due to its highly urbanized nature. In the last few years Tamale has developed and transformed significantly due to the rush by various companies to open branches in the city. Tamale developed from a collection of towns and villages where one could find an architectural blend of traditional mud houses and more modern buildings.

Rationale for Selecting the Study Setting

The Tamale Metropolis was selected for this study based on a number of reasons: First, the metropolis falls within the catchment area where there is limited research on food safety issues even though there are reported cases of food borne illnesses which calls for attention. Information from two government hospitals (TTH & TCH in Fig.1 & 2) revealed reported incidences of borne illnesses. For instance, in 2013 there was an incident of food borne illness when adulterated margarine was used to prepare a birthday cake for students.

Secondly, the metropolis is surrounded by historical and tourist attractions such as Mole National Park located in the West Gonja district, Nankpanduri water falls, Nalerigu Defence Wall, Gambaga Escarpment, Yendi German Settlement, Bui National Park, Salaga Slave Heritage Site,

Ancient mosques such as the 13th century mosque of Sudanese architecture in Laribanga, Bole mosque, Banda Nkwanta and Malewe mosque. Others include myths such as the Mystical Rock in Laribanga, the Tikpirah sacred grove in Zabzugu, the Kpalvogu grove at Katariga in the Tamale metropolis and peculiar architecture, archaeology and culture (Ghana Statistical Service (GSS), 2013). All these draw a large number of people including both domestic and foreign tourists from various parts of the country and the world who need to be catered for as they transit in Tamale.

Thirdly, the metropolis is where most of the prominent hotels and restaurants are concentrated and they are likely to attract both foreign and local tourists who will need to be accommodated and fed. Also, there is a wide range of non-governmental organizations and businesses which have made the metropolis a business destination of many multinational and Ghanaian companies which for many years have limited their activities to the Southern part of Ghana.

The fourth reason is that, apart from the increase in human population, Tamale and its environs for almost a decade now has also experienced a very significant growth in the hospitality industry, physical infrastructure and increased business and other human activities in all spheres of the local economy, making it the fastest growing city in the West African Sub-Region (UN-Habitat 2013).

Finally, the only airport in the northern sector of Ghana is located in the metropolis and it serves as a transit point for travelers; both foreign and locals who wish to travel to other areas of northern Ghana. Thus the hospitality industry has the responsibility of catering for these visitors.

Consequently, there are a number of hotels and restaurants that serve a variety of meals to cater for both local and foreign visitors.

Research Philosophy

Neuman (2000) indicated that the basic approaches to social research are the Positivist, Interpretivist and Critical Social Science (realist) approaches. The Positivist approach is an organized method which combines deductive logic with precise empirical observation of individual behaviour in order to discover and confirm a set of probabilistic causal laws that can be used to predict a general pattern of human activity.

The Interpretive approach refers to a systematic analysis of socially meaningful action through the direct detailed observation of people in natural settings in order to arrive at understanding and interpreting how people create and maintain their social worlds. The Critical Social Science approach refers to the critical process of inquiry that goes beyond surface illusions to uncover the real structures in the material world in order to help people change conditions and build a better world for themselves (Neuman, 2000). In other words, the critical realist goes beyond what is observed about food handlers to seek meanings and reasons for their actions.

In view of the forgoing approaches put forward by Crotty (1998), and Neuman (2000); coupled with the objectives and research questions guiding the study, the positivism paradigm was considered appropriate. This is because the study aimed at assessing the food safety knowledge, and practices among food handlers in restaurants as well as investigating the association or linkages between food safety knowledge and practices among food handlers.

Furthermore, Hughes (2001) explained that the positivist paradigm sees the world as being based on unchanging, universal laws and the view that everything that occurs around us can be explained by knowledge of these universal laws. Thus, food handlers' actions and inactions can be explained in relation to the laws and regulation in the industry.

Consequently, the assumption that knowledge transcends into action or practice may remain unchanged or otherwise in this study. Food safety knowledge therefore may bring about change or influence food safety practices which could be explained through knowledge and application of universal food safety laws. To understand how food handlers use these laws the individual needs to observe and record events and phenomena in a systematic way and then work out the underlying principle that has caused the event to occur.

Moreover, the positivism perspective is in line with the quantitative methods employed for this study. A quantitative research is employed for this study in order to generate in-depth information and get a better understanding of the research problem (Creswell, 2009). This study involves measuring variables, assessing the relationship between food handlers' knowledge and practices or impact of the variables, testing hypotheses and applying the results to a large number of people. The quantitative approach will also enable the researcher to measure the knowledge and practices of a great number of people; precisely the food handlers in restaurants to a limited set of questions which facilitate comparison and statistical aggregation of the data.

Research Design

The choice of the positivist paradigm has implications for the study, in terms of the research design, methodology, the kind of data to be collected, sample size and the validity of the measurement. According to Sarantakos, (2005) an important aspect of a research design is the logical sequence of linking empirical data to the initial question or problem of the study and ultimately to its conclusions. Naturally, the research design had to be consistent with the chosen paradigm. Thus, bearing in mind the research questions, the objectives of the study and the research philosophy, the descriptive research design which describes and interprets what exists was adopted for this study.

The descriptive research design was adopted to help specify the nature of a given phenomenon as it determines and reports the way things are. According to researchers such as Creswell (2003) and Best and Khan (1998), descriptive research is concerned with the conditions or relationships that exist; such as determining the nature of prevailing conditions, practices and attitudes; opinions that are held; processes that are on-going; effects that are evident or trends that are developing.

The purpose of this design is to observe, describe and document facets of a situation as it naturally occurs. Thus, the objective of descriptive design is to give accurate description of activities, objects, processes and persons. It deals with determining or interpreting the degree of association or relationships between variables and describing their relationships (Malhotra & Birks, 1999; Amedahe, 2002). The design is deemed appropriate because the

study sought to ascertain the food safety knowledge and practices of food handlers in restaurants in the Tamale metropolis.

Sources of Data

The data for the study were obtained mainly from primary sources. The data were obtained from a survey and field observations of selected food handlers in 23 restaurants in Tamale Metropolis. Questionnaires and an observation checklist were used to record procedures and practices employed by food handlers. The use of primary data provided the researcher first hand information on the food handlers in terms of their actual knowledge, practices and the barriers to their food safety practices. Additional information was obtained from existing documents such as a food safety and sanitation checklist from FDA (modified based on the research objectives and questions), the 2010 Ghana Population Census Report, statistical information on hotel and restaurant facilities in Ghana from GTA, and statistics on food-borne illnesses from the Ministry of health and the internet.

Population

The target population for this study was all food handlers in restaurants in the Tamale Metropolis. As at the time of this study there were 85 hotel facilities (comprising 9 two star, 13 one star, 58 budget and 5 guest house categories) and 22 restaurants (made up of 10 grade-three and 12 grade-two categories) with a total number of 419 workers (GTA). However, the accessible population was all food handlers in one and two star hotels with restaurants and grade two and three independent restaurants.

These classes or ratings of restaurants identified as the accessible population were the highest rating categories in the Tamale Metropolis. The rest of the facilities were either budget hotels or guest houses which did not serve meals as expected. Some of them served only breakfast while others did not serv any meal at all; thus it was impossible to consider them as a source of information for this study. The segment of the population selected was considered appropriate to provide information for this study because aside being the highest ranking facilities, they have facilities for hosting events or programmes such as workshops, seminars, wedding receptions, and general meetings which gave them the opportunity to always have patronage.

At the time of the study there were 22 one and two star hotel restaurants with about 284 food handlers and 21 grades two and three independent restaurants with about 135 food handlers which gave a total of 43 restaurants with 419 food handlers. Thus, the accessible population could give the number of food handlers required for a quantitative study such as this.

Sample and Sampling Procedure

According to Aaker, et al. (2007), the size of a sample can be determined either by using statistical techniques or adhoc approaches when the researcher knows from experience the sample size to adopt. Peng, et al. (2006) indicated that, aminimum sample size of hundred respondents is needed for any quantitative study to reach a significant result.

Based on the list of licensed and registered hotels and restaurants received from the GTA office, it was noted that a total number of food handlers in the hospitality facilities in the Tamale Metropolis at the time of the study (2016/2017) was 419 (284 from hotel restaurants and 135 in

independent restaurants). Since it was practically not possible to involve all the target population in the study, a sample was selected.s. This choice of the samle size was guided by what the researcher thought would be representative, credible, what could be done within the time and resources available (Patton, 1990), the variance in the population, and the proposed strategy of analysis.

To calculate the minimum sample size required for accuracy in estimating proportions, the inconsistency of food safety knowledge or awareness within the population (0.60), the acceptance margin of error of the estimate (0.06) and the degree of confidence of 95% was considered appropriate. The selection of the margin of error (0.05) for the calculation was guided by recommendations by Malhotra and Birks, (2000). According to these researchers a margin of error within the range of 0.01 to 0.05 is considered appropriate in social science and the formula below portrays the practical requirements needed for the calculation of the minimum sample size.

Consequently, the sample for this study was pegged at 229 food handlers. The choice of a sample size was informed by factors such as representativeness, the size of the population and the confidence level required. The estimation of the sample size of 229 was based on Fisher's (1950) formula for determining sample size for a population less than 10,000 as follows:

$$n = \frac{z^2 \ pq}{d^2}$$

Where **n**= the required sample size

z = the standard normal deviation usually set at 1.96 with a confidence level at 95%

p= the population of the target population estimated to have peculiar characteristics

q= 1.0 – p

d = the degree of accuracy desired; usually set at 0.05 (margin of error at 5%)

Given the proportion in the target population that is estimated to have peculiar characteristics as 0.60, the z statistic being 1.96 and desired accuracy at 0.065, then the sample size is:

$$n = \frac{1.96^2(0.60)(0.40)}{0.065^2}$$

$$=218$$

Adding 5% for non-response

$$5/100 * 218 = 10.9$$

$$=218 + 10.9 = 228.9 \text{ (approx. 229)}$$

The calculated value of 'n' means that at least 218 food handlers were targeted to be selected within the categories of facilities in the metropolis to get a representative population. It is worth mentioning that 5% of the estimated sample size (10.9) was added to the desired number in order to account for non-response rate.

Sampling Procedure

This study employed a multi-stage sampling technique in the selection of the sample of restaurants for the study as there was the need to go beyond two stages in cluster sampling before getting the sample for the study (Neuman, 2000). Based on the list of hotels and restaurants received from the GTA office in Tamale metropolis (the sampling frame), it was noted that the number of restaurants (hotel restaurants and independent restaurants) in the

Tamale Metropolis was 43 (comprising 22 restaurants from 2 and 3 star hotels and 21 grades 2 and 3 independent restaurants), with a total number of 419 food handlers (284 from hotel restaurants and 135 in independent restaurants) (GTA). The sample of 229 food handlers was drawn from a total of 23 restaurants bearing in mind what would be representative, credible and could be done within the given time.

In the first stage a cluster sampling procedure was used to group the restaurants into two clusters: hotel restaurants and independent restaurants. Secondly, through stratified sampling the restaurants in each cluster were put into two strata based on their class or rating. Thus, all one and two star hotel restaurants were categorized as group one and the second group comprised all grade 2 & 3 independent restaurants. Thirdly, the restaurants were grouped based on their location in the metropolis (Tamale North, Tamale South and Tamale Central (see Table 1). With the support of three Field Assistants, a list of names of the restaurants in the various locations were compiled. The restaurants in the Northern zone were 21; 17 in the Central zone while those in the southern zone were 5.

Table 1: Distribution of Restaurants by Zones

Zone	Hotel Restaurant (1& 2 Star)	Independent Restaurant (Grades 2&3)	Total Restaurants	Percentage (%)
Tamale North	13	8	21	48.84
Tamale Central	7	10	17	39.53
Tamale South	2	3	5	11.63
Total	22	21	43	100.00

Source: Field survey. Seidu, (2017)

The fourth stage was the use of simple random sampling technique (lottery) for the selection of 23 (12 hotel restaurants and 11 independent restaurants) restaurants based on a proportion (54% and 52% respectively) of restaurants in each cluster. Consequently, the names of the restaurants were (in the two categories within the zones were) written on strips of paper and put in two containers and mixed well. The strips of paper were picked one by one and the names selected were recorded until the required numbers were obtained and each name was recorded once.

The researcher purposely selected these sample sizes (a little above half of each population in the two categories) in order to obtain appropriate number of respondents for a quantitative study like this. The sample size for the first and second groups or strata were allocated 0.54 and 0.52 proportion rates respectively to ensure that each class of restaurant was adequately represented (Table 2). Accordingly, the researcher assigned proportions to the number of restaurants to be selected from each category of restaurants within the zones as the number of restaurants in the zones were not equal. The sample for the restaurants was obtained based on proportion in which the elements occur in the total population. Thus, the zone with more facilities had high numbers selected.

Table 2: Distribution of Sampled Restaurants by Zones

Zone	Hotel restaurant (1&2star-first group)	Sample from first group	Percentage Sampled (%)	Independent restaurant (Grade 2&3- second group)	Sample from second group	Percentage Sampled (%)	Total Sample	Percentage (%)
Tamale North	13	7	58.4	8	4	36.3	10	47.35
Tamale Central	7	4	33.3	10	5	45.5	9	39.40
Tamale South	2	1	8.3	3	2	18.2	3	13.25
Total	22	12	100.0	21	11	100.0	22	100.0

Source: Field survey, Seidu (2017)

Finally, purposive and accidental or convenient sampling were employed to draw the required sample (229) of food handlers from the selected restaurants for this study. According to Babbie (2010), a purposive sample is a nonrandom sample where the units of observation are selected based on the "researcher's judgement about which ones will be most useful or representative" (p193). The purposive and convenient sampling procedures were employed as the researcher sought to observe specific activities during the handling and preparation of specific foods such as ready-to-eat food, salads, sandwiches, and soups. Therefore, all qualified food handlers who were present and working at the research team visited the restaurants were selected for the study (see Table 3). This was in anticipation of whatever number that happened to be available and carrying out activities related to food preparation and service at the time of visit.

Table 3: Selected Facilities and Sample Sizes

S/N	Facility H&R	Population (PRH&R)	Sample Size (SS)	Observed Sample size
1	H001	33	18	4
2	H002	27	15	4
3	H003	13	7	2
4	H004	11	6	2
5	H005	27	15	4
6	H006	38	20	5
7	H007	49	26	5
8	H008	15	8	2
9	H009	9	5	2
10	H010	15	8	2
11	H011	13	7	2
12	H012	18	10	3
13	R013	18	10	3
14	R014	31	17	4
15	R015	26	14	3
16	R016	7	4	1
17	R017	11	6	2
18	R018	13	7	2
19	R019	9	5	1
20	R020	15	8	3
21	R021	11	6	2
22	R022	5	3	1
23	R023	7	4	1
Total		419	229	60

Source: Field survey, Seidu (2017)

$$SS = \frac{TSS}{TP} \times PRH/R$$

Where: SS = *Sample Size;*
TSS = Total Sample Size (229);
TP = Total Population (419);
PRH/R = Population of Respondents in Hotels/Restaurants

Based on the perception that food preparation is usually undertaken by women, the researcher did not allocate any special quotas to the sexes. However, any male food handler who was willing to take part in the study was selected. Due to the fact that the surveyed facilities were running the shift system, the researcher used both the morning and afternoon shift food handlers so that they could stand the chance of being selected for the study. Thus, all

chefs, chief cooks, cooks, kitchen helps in charge of washing up and waiters/waitresses who were at work at the time the research team visited the facility were selected for the study. The chefs were specifically included in the sample as they were the first point of contact and had a greater responsibility of seeing to it that safe food is produced and served.

In addition, a sample of 60 food handlers were purposively selected from the 23 restaurants for the observation of their food safety practices. The researcher purposely observed chefs, food handlers working on foods eaten raw and any other activity that could bring about food safety. The 60 food handlers represented over a quarter of the 229 respondents selected for the study. The fact that observation is a technique that is used for small numbers and takes prolonged periods (Fisher, Laing, Stoeckel & Townsend, 1991) accounts for the reduction in the number of respondents for the observation section. The 60 food handlers who also completed the questionnaire were observed for food safety practices using a check list covering personal hygiene and food hygiene measures. The researcher purposively selected food handlers based on proportions of elements in the facilities.

Environmental hygiene practices were observed on facility bases because the sanitation of both the outside and inside the facility could not be linked to a specific food handler since that work was assigned to a different category of people. Thus, the research team observed the environmental hygiene practices inside and outside of the 19 selected facilities. The observed food handlers were linked with their knowledge scores to find the difference between their food safety knowledge and practices.

Research Instrument

In line with positivist tradition, the survey method was used for gathering data for this study. Consequently, questionnaire and an observation checklist were used to obtain information for this study. The two research instruments were chosen because it was anticipated that the questionnaire alone could not bring out the actual practices of the food handlers; thus deeming it necessary to use the observation method to ascertain them.

Questionnaire

The questionnaire approach was used because it is able to measure the reactions of a great number of people which makes the comparison and statistical aggregation of the data simple (Bryman, 2004). According to Patton (2002) it is possible to obtain the right information from respondents when questionnaires are used. In terms of structure, the questionnaire consisted of four sections where the first section gathered information on the socio-demographic characteristics of the respondents such as gender, age, marital status, education, working experience, food safety and sanitation training obtained. The second part covered 33 questions relating to food safety knowledge of food handlers (ranging from the three main domains including personal hygiene, environmental hygiene to food hygiene) as well as the sources of information on food safety. The third section sought information on practices of respondents towards food safety while the fourth section solicited views on barriers to food safety practices in terms of personal hygiene, environmental and food hygiene measures. The items measuring each of these issues were largely adapted from the literature (Malik, 2014; Ghazali, Othman, Hashuki & Roslan, 2012).

The questionnaire was made up of open and close-ended questions in the three major sections (socio-demographic characteristics and employment profile of respondents, food safety knowledge of food handlers, food safety practices and barriers to food safety practices). The few open-ended questions were to offer participants the opportunity to express their views.

The socio-demographic information included the respondents' gender, age, marital status, educational attainment and religion. Their employment profile consisted of their work status (position), work experience (number of years), training received, facilty type and their sources of knowledge on food safety and preparation.

As indicated earlier, the information on food safety knowledge of respondents was examined in three domains such as personal hygiene, food hygiene and environmental hygiene. A 'true' or 'false' scale was used to measure the respondents' food safety knowledge. The respondents were to indicate whether the 33 statements were 'true' or 'false.' The statements were assigned one mark each and the number of correct scores obtained by each respondent was calculated out of the total statements to ascertain how knowledgeable the respondent was.

As regards the barriers to food safety practices the major barriers deduced from reviewed literature were listed and the respondents were required to tick the applicable ones that resulted in their inability to practice food safety. The respondents were also given the opportunity to write some barriers to their practices that were not on the list provided.

Observation Checklist

Observation method was used as a data collection tool because it provides rich, detailed and context specific descriptions which are close to the inside perspectives (Sackmann, 1991 cited in Altinay & Paraskevas, 2008). Thus, observation was employed to gather data on food handlers' food safety practices which they were otherwise reluctant or incapable of providing. The checklist was also made up of food safety measures in relation to the three domains of food safety. The researcher was to indicate 'Yes' if the food handler's practice was observed to be right and 'No' if the practice was not right by food safety standards.

A structured observation checklist was adapted from the food safety and sanitation compliance checklist from the Food and Drugs Authority. It was modified in relation to the study objectives and research questions. The use of exploratory and general observation was carried out to enable the researcher obtain first-hand information (Sarantakos, 2005) on the practices of the respondents which otherwise would be difficult to get as well as offer data when respondents are unable or unwilling to give information.

However, it cannot be employed when large groups or extensive events are studied. In spite of its shortfalls it is considered appropriate as it approaches reality in its natural structure and studies events as they evolve.

Pre-testing of Instrument

According to Sarantakos (2005), pretests are small tests of single elements of a research instrument that are mostly used to check the mechanical structure of the instrument. As regards this study a pretest was carried out in October 2016 to ensure that the instrument was clear enough to be able to

draw information or answers from the respondents. The pre-testing was meant to check the clarity of the items and identify ambiguities, misunderstandings or other inadequacies to make the instrument more relevant and appropriate for the actual data collection.

The questionnaire was self-administered to 20 food handlers in two restaurants (one hotel restaurant and one independent restaurant) in the Cape Coast Metropolis. The food handlers were asked to complete the questionnaire as well as comment on the time it took to complete it. The researcher spent three days in each facility to observe the participants as well as administer the questionnaire. At the end of the third day in each facility the questionnaires were retrieved from the respondents and scored.

The major issues identified during the pre-test were that: some of the questions were not properly stated. Others were ambiguous and irrelevant. The instrument was revised by re-phrasing the ambiguous questions, addition of some items, deletion of some unrelated items, re-arranging some items to ensure logical ordering and revising the layout to ensure consistency.

Training of Field Assistants

In order to collect relevant data and on time, three Research Assistants were given a two-day training to be in a position to assist with the data collection. The researcher recruited field assistants who had first degree, experience in data collection and could speak Dagbani and Twi in addition to English. They were taken through questionnaire administration techniques as well as translation of the questionnaire into the two local dialects to ease and fasten interaction, especially in administering the questionnaire to food handlers who could not read and write. After the training the research

assistants had a mock data collection section using Level 400 Family and Consumer Sciences students in the University for Development Studies to demonstrate their understanding of the issues discussed.

Data Collection Procedure

Data were collected in two stages using questionnaire and observation check-list from November 2016 to March, 2017. The first stage was the observation section where the researcher, with the consent of the management of the establishments, observed the activities of food handlers while participating in the activities with them. All observed practices were recorded in the observation check-list in order to get information in an organized manner. The observation gave the researcher the chance to have a good observation of the food handlers as they worked. The observation took the whole working period for the day; following the shift system schedules. Each participant was observed for two hours during meal preparation and service (either the noon or evening meal) and two food handlers were observed concurrently if they were close to each other. A maximum of four days was used in each establishment. With permission from participants, pictures were taken to confirm the practices.

After the first day's observation, the three trained research assistants distributed the questionnaire to the selected participants and followed up for collection after the second day. The three trained field assistants administered the questionnaire to food handlers who could read and write and had face to face interviews with respondents who could not read and write using the questionnaire. The distribution of the questionnaires was done early before the start of work and after the peak hours of meal preparation and service.

This strategy was employed to get the attention of the participants as the service pressure would have gone down and participants would be relaxed to respond to the questions. To avoid employee nervousness, the researcher employed a number of strategies such as: 1) dressing in similar clothing like the employees, 2) researcher and assistants initiated small talk with food handlers and other staff, 3) recorded observations in a small note pad and check lists and 4) extended period of observation. The researcher observed the preparation and service of dishes such as Salads, meat, fish, snacks and the storage of food. The actual field work for this study was undertaken from November 2016 to March 2017 in the Tamale Metropolis of Ghana.

Ethical Issues

The study considered the issue of informed consent, anonymity and confidentiality. As indicated by Newman (2007), researchers must not compel people to participate in a study. Also, in social science, it is unethical to collect information without the knowledge of the participants (Schinke & Gilchrist, 1993). Hence, participants should at all times willingly or voluntarily take part in research. Consequently, a letter of introduction was taken from the Department of Tourism and Hospitality Management of the University of Cape Coast to the Ghana Tourism Authority (GTA), FDA, Northern Regional Restaurant and Hoteliers' Association and the facility managers for their consent before the field work began.

In addition, informed consent was also obtained from the managers of the participating restaurants and the food handlers before the instruments were administered. Permission was sought from them to record and take pictures of observed practices as well as present pictures in the work where necessary

with their faces covered. The purpose of the study was clearly explained to them and the issue of anonymity was also assured. Anonymity protects privacy by not disclosing a respondents' identity. Thus, the names of the food handlers were not associated with the responses given. The names of the respondents and the participating restaurants were rather given codes for the sake of anonymity.

Fieldwork and Related Challenges

In the field of research, data collection comes with some challenges which are unavoidable and this study was no exception. This study faced the following challenges:

First, on arrival at the premises of selected hotels and restaurants the research team could not gain easy access to the kitchen area as it was difficult for the workers to allow the team into the kitchen without permission. To resolve this, the team first met with the facility managers who then introduced the team and explained the purpose of the visit to the employees. Initially it was taken for granted that since permission was sought from them through letters and personal contacts they had informed the workers but it was not so in some of the selected facilities.

Secondly, the research team was also suspected by some of the employees to have been sent by some regulatory bodies like GTA and FDA on monitoring. Thus the workers did not want to open up and tried to pretend. To address this constraint, the team had to explain the nature and purpose of the research to them over and over again. They were also told how the study could serve as a way of identifying their training needs as well as serve as a medium

for them to communicate some of their concerns to management, their professional associations and the regulatory bodies.

Thirdly, due to the busy schedule of the food handlers especially during the peak hours, the participants did not have time to fill out the questionnaires as expected. The team had to revisit facilities a number of times in order to retrieve questionnaires. There were occasions that team members had to administer the questionnaires to some respondents. In this regard, the questionnaires were hand delivered to each available food handler shortly after observing their practices.

Finally, the respondents wanted to know what they could benefit from responding to the questions before answering the questions. To this the team promised to show them their scores so that they could know their knowledge levels and the areas they need to improve upon. This motivated them to fill the questionnaire.

Amidst these challenges, the participants responded to the questions as expected and out of the 229 questionnaires administered, 214 of them were retrieved; representing a response rate of 94%. On the whole the data collected were reliable and therefore could be used.

Data Processing and Analysis

Both descriptive and inferential statistical techniques were applied for the analysis of the data collected from the field. In order to ensure quality, the data were coded and entered into STATA version 15 software for analysis. Accordingly, the data were carefully edited or cleaned to remove all outliers or extreme values which could have affected the validity of the results.

Descriptive statistics such as means, percentages, frequencies, cross tabulations and standard deviations were used in analyzing the socio-demographic, work related characteristics of respondents, their food safety knowledge and practices as well as the barriers to food safety practices.

The independent samples t-test and one-way analysis of variance (ANOVA) were used to test for mean differences in the dimensions of food safety knowledge across the background characteristics (such as sex, age, and type of restaurant) of the respondents. The significance in the mean differences of the groups was estimated using a probability value of 0.05. The food safety knowledge dimensions were personal hygiene knowledge, food hygiene knowledge, and environmental hygiene. The t-test was used in instances when the independent variable had two categorical outcomes/groups, for example, sex: male and female and ANOVA when the categories were more than two (Pallant, 2018).

The continuous outcome for each of the food safety knowledge dimensions was computed by totaling the number of correct responses of each question under each knowledge domain. The total number of items for personal hygiene knowledge was thirteen (13), food hygiene knowledge was twelve (12), and environmental knowledge was eight (8). Therefore, the total number of questions used to measure food safety knowledge was thirty-three (33). The same principle was applied in determining the number of correct practices. In sum, thirty-eight (38) questions through observation were used to gauge food safety practices. This was made up of eleven (11) items for the personal hygiene practices, twelve (12) for the food hygiene practices, and fifteen (15) for environmental hygiene.

Chapter Summary

This chapter was devoted to the methodology of the study. The areas discussed included the study area, the research philosophy and design guiding the study, the population, sample size and the procedures followed in collecting and analysing the field data. The study followed a descriptive research design and primary data was the main source of data; supported with secondary information from GTA, FDA, Ghana statistical service and 2010 PHC report.

The researcher used questionnaire and observation check-list to collect data from food handlers in restaurants. Both probability and non-probability sampling procedures were employed to select the sample of 229 food handlers. The chapter also discussed issues related to pretesting of the research instrument and the outcome as well as the field work and the challenges associated with the data collection and how they were addressed.

Additionally, the chapter identified data analysis methods used and how the results were presented. The next chapter presents the analysis, results and discussion of the findings in relation to the socio-demographic and work-related characteristics of the respondents.

CHAPTER FIVE

FOOD SAFETY KNOWLEDGE OF RESPONDENTS

Introduction

The chapter presents the respondents' food safety knowledge and related issues. The issues covered included a description of the socio-demographic characteristics and work profile of the respondents, their food safety knowledge and the sources of the food handlers' information on food safety. As regards the respondents' food safety knowledge, the issues considered were the food safety knowledge in relation to their socio-demographic characteristics and the categories of restaurant as well as their sources of information on food safety knowledge.

Background Characteristics of Respondents

Although the study is not specifically on the personal characteristics of food handlers, the opportunistic data as indicated in Chapter One (pg. 20) is essential to highlight some factors that are associated with the respondents' knowledge base and the sources of information that in turn affect their food safety practices. The specific elements covered under the background characteristics were gender, age, marital status and educational attainment of the respondents as shown in Table 4.

According to Mason and Cheyne (2000), cited in Amuquandoh (2006), gender has been found to influence individuals' needs and aspirations as well as their perceptions and attitudes towards issues and events; thus the need to give attention to the gender of the respondent. In Africa, the popular notion is that food preparation and service is the primary responsibility of women and the belief is that restaurant work is often reserved for females. Out of the 214

individuals who engaged in the study, 30.4% were males while 69.6% were females.

Table 4: Background Characteristics of Respondents

Background Characteristics	(N=214) Frequency (n)	Percentage (%)
Gender		
Male	66	30.8
Female	148	69.2
Age group		
18-27	128	59.8
28-37	61	28.5
38-47	18	8.4
48 and above	7	3.3
Marital status		
Single	130	60.7
Married	84	39.3
Religion		
Christianity	109	50.9
Islam	105	49.1
Level of Educational		
No Formal Education	9	4.2
JHS/MSLC	18	8.4
SHS	105	49.1
Tertiary	82	38.3

Source: Field survey, Seidu (2017)

Traditionally, age has been found to influence individuals' knowledge, perceptions, attitudes towards issues and ability to take risks, and accept or reject change. Age has also been associated with individual's ability to seek and obtain information and services (Awusabo-Asare, Biddlecom, Kumi-Kyereme & Patterson, 2006). Consequently, age was considered as an important variable in this study that could influence respondents' ability to take decisions to bring about change in food safety practices. The results show that, 59.8% (128) were aged between 18-27years, 28.5% (61) were within 28-37 years, and 8.4% (18) were aged between 38-47years while 3.3% (7) were

48 years and above. Based on the data obtained the estimated mean age of the respondents of the study was 28years.

The results depict that over one-sixth of the respondents (60.7%) were single whilst the rest (39.3%) were married. This finding reinforces that of Kibret and Abera's (2012) who observed that most of the food handlers (77%) in their study were single; which implies that they were more likely to have time for knowledge acquisition and practice compared to their counterparts who were married.

Education is regarded as the ladder to achieve higher heights as it provides people with the knowledge and skills that can lead to better employment opportunities and a better quality of life. Educational attainment is known to be an important determinant of knowledge and practice (Ackah et al. 2011). Information regarding the educational level of the respondents showed that 49.1% of the food handlers in the restaurants were senior high school certificate holders, 38.3% (82) had tertiary (polytechnic degree holders) education and 8.4% (18) were JHS/MSLC certificate holders while 4.2% of the respondents had no formal education. This conforms to the assertion by Jianu and Chis (2012) that food handlers with higher education had higher knowledge; which could be regarded as the bases of the respondents' knowledge.

Work-Related Characteristics of Respondents

The work-related characteristics included the respondents' professional qualification, the positions held, their work experience, and the in-service trainings received. The results in Table 5 revealed that, 60.7% of the respondents were professionals (14.5% HND in Hotel/Institutional

management, marketing, 23.4% advanced catering, 16.4% intermediate catering and NVTI, 6.5% Home Economics) and 39.3% non-professionals.

Over half (63.6%) of the respondents were from hotel-based restaurants while the remaining 36.4% (78) were in independent restaurants. This is due to the fact that, at the time of the survey, there were more 1and 2 star hotels than grades one and two restaurants from which the sample was selected.

Table 5: Work Related Characteristics of Respondents

Work related characteristics	N=214 Frequency (n)	Percentage (%)
Professional qualification		
Professionals	130	60.7
Non professionals	84	39.3
Type of facility		
Hotel restaurants	136	63.6
Independent restaurants	78	36.4
Position in the organization		
Chef	19	8.9
F&B supervisor/manager	7	3.3
Cook	124	57.9
Waiter/ waitress	64	29.9
Work experience		
1-6months	101	47.2
7-12months	44	20.6
13-18months	38	17.8
19 months and above	31	14.5
Routine medical check-ups in a year		
No medical check-ups	23	10.7
Does medical check-ups at intervals	191	89.3
In-service training on food safety practices during the past year		
Received in-service training	90	42.1
Not received in-service training	124	57.9

Source: Field survey, Seidu (2017)

In terms of the respondents' position in the work place, it was found that 57.9% of the respondents were cooks, 29.9% (64) waiters/waitresses, with a few respondents in the managerial positions as chefs and food and beverage supervisors/managers (9.3%; 8.4%) respectively.

As regards the respondents work experience, it was realized that 47.2% of the respondents had worked for between 1-6 months, 20.6% had worked between 7-12 months, 17.8% worked between 13-18 months while 14.5% had worked for 19 months and above. Thus, most of the respondents had worked for less than a year. This could be associated with widespread turn overs in the food service industry.

Medical examination and routine check-ups are public health requirements for all food handlers in the hospitality industry to ensure that food handlers with infectious diseases are excluded from handling food (Ackah et al., 2011; CCMA, 2012; GTA, 2012). The analysis shows that, the majority (89.3%) of the respondents did have routine medical check-ups in the year while 10.7% did not. This result is in consonance with Addison's (2015) findings that 59% of the respondents undertook routine medical screening at intervals while 19.2% did not. Although the number (10.7%; 23) may be considered small it is still risky for consumers. This is due to the fact that the risk of contaminating food is often linked to food handlers who could be asymptomatic carriers of microorganisms that cause food borne illnesses (Walker, Pritchard, & Forsythe, 2003).

Education and training are considered key to food safety knowledge and practice as training enables workers to be conversant with work tasks, new knowledge and techniques to improve on their performance and demands of the establishment (McSwane, Rue & Linton, 2003). According to Gul (2012) education is an effective determinant of acceptable food safety and hygiene practices. In this regard, the respondents were asked to indicate whether they received in-service training on food safety and hygiene practices or not. The

result indicates that, 42.1% (90) of the respondents received in-service training while over half (57.9%; 124) did not. This suggests a high risk of contamination of food since most of them have not received training and may not be familiar with appropriate food handling techniques.

Food Safety Knowledge of Respondents

The respondents' food safety knowledge was assessed in three main areas namely personal hygiene, environmental hygiene and food hygiene. Thirty-three statements were used to gauge the respondents' food safety knowledge in the three domains. The responses on the three domains are discussed in this section.

Personal Hygiene Knowledge of the Respondents

Thirteen statements were used to gauge the respondents' personal hygiene knowledge and the results are presented in Table 6. Overall, about 76% (162) (a mean or average of all correct responses) of the respondents were found to be knowledgeable in personal hygiene issues as they gave correct responses to the 13-personal hygiene-related statements. This gives some assurance of safety as it has been noted by Clayton et al., (2002) that when food handlers have appropriate personal hygiene perceptions, the risk of food-borne illnesses might be minimised.

Segregating the personal hygiene knowledge by specific personal hygiene measures, it was noted that the majority of the respondents were knowledgeable in areas such as the importance of medical examination as a requirement for employment in the food industry (95%), coughing and sneezing directly on food during food preparation and service not being a hygienic practice (92%).

Table 6: Personal Hygiene Knowledge of Food Handlers

Personal Hygiene Statements	Number with correct Responses (%)	Number with incorrect Responses (%)
Food handlers are at liberty to put on hair restraints/caps during food preparation and service	35 (16.4)	179 (83.6)
Using aprons or overcoats during food preparation is a luxury	143 (66.8)	71 (33.2)
It is optional to wear hand gloves when preparing foods that are eaten raw/fresh	130 (60.7)	84 (39.3)
A food handler cannot continue to wear soiled clothing to work until he/she is off duty	158 (73.8)	56 (26.2)
It is compulsory for food handlers to have jewelries on during food preparation	194 (90.7)	20 (9.3)
Hand washing with soap and warm water before commencing and during cooking and service reduces the risk of food contamination	195 (91.1)	19 (8.9)
Hand washing is necessary only after visiting the toilet	174 (81.3)	40 (18.7)
Food handlers are at liberty to scratch skin, touch hair, nostrils and ears during food preparation and service	195 (91.1)	19 (8.9)
Food handlers are at liberty to wear long finger nails	192 (89.7)	22 (10.3)
A food handler is at liberty to lick fingers during food preparation and service	160 (74.8)	54 (25.2)
Coughing or sneezing directly on food during preparation and service has no effect on the food	197 (92.1)	17 (7.9)
Medical examination is not a requirement for employment in the food production and service industry	203 (94.9)	11 (5.1)
Regular or routine medical examination is optional in the food production and service unit	130 (60.7)	84 (39.3)
Overall Score	162 (75.7)	52 (24.3)

Source: Field survey, Seidu (2017)

They were also aware of the need to wash hands with soap and warm water before, and during food preparation and service (92%), the need to avoid

scratching parts of the body during food preparation and service (91%), not wearing jewellery during food preparation (91%), and the necessity of avoiding long finger nails (89.7%) and washing hands after visiting the toilet (81%).

Their knowledge on the medical issues suggests that a good proportion of them were aware of the public health requirements which demand that all individuals who handle food in the industry undergo a medical examination and routine check-ups (Ackah et al., 2011; CCMA, 2012; GTA, 2012). They were also aware that a food handler who is ill or shows symptoms should abstain from handling food (FDA, 2001; Kitagwa, 2005).

Respondents' knowledge in relation to coughing and sneezing directly onto food can be said to be in consonance with the popular notion that coughing and sneezing should be done away from food or into disposable napkins since body fluids such as saliva and sweat have the potential to contaminate food (Hayter, 2006 and McSwane et al., 2003). Similarly, their responses relating to scratching body parts and the wearing of jewelleries during food preparation and service indicates that they agree with the suggestion from Sprenger (2009) and McSwane et al. (2003) that food handlers should not wear rings and other jewellery during food preparation and service as they can harbour germs that could cause food-borne illness.

The knowledge demonstrated by the majority of the respondents (91%) with regards to hand washing was found to be consistent with the observations made by Onyango et al. (2016), Apanga, Addah & Raymond (2014) and Ackah et al. (2011); that most respondents had very good knowledge on the need to wash hands after visiting toilet, blowing nose,

counting money, and sneezing into handkerchiefs before and during food preparation and service.

On the other hand, a little over half of the respondents demonstrated good knowledge in areas such as the need to use protective clothing such as aprons/overcoats (67%) and gloves (61%) during cooking as well as undertake routine medical examination (61%). It is expected that food handlers should have high knowledge on the use of protective clothes as they serve as barriers between bare hands and the food being handled (FDA, 2001, Green & Selman, 2005; Green et al., 2007).

Thus, the level of knowledge exhibited by the respondents on the need to use these hair restraints falls below the recommended knowledge level. On the whole, as high as 83.6% of the respondents did not know the importance and urgency of putting on hair restraints during food preparation and service. Only a small proportion of the respondents (16%) were knowledgeable in this regard. This could perhaps, be attributed to the food handlers' ignorance of the fact that the wearing of hair restraints (scarfs, hair nets, hats, caps, and hair bands) during food preparation and service is obligatory as they prevent hair from falling into the food.

Environmental Hygiene Knowledge of Respondents

Eight environmental related items were employed to elicit respondents' knowledge on environmental hygiene. Table 7 presents the distribution of scores in relation to the physical surroundings of the food service facilities (both inside and outside the kitchen as well as the work surfaces, kitchen linen and equipment used).

In total, 78% of the respondents gave correct responses to the statements on environmental hygiene, indicating that they were knowledgeable in environmental hygiene issues.

Table 7: Environmental Hygiene Knowledge of Respondents

Environmental Hygiene Statements	Number with correct Responses (%)	Number with incorrect Responses (%)
Food preparation and service area should be free from pests and rodents	194 (90.7)	20 (9.3)
Adequate and clean toilet facilities is a luxury	192 (89.7)	22 (10.3)
Proper cleaning of premises reduces the risk of food contamination	180 (84.1)	34 (15.9)
All kitchen cloths must be washed with soap/detergent once a week	165 (77.1)	49 (22.9)
All garbage bins in the food preparation and service area should be left opened for easy usage	189 (88.3)	25 (11.7)
Garbage bins should be emptied once a week	193 (90.2)	21 (9.8)
Hand washing stations should be equipped with sanitary towels/drying services	171 (79.9)	43 (20.1)
Good drainage system can limit the spread of microorganisms	56 (26.2)	158 (73.8)
Overall Score	167.5 (78.3)	46.5 (21.7)

Source: Field survey, Seidu (2017)

In specific terms, the majority of them had high knowledge in areas such as: keeping the kitchen free from pests and rodents (90.7%), the need to have a clean toilet facilities (89.7%) and emptying garbage bins regularly (90%). This finding is consistent with the normative knowledge that proper waste disposal guards against the breeding of insects and pests in the environment (McSwane et al. 2000 & WHO, 2006). This knowledge is also in line with the ISO 22000 (2015) standard that waste bins should have

appropriate lids and that liquid and solid waste be removed from food processing area without contaminating products and the environment.

In addition, most of the respondents (90%) were aware that unclean work surfaces and kitchen cloths are vehicles of contamination as well as major sources of cross-contamination (Hill, 2011); consequently, they were not in favour of washing kitchen cloths once a week. An appreciable percentage (84.1%) of them agreed that proper cleaning of premises reduces the risk of food contamination. Likewise they affirmed the need to equip hand washing stations with sanitary towels/drying service (79.9%). However, it is worth noting that as many as 158 (73.8%) respondents were not aware that good drainage systems limit the spread of microorganisms. This suggests that the food handlers are likely to ignore their drainage systems which could lead to the accumulation of waste and subsequently lead to contamination.

Food Hygiene Knowledge of Respondents

As regards the food handlers' food hygiene knowledge, twelve measurement items were used to gauge it and the results are presented in Table 8. In all, 75% of the respondents gave correct responses on the food hygiene knowledge statements. This observation shows that they are knowledgeable in food hygiene issues. The majority of them displayed high knowledge on issues such as washing, rinsing equipment and serving dishes under running water (95%), the importance of using separate chopping boards during food preparation (90%), not mixing raw food and cooked foods during storage (87.4%) and the need to reheat leftover cooked foods well to reduce the risk of food contamination (81.8%).

Their knowledge on separating cooked and raw foods during storage reinforces the observation made by Ko (2011) that most restaurant staff in China are aware that salads and vegetables should not be stored with fresh meat in the same container.

Table 8: Food Hygiene Knowledge of Respondents

Food Hygiene Knowledge Statements	Number with correct Responses (%)	Number with incorrect Responses (%)
Reheating cooked food contribute to food contamination	175 (81.8)	39 (18.2)
Appropriate refrigeration temperatures (freezing) kills all bacteria that may cause food-borne illness	117 (54.7)	97 (45.3)
Raw/fresh foods and cooked ones (vegetables, meat) can be put together during storage	187 (87.4)	27 (12.6)
Cooked foods (meat, soups and sauces) can be left out of the fridge to cool overnight before refrigeration (stacking discipline)	117 (54.7)	97 (45.3)
Cooked food should be very hot (at a temperature of 65 ^{o}C) before serving	181 (84.6)	33 (15.4)
Food items purchased from reliable sources need no cleaning before storage	158 (73.8)	56 (26.2)
The best way to thaw frozen food is to put it in a bowl and leave it in the open	108 (50.5)	106 (49.5)
It is a luxury to use separate chopping boards during food preparation	188 (89.9)	26 (12.1)
Food handler is not obliged to wash and rinse equipment and serving dishes under running water	204 (95.3)	10 (4.7)
It is not important to heat or sanitize serving plates and dishes before they are used for service	166 (77.6)	48 (22.4)
The manipulation of food with uncovered hands increases the risk of food contamination	170 (79.5)	44 (20.6)
Overall Score	161 (75.2)	53 (24.8)

Source: Field survey, Seidu (2017)

Similarly, about 84.6% agreed that cooked foods be served very hot and also food should not be manipulated with bare hands to avoid contamination (79.5%).

Furthermore, about 78% (166) of the respondents displayed awareness of the importance of sanitizing serving plates and dishes before they are used for service. Surprisingly, only a little over half (54.7%) of the respondents knew that appropriate refrigeration temperatures or freezing does not kill all microorganisms in food. This means that an appreciable number of the respondents (45.3%) were not aware of the fact that some microorganisms are only inactivated under cold or freezing conditions and will revive when they get favourable conditions. Similarly, about half (49.5%) of the respondents had no knowledge of the right way to thaw frozen foods. Thus, they stand a chance of contaminating foods during the thawing process.

Levels of Food Safety Knowledge of Respondents

In order to establish the levels of food safety knowledge of the respondents, they were asked to respond to thirty-three items on food safety and the number of correct responses obtained out of the thirty-three was considered as the level of the individuals' knowledge. The scores were put in ranges between 0-10 representing low knowledge, 11-21 moderate knowledge and from 22-33 for high knowledge level and the results are presented in Table 9.

As evident in the Table, the respondents' knowledge on food safety issues ranged between moderate (19%) and high (81%). The results showed marked differences in the levels of the respondents' knowledge where 81% of the respondents had high knowledge while 19 % had moderate knowledge.

Table 9: Respondents' Food Safety Knowledge Levels

Knowledge Level	Frequency (n)	Percentage (%)
Moderate	41	19.00
High	173	81.00
Overall score	214	100.00

Source: Field survey, Seidu (2017)

There was no respondent within the low knowledge level category. This implied that the respondents were knowledgeable in food safety issues.

Consistent with the KAP model (Ko, 2013) which informed this study, the respondents were expected to exhibit good food safety practices given that nobody showed low or poor knowledge on food safety issues. The KAP model assumes that an individual's behaviour or practice depends on his or her knowledge and that the mere provision of information to an individual can lead directly to change in attitudes and practice. Thus, the high knowledge levels could influence their food safety practices.

Food Safety Knowledge by Socio-demographic Characteristics

Individuals' knowledge on issues, events and phenomenon including food are known to vary across their background characteristics (Ko, 2013; Rennie, 1995). In order to gain insights into the differences in food safety knowledge (using the continuous measure of knowledge, which was computed as the number of correct responses) among the food handlers, an independent samples t-test and one-way analysis of variance (ANOVA) were used to explore such possible variations across their socio-demographic characteristics. The results of these analyses are presented in Table 10.

Table 10: Food Safety Knowledge by Respondents' Socio-demographic Characteristics

Socio-demographic Characteristics	Personal hygiene			Food hygiene			Environmental hygiene		
	Pooled sample	Hotel Restaurants	Independent Restaurants	Pooled sample	Hotel Rest. M(SD)	Independent Rest.	Pooled sample	Hotel Rest. M(SD)	Independent Rest.
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Sex									
Male	11.04	11.23	10.57	9.07	9.06	9.10	6.46	6.59	6.15
Female	10.35	10.43	10.24	9.06	9.16	8.91	6.16	6.23	6.06
t(p-value)	2.35(0.01*)	2.28(0.02*)	0.63(0.52)	0.00(0.48)	0.08(0.77)	0.12(0.72)	2.33(0.12)	2.50(0.11)	0.06(0.81)
Age									
18-27	10.41	10.38	10.45	8.88	8.80	9.02	6.15	6.19	6.09
28-37	10.68	10.95	10.16	9.32	9.34	9.29	6.34	6.58	5.87
38-47	10.82	11.12	10.14	8.73	9.75	6.42	6.30	6.25	6.42
48 and above	11.14	12.33	10.25	10.57	10.33	10.75	7.00	7.33	6.75
F(p-value)	0.64(0.59)	1.81(0.14)	0.12(0.94)	2.24(0.08)	1.74(0.16)	6.90(0.07)	1.04(0.37)	1.51(0.21)	0.60(0.61)
Marital status									
Single	10.59	10.62	10.53	8.95	8.96	8.93	6.24	6.29	6.15
Married	10.53	10.84	10.00	9.25	9.40	9.00	6.28	6.46	6.00
t(p-value)	0.20(0.83)	0.63(0.52)	1.08(0.27)	1.10(0.29)	1.59 (0.21)	0.02(0.89)	0.04(0.83)	0.55(0.46)	0.22(0.63)
Religion									
Christianity	10.80	11.05	10.19	9.28	9.52	8.67	6.45	6.63	6.03
Islam	10.36	10.32	10.41	8.87	8.66	9.15	6.06	6.01	6.13
t(p-value)	1.95(0.14)	3.12(0.04*)	0.22(0.63)	1.36 (0.25)	3.62(0.02*)	0.97(0.32)	2.35(0.09)	4.07 (0.01)*	0.09(0.76)

Table 10: Continued

Level of education									
No formal education	11.11	11.16	11.00	9.55	9.66	9.33	6.66	6.50	7.00
JHS/MSLC	9.33	9.50	9.25	8.94	8.00	9.41	5.88	5.50	6.08
Senior High School	10.59	10.64	10.46	8.91	9.05	8.56	6.34	6.52	5.90
Tertiary	10.75	10.90	10.53	9.24	9.32	9.12	6.19	6.20	6.18
F(p-value)	5.41(0.14)	1.04 (0.37)	1.46(0.23)	0.61(0.61)	0.98(0.40)	0.64(0.58)	0.94(0.42)	1.59(0.19)	0.63(0.59)
Professional qualification									
HND, Institutional management	10.96	11.16	10.69	9.19	9.50	8.76	6.35	6.33	6.38
Advanced catering	10.20	10.28	10.00	9.10	8.91	9.53	6.12	6.17	6.00
Intermediate catering	10.54	10.39	10.83	9.28	9.39	9.08	6.34	6.52	6.00
NVTI, DBS, Home Economics	11.20	11.37	10.50	9.40	9.70	9.25	6.42	6.50	6.25
Nonprofessional training	10.52	10.82	10.06	8.83	8.92	8.69	6.25	6.39	6.03
F(p-value)	12.35(0.03)**	1.02 (0.40)	0.72 (0.56)	0.63(0.63)	0.70(0.59)	0.46(0.76)	0.26(0.90)	1.73(0.78)	0.19(0.94)

Source: Field survey, Seidu (2017)
Asterisks (*) indicate areas of significant differences.

It was observed that on the whole, the knowledge on personal hygiene varied by sex (p = 0.01) as well as respondents who worked in hotel restaurants (p = 0.02) but not for those who worked in independent restaurants (p = 0.52). On the whole, while both sex cohorts scored high on personal hygiene issues, the mean rating for males (mean =11.04) was higher than their female (mean =10.35) counterparts. The overall finding confirms the hypothsis that there will be a significant difference in the personal hygiene knowledge by the sex of the food handlers. This agrees with Byrd-Bredhenner et al.'s (2009) finding that male food handlers were likely to be more knowledgeable than the female respondents. Similarly, it was noted that the male food handlers in hotel restaurants (mean =11.23) were more knowledgeable as compared to the females (mean = 10.43) in the same facility. It can also be inferred that the male food handlers who work in hotel restaurants are more likely to have high knowledge on personal hygiene compared to their female counterparts in the same facility. The trend was similar to that of food handlers in independent restaurants. In addition, it was clear from Table 10 that the male respondents from hotel restaurants had more knowledge in personal hygiene issues than their counterparts in independent restaurants.

The results further indicated that significant differences (p=0.04) existed between respondents from different religious groups as well as the category of facilities they worked in. Regarding personal hygiene, it was observed that Christians (mean=11.05) had higher knowledge scores compared to food handlers affiliated to the Islamic religion (mean =10.32) in hotel restaurants. This indicates that food handlers who are Christians tend to

have more knowledge on personal hygiene compared to their colleagues from other religious backgrounds.

As regards the overall food hygiene knowledge and religious affiliation, no significant variation was observed ($p>0.05$), such that those respondents who were Christians (mean =9.52) exhibited similar knowledge levels as that of their Moslems (mean =8.66) colleagues. This observation reinforces the null hypothesis that there will be no significant difference in the food hygiene knowledge by the religion of the food handlers. This is possibly attributed to the fact that all religious frateneties in Ghana emphasis the need for cleanliness since it is next to Godliness.

Though there was no significant difference in the food safety knowledge of the respondents in terms of their ages, it was clear from Table 10 that food handlers within 48 years and above had higher mean scores. This is in consonance with Sanlier and Konaklioglu's (2012) finding that knowledge increased with age but contrary to Sun et al.'s (2012) finding that younger respondents have higher knowledge scores.

While the study hypothesized that there will significant difference in the environmental hygiene knowledge by the educational status of the food handlers, the contrary was established ($p = 0.42$). This gives credence to the null hypothesis. However, the variation existed for personal hygiene knowledge ($p = 0.03$) in relation to the various professional qualifications. It was observed that food handlers with NVTI/DBS/Home Economics (mean = 11.20) had the highest mean score, followed by those with HND/Institutional Management (mean = 10.96) and then Intermediate catering (mean = 10.54). It can be said that food handlers with NVTI/DBS/Home Economics

qualifications tend to be more knowledgeable in personal hygiene issues as compared to food handlers with other qualifications.

This could be as a result of the training they received (hospitality programme) as it was noted that some of the food handlers offered other courses than hospitality but found themselves working in the industry. Thus, the information they acquired during training accounted for their knowledge level.

Food Safety Knowledge by Work Related Characteristics

With regard to the location of the facility the respondents worked in, it was observed that food handlers' knowledge on the environment hygiene varied ($p = 0.04$). On the average, food handlers in the Tamale South (mean = 6.69) and Tamale North (mean = 6.21) zones exhibited high knowledge of the environmental hygiene issues than their colleagues in the Tamale Central area (mean = 5.89) (Table 11). It can be inferred that food handlers working in the Tamale South are more knowledgeable on environmental hygiene in relation to the safety of food. In terms of the categories of restaurants, the food handlers in hotel restaurants in the three zones were noted to possess more knowledge on environmental hygiene (mean =4.03) as compared to their counterparts in the independent restaurants (mean =0.76). It was evident that those in hotel restaurants in Tamale south were more knowledgeable (mean = 6.70).

As shown in Table 11, food handlers' knowledge on environmental hygiene also varied by their work experiences ($p = 0.00$). It was observed that respondents' knowledge increased by their work experience in the field; four years and above (mean = 6.78), 3 years (mean = 6.29), 1year (mean = 6.18)

and below a year (mean = 5.85). This means that food handlers who had worked longer tend to have more knowledge on food safety than their counterparts; which possibly might be as a result of experiences gained with time. However, this finding is at variance with Hislop and Shaw's (2009) observation that the longer a food handler is at the work place the lower the knowledge level. This could be because they are not retrained as expected.

Lastly, significant differences were noted across the in-service training status ($p = 0.03$) of the respondents in relation to their knowledge on food hygiene in general but not across the category of facility they worked in. Respondents who had received training were more knowledgeable (mean = 9.41) than those who had not received training (mean = 8.82). It can be concluded that food handlers who have received training have more knowledge due to the lessons they had received, as a significant increase in knowledge was noted after training an intervention group in personal hygiene and food handling and service (Thelwell-Reid, 2014).

In terms of the category of restaurants, the results indicated that the food handlers in the hotel restaurants in the Tamale north and Tamale south zones were more knowledgeable in almost all domains than their counterparts in the independent restaurants. This agrees with Panchal et al. (2001) as they identified high knowledge scores among large size restaurant employees in Switzerland. Nevertheless, those in independent restaurants in the Tamale central zone were knowledgeable in personal hygiene and environmental hygiene domains.

Table 11: Food Safety Knowledge by Work Related Characteristics

		Personal hygiene			Food hygiene			Environmental hygiene	
Facility characteristics	Pooled	Hotel Restaurants	Independent Restaurants	Pooled	Hotel Restaurant	Independent Rest.	Pooled	Hotel Restaurant	Independent Restaurant
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Location									
Tamale north	10.68	10.82	10.43	9.15	9.12	9.09	6.21	6.35	5.98
Tamale south	10.48	10.67	9.75	8.79	8.93	8.25	6.69	6.70	6.62
Tamale Central	10.07	9.83	10.25	9.21	9.66	8.87	5.89	5.50	6.18
F(p-value)	1.17(0.31)	1.36(0.25)	0.42(0.66)	0.47(0.62)	0.58(0.55)	0.59(0.55)	3.25(0.04) *	4.03(0.02)*	0.76(0.47)
Position									
Chef	10.90	10.80	11.20	9.25	9.40	8.80	6.80	6.73	7.00
F&B	9.72	11.00	8.20	8.45	8.33	8.60	6.09	6.66	5.40
Supervisor/manager									
Cook	10.31	10.40	10.15	8.93	9.06	8.68	6.06	6.08	6.03
Waiter/waitress	11.00	10.60	13.00	10.00	10.00	10.00	6.50	6.40	7.00
Kitchen help	10.92	11.13	10.62	9.23	9.32	9.11	6.39	6.59	6.11
F(p-value)	1.27 (0.27)	0.66 (0.65)	1.98(0.09)	0.66(0.65)	0.68(0.63)	0.47(0.79)	1.25(0.28)	1.14(0.34)	0.74(0.59)
Work experience									
Below 1yr (1- 6months)	10.61	11.07	10.23	9.11	9.60	8.70	5.85	6.10	5.64
1 year	10.43	10.54	10.25	9.01	8.90	9.20	6.18	6.15	6.25
2 years	10.41	10.15	10.90	9.03	9.00	9.10	6.41	6.15	6.90
3 years	10.54	10.73	10.22	8.79	8.80	8.77	6.29	6.26	6.33

Table 11: Continued

4+ years	10.78	10.83	10.25	9.23	9.16	10.00	6.78	6.80	6.50
F(p-value)	0.24(0.91)	0.70(0.59)	0.23(0.92)	0.21(0.93)	0.63(0.64)	0.46(0.76)	3.49(0.00) *	1.97(0.10)	1.96(0.11)
In-service training									
Received	10.79	11.03	10.39	9.41	9.50	9.27	6.35	6.44	6.21
Not-received	10.40	10.48	10.27	8.82	8.87	8.72	6.19	6.29	6.00
t(p-value)	2.01(0.15)	2.63(0.10)	0.07(0.79)	4.56 (0.03*)	3.32 (0.07)	1.31(0.25)	0.82(0.36)	0.45(0.50)	0.42 (0.51)
Number in a year									
Once	10.71	11.18	9.78	9.50	9.78	8.94	6.32	6.51	5.94
Twice	11.46	11.90	10.25	9.66	9.45	10.25	6.60	6.63	6.50
Thrice or more	11.20	9.66	11.85	9.00	7.66	9.57	6.40	6.00	6.57
Four times	10.33	9.66	11.00	9.16	9.00	9.33	6.16	5.66	6.66
F(p-value)	1.07 (0.36)	2.27(0.09)	3.94(0.01)	0.34(0.79)	1.48(0.23)	0.64(0.59)	0.27(0.84)	0.75(0.53)	0.66(0.58)
Area of in-service training									
Food hygiene and safety	10.88	11.13	10.56	9.56	9.60	9.52	6.39	6.40	6.39
Customer care and waiting	10.44	10.57	10.00	8.66	9.00	7.50	5.66	5.57	6.00
Facility management	11.20	11.20	9.66	8.60	8.60	8.66	6.80	6.80	-
Food handling and preservation	10.50	10.33	11.00	9.50	9.33	10.00	6.87	6.83	-
F(p-value)	0.41(0.80)	2.04(0.10)	0.63(0.60)	0.91(0.46)	1.63(0.18)	1.13(0.35)	1.39(0.24)	2.07(0.09)	1.51(0.23

Source: Field survey, Seidu (2017)
Asterisks (*) show areas of significant differences

Although on the whole, there was no significant difference in the food handlers' knowledge in relation to their status at work, there were slight differences between them in terms of their specific positions. Surprisingly, the results revealed that waiters/waitresses were more knowledgeable in personal hygiene and food hygiene issues than the chefs and the other food handlers. It is evidents from Table 11 that the chefs and waiters/waitresses in independent restaurants were more knowledgeable in personal hygiene and environmental hygiene issues than those in hotel restaurants. On the contrary, chefs and waiters/waiteresses in hotel restaurants had high knowledge in food hygiene measures than their counterparts in independent restaurants.

Respondents' Sources of Information on Food Safety Issues

In identifying the sources by which food handlers obtained food safety information, they were asked to state their main sources of food safety information and the results are presented in Table 12. The results show that the food handlers obtained information from five main sources including: lecturers or teachers (42%), in-service training or workshops (26.2%), friends and colleagues (15.4%), health personnel (14.5%) and the media including television and radio (1.9%). Thus, the least patronized source of information was the electronic media (Television, Radio). It was noted that 42 % (90) of the respondents identified lecturers and teachers as the most popular source of food safety information.

Table 12: Respondents' Main Sources of Information on Food Safety Issues

Sources	N	Frequency	Percentage (%)
Lecturers/Teachers	214	90	42.0
Training (In-service/On the job)	214	56	26.2
Friends/Colleagues	214	33	15.4
Health personnel	214	31	14.5
Media (Electronic)	214	4	1.9
Total		214	100

Source: Field survey, Seidu (2017)

This is an indication that most of the food handlers relied on the knowledge and skills they acquired from school at the workplace. Also 26.2% (56) of the food handlers indicated they obtained information on food safety through in–service training and workshops. Deductively, it can be said that lecturers, teachers and the training workshop facilitators are identified as the most popular source of food safety information probably because they believe that lecturers, teachers and facilitators are well informed and as such they are likely to give accurate information.

It was noted that 15.4% of the food handlers acquired food safety information from friends/colleagues. The respondents who obtained food safety information from health personnel formed about 14.5%. These findings are inconsistent with observations made by Apanga et al. (2014), who found health officials (67%), television (38.5%) and radio (14.0%) as the main sources of information among food vendors in rural northern Ghana. Surprisingly, the food handlers did not indicate reading of books and other print media as well as the use of internet and social media as their sources of

information. The implication is that the respondents are probably not aware that they could obtain food safety information from these sources. It could also be that they are not familiar with searching for information from these sources (books, internet, print and social media). Thus, it can be concluded that the respondents' source of information is narrow.

Chapter Summary

This chapter highlighted the socio-demographic and work related characteristics with regards to food safety knowledge of the respondents. The socio-demographics and work characteristics provided the needed context for analyzing or discussing the respondents' food safety knowledge levels in relation to the type of facilities they worked in. The specific socio-demographic and work related characteristics discussed included: gender, age, marital status, religion, educational attainment, professional qualification, position at work and work experience and in-service training. The respondents' food safety knowledge was discussed based on three domains in food safety (personal hygiene, environmental hygiene and food hygiene) in relation to the categories of restaurants. The sources of the respondents' food safety information were also discussed.

The results showed that the respondents were knowledgeable in all domains of food safety and there was no significant difference in the food safety knowledge levels of respondents and their socio-demographics characteristics. Nevertheless, more males were found to be knowledgeable than their female counterparts. Respondents also obtained food safety information from varied sources including lecturers/teachers, friends and colleagues, health personnel, training and electronic media. Surprisingly, the

respondents did not rely on books, internet and social media for food safety information. The next chapter describes the food safety practices of the respondents and the barriers to food safety practices as well as the relationships that exist between the variables.

CHAPTER SIX

FOOD SAFETY PRACTICES AND RELATED BARRIERS

Introduction

According to Singh (2011) practice refers to the application of skills, techniques, methods or standard operating procedures. It involves putting rules and knowledge into action. The conceptual framework guiding the study is based on the assumption that knowledge from all sources will translate into appropriate action or practice. Nevertheless, the framework is mindful of the fact that there are barriers that could thwart practice. This chapter examined the food safety practices, the relationship between food safety knowledge and practice, and factors that pose as barriers to food safety practices among food handlers in restaurants in the Tamale Metropolis.

Respondents' Food Safety Practices

The assumption is that individuals' knowledge on food safety across all dimensions will translate into appropriate practices that will lead to safe food. In this section, the respondents' food safety practices were assessed using an observation checklist on personal hygiene, environmental hygiene and food hygiene issues. The observation was limited to sixty respondents drawn from the original sample of 214 given the time available to the researcher.

In this section, eleven personal hygiene related items were used to assess the respondents' practical application of personal hygiene measures during food preparation and service and the results are presented in Table 13.

Table 13: Personal Hygiene Practices of the Respondents

Personal Hygiene practices	Correct practices n (%)	Incorrect practices n (%)
Food handler wears a cap or hair restraint during food preparation	29 (48.3)	31 (51.7)
Food handler wears clean apron/over coat	28 (46.7)	32 (53.3)
Food handler wears clean and neat clothes during food preparation and service	55 (91.7)	5 (8.3)
Food handler wears hand gloves during food preparation; especially during the preparation of food eaten raw	2 (3.3)	58 (96.7)
Food handler did not wear jewelry (large and dangling) during food preparation and service	44 (73.3)	16 (26.7)
Food handler wears trimmed finger nails	56 (93.3)	4 (6.7)
Food handler washes hands with soap and warm water before food preparation and service	60 (100.0)	0 (0.0)
Food handler washes hands in between handling raw and cooked foods	26 (43.3)	34 (56.7)
Food handler does not scratch parts of the body (hair, skin, nose, ears) during food preparation and service	56 (93.3)	4 (6.7)
Food handler does not cough/sneeze directly on to food during food preparation and service	60 (100.0)	0 (0.0)
Food handler does not lick fingers during food preparation and service	58 (96.7)	2 (3.3)
Overall	43 (71.7)	17(28.3)

Source: Field survey, Seidu (2017).

On the whole 72 percent of the food handlers observed were found to exhibit correct personal hygiene practices during food preparation and service.

Specifically, it was realized that all the sixty food handlers (100%) washed their hands with soap and warm water before starting food preparation and did not cough or sneeze directly on food during food preparation and service (100%). In contrast, 43% of the respondents were observed to wash their hands when they shifted from handling raw food to cooked or ready to eat foods. However, none of them was noticed using soap during the hand washing.

Generally, it was observed that after the first wash with soap and water, no respondent washed his or her hands with soap again during food preparation and serving process. They just rinsed their hands in water or wiped them with kitchen cloth or their aprons. This observation is consistent with Green et al.'s (2006) finding that, proper hand washing (using soap and warm water) was usually carried out prior to food preparation and that the food handlers often omitted the use of soap as they progressed during the preparation of dishes. This means that the respondents probably did not know the importance of hand washing with soap and the implications of their actions.

Similarly, the respondents were not found to have coughed or sneezed directly on food. The few (7%) individuals who had to cough or sneeze moved away from the food and wiped their mouths and noses with tissue. They also washed their hands with water but did not use soap. As stipulated in the Health Belief Model (HBM) individuals will behave appropriately when they know the health benefits of their actions. Thus, if the food handlers knew the repercussions of their actions they would have probably acted right. In terms of hand washing and glove-use it was noted that employees who wore gloves

were less likely to wash their hands before and after performing tasks that required hand washing. This observation may be linked to the fact that employees do not understand the importance of hand washing and the use of gloves.

A high number of the employees were observed to have well-trimmed, unpolished finger nails (93.3%) as well as wearing clean clothes (uniform) during food preparation and service (91.7%). This could be attributed to the fact that the food handlers are aware that adverse practices could contaminate the foods they were handling. Aside these, it was noted that 96.7% of the respondents did not lick their fingers during food preparation and service nor did they scratch parts of their bodies (93.3%).

In-spite of FAO's (1999) recommendation that food handlers should not wear jewelry such as rings, bracelets and large/dangling earrings during food preparation and service as this could be a source of contamination, it was observed that 27% of the employees had their jewelry on whilst cooking. This finding is similar to Cuprasitrut, Srisorrachatr and Malai's (2011) observation from a study in Bangkok, Thailand that 50% of food handlers wore jewelry during food preparation. This indicates that a reasonable number of the food handlers in restaurants do not comply with the rules and regulations of the industry and thereby constitute a potential source of spreading food-borne illness.

Though the food handlers were provided with protective clothing to prevent contaminating food with hair and other contaminants from the body, it was observed that a good number of them did not pay much attention to the use of protective clothing during food preparation and service. Specifically,

less than half of the food handlers (48%) were identified to use hair restraints and aprons/overcoats (46.7%). This finding is contrary to the observation made by Cuprasitrut, Srisorrachatr and Malai (2011), that about 66% and 84% of their respondents wore aprons and hair nets respectively. There is therefore the need to create more awareness on the importance of using protective clothing during food preparation and service to prevent the contamination of food.

With respect to the need to wear hand gloves to reduce cross contamination of food, only 3% of the food handlers were noted to use them. This finding is at variance with the observation made by Arendt, Strohbehn and Jun (2015), where 63% of the respondents were reported to put on gloves during food preparation. The very low usage of hand gloves can also be said to be inconsistent with the recommendation by FDA (2001) that gloves be used in handling cooked foods as well as those eaten raw because they serve as barriers between food handlers hands and the food.

In plate 1, the food handler put on gloves during the handling of cooked food (cutting up of cooked pizza for service) while plate 2 shows a food handler preparing cole slaw with covered hands. This indicates how some food handlers tried to follow best practices.

Plate 1: Use of gloves during the cutting of Pizza

Plate 2: Correct Practice (Using Gloves)

Plate 3: Incorrect Practice (Using Bare hands)

Source: Field survey, Seidu (2017)

Plate 3 shows an incorrect practice of food handlers during the preparation of vegetable salad with bare hands. This implies that there is a high risk of contaminating food by the food handlers in restaurants.

Food Hygiene Practices of the Respondents

The food hygiene practices of the food handlers were assessed using eleven (11) food hygiene related items and the results are shown in Table 14. It was noted that all the food handlers (100%) separated raw food from cooked ones before and during storage. The practice may be linked to the high level of awareness that mixing different food items during storage leads to cross-contamination as linked to HACCP practices. This finding is contrary to the observation made by Onyango, Kieti and Mapelu (2016) that 30% of their respondents did not practice the storage of food items correctly as they were probably not aware that food could be a vehicle for food contamination.

In view of the fact that the WHO recommended that foods should not be cooked and kept at room temperature for more than two hours before service, it was observed that the food handlers prepared and served food close to or just at the time of request. Thus, they were mindful of HACCP principles as well as their time for service.

Table 14: Food Hygiene Practices of Respondents

Food Hygiene practices	Correct Practice n (%)	Incorrect Practice n (%)
Food handler reheated/microwaved leftover foods before service	15 (25.0)	45 (75.0)
Separated raw foods such as meat, vegetables and salads from cooked foods during storage	60(100.0)	0 (00.0)
Cooked foods served hot and cold foods served cold	60(100.0)	0 (00.0)
Food items are cleaned/washed before use/storage	58 (96.7)	2 (3.3)
Food handler thawed frozen foods in cold water baths or in refrigerator	46 (76.7)	14 (23.3)
Food handler used separate chopping boards for raw meat and ready to eat foods	10 (16.7)	50 (83.3)
Food handler manipulated cooked and ready to eat foods with covered hands/tongs	3 (21.7)	47 (78.3)
Food handlers used calibrated food thermometer to check food temperatures (CCPs)	0 (00.0)	60 (100.0)
Equipment and serving dishes washed and rinsed under running water	60 (100.0)	0 (00.0)
Plates and serving dishes were heated or sanitized before they were used for service	0 (00.0)	60 (100.0)
Food handler washed and ironed kitchen linen daily	22 (36.7)	38 (63.3)
Overall	31 (51.7)	29 (48.3)

Source: Field survey, Seidu (2017).

Additionally, it was observed that all the food handlers ensured that cooked foods were hot during service. They ensured this by storing cooked food in food warmers and chafing dishes with heat under them to keep them hot throughout the service period.

Nevertheless, it was observed that 25% of the food handlers prepared foods like T.Z and Banku well ahead of the peak hours and they reheated/microwaved them and served steaming hot. However, no food handler was observed to have used food thermometers to measure critical control points of foods (meat, eggs, beans) they were handling. This was because it was noted that they were not available in any of the selected facilities. In the same vein, it was realised that no food handler heated nor sanitized equipment, plates and serving dishes by passing them through a source of heat (dish warmer) before using them. On the contrary, all (100%) the observed respondents washed and rinsed serving dishes and equipment under running water as none of the facilities had a dish washing machine.

Evidence from the Table (14) indicates that 96.7% (58) of the food handlers washed food items before using them. This finding is consistent with the observation made by Apanga et al. (2014) and Omemu, and Aderoju (2008) where majority of their participants (100% and 70%) respectively washed their food items before use. On the other hand, this finding was found to contradict the observation made by Muinde and Kuria (2005) that most of the food handlers did not wash their food items before using them. Similarly, the finding can be said to be at variance with the findings of Abdalla et al. (2009) where only 34% of respondents washed food items before use.

In order to maintain safety standards, it is required that different cutting boards of different colours be used for different foods (Spears and Gregoire, 2007). It was observed that only 16.7% (10) of the respondents used separate chopping boards for preparing separate food items. This means that, most of the food handlers used one chopping board for all foods during food

preparation. This did not buttress the fact that the majority (95%) of the food handlers were knowledgeable on the use of separate chopping boards during food preparation. It is also defeated the idea behind having well labeled chopping boards for different food items and activities such as those used for raw meat and fresh fish, for vegetables and ready -to-eat foods as identified in all the selected facilities. This could probably be due to time constraint or lack of supervision on the use of equipment.

In terms of the proper usage of chopping boards, it was observed that, the majority (83.3%) of the respondents often just wiped the surface of the board or turned it and continued to work; which has a high risk of contaminating ready to eat foods. This practice is contrary to a suggestion by Spears and Gregoire (2007) that cutting boards be washed properly between each use because they are likely to harbour microorganisms. The finding is a pointer to the fact that it is not sufficient to supply the necessary materials and equipment to be used in the restaurants but to ensure their proper usage.

It was however observed that a large number of food handlers (78.3%) manipulated cooked and ready to eat foods with their bare hands as shown in Plates 4. This means that there is a high chance of contaminating the foods as the hands are noted to have several loads of micro-organisms.

Plate 4: Preparing vegetable salad with bare hands
Source: Field survey. Seidu, (2017)

It was also observed that 76.7% (46) of the food handlers thawed frozen foods under running water or a bath of cold water while the rest of the respondents (23.3%; 14) thawed frozen foods in bowls or basins outside the storage facility. Thus, most of the respondents followed the recommendation by McSwane et al. (2003) and WHO (2006) that frozen foods be thawed in a refrigerator, under cool running water or in a microwave oven.

Although food handlers are required to wash their kitchen linen or cloths on daily basis, it was noted that less than half (36.7%) of them washed and ironed them as expected. Only 27% of the food handlers were noted to have adequate kitchen linen. Individuals were noticed to use one kitchen napkin throughout the day which gives a high chance of contamination. This finding is at variance with Hill's (2011) suggestion that different kitchen cloths including dish cloths and kitchen towels should be used for different purposes and that re-usable cloths be washed thoroughly, disinfected and dried

between tasks, not when they look dirty. On the whole, it was noted that, about 52% (31) of the respondents observed good food hygiene practices while the remaining 48% (29) ignored the best practices.

Environmental Hygiene Practices

Under the environmental hygiene domain 19 facilities were observed using eight (8) items and the results are presented in Table 15.

Table 15: Environmental Hygiene Practices in Restaurants

Environmental hygiene practices	Correct practices n (%)	Incorrect practices n (%)
Food handlers operate in clean facility environment (inside, outside and equipment)	19 (100.0)	0 (00.0)
Facility has adequate and appropriate drainage system	17 (89.5)	3 (15.8)
Kitchens provided with adequate windows and self-closing doors to eliminate flies and pests	18 (94.7)	1 (5.3)
Equipment, walls and ceilings kept clean; free from stains and cobwebs	17 (89.5)	2 (10.5)
Waste bins have fitting lids	3 (15.8)	16 (84.2)
Waste bins are emptied daily	19 (100.0)	0 (00.0)
Availability of adequate toilet facilities	14 (73.7)	5 (26.3)
Provision of adequate hand washing stations for kitchen staff.	0 (00.0)	19(100.0)
Overall	13 (68.4)	6 (31.6)

Source: Field survey, Seidu, (2017)

Overall, 68.4% (13) of the selected facilities maintained standard environmental hygiene practices. In relation to the specific areas, the results

showed that all nineteen (19) facilities had clean environment (inside and outside), they had large waste bins outside the kitchen and medium size ones inside to hold solid waste generated. It was also observed that all waste bins were emptied on daily basis. However, only 15.7% (3) of the waste bins in the kitchens had fitting lids. The rest had the lids put aside because the workers wanted easy assess into the bins. The practice of not covering waste bins is contrary to ISO 22000, (2005 & 2015) recommendation that waste bins should be fitted with lids at all times. Consistent with best practices, all the waste bins in the kitchens were emptied on a daily basis. This may be linked to their awareness that proper waste disposal prevents insects and pests invasion as well as bad odour in the premises (WHO, 2006; McSwane et al. 2003).

In addition, it was noted that the majority of the facilities (94.7%) had adequate windows for ventilation and well netted self-closing doors to eliminate flies and pests. The provision of adequate windows and hoods and extractor fans to remove fumes and odour by most of the facilities can be in line with ISO standards (Foskett et al, 2007; ISO 2000, 2005).

It was also evident that seventeen (17) representing 89.5% of the facilities had adequate and appropriate drainage systems, 74% had adequate (4-8 seated) and well-kept toilet facilities for staff and customers. It was noted that the toilet facilities were kept clean and in good state of repair. Unlike the others, 26% of the facilities had only two seated toilet facilities for both staff and customers and they were not very clean. On the whole, none of the facilities had adequate hand washing stations in the kitchen for the food handlers to readily wash their hands during food preparation and service. This

might have accounted for the respondents' inability to easily and regularly wash their hands during food preparation and service.

Respondents' Food Safety Knowledge Versus Practices

According to Glanz, Lewis and Rimer (2002) practice is influenced by knowledge. In terms of the KAP model adapted for this study, it is assumed that the individual's food safety practices can change when knowledge increases. Thus, knowledge gives individuals confidence to act or carry out activities rightly. This section sought to identify the gaps between the respondents' food safety knowledge and their food safety practices along the personal hygiene and food hygiene domains.

As indicated earlier, sixty respondents were used for this exercise. The actual correct practice scores of the sixty respondents were computed and the number of respondents who were knowledgeable in a food safety practice were deducted from the number who actually practiced to ascertain the gaps or differences. In this vein, all the negative score differences indicate that the respondents' knowledge exceeded their practices whereas positive differences means the practice outweighed respondents' knowledge in the various domains.

Generally, a significant difference was observed between food safety knowledge (mean =48) and food safety practices (mean =40.5) of the food handlers (gap = -7.5; p= 0.00). Since their food safety knolwdege level was higher than their practices, it implied that they were not able to translate their knowledge into practice. This outcome failed to reject the alternate hypothesis that significant difference will exist between the food safety knowledge and food safety practices of the food handlers. Several pevious studies (including

Moreaux, 2014; Ababio & Lovatt, 2015; Moreaux et al., 2018) have confirmed this food safety knowledge and practice gap.

With regards to the personal hygiene domain, the differences between the respondents' personal hygiene knowledge and practices were obtained by comparing the number of respondents who were knowledgeable in personal hygiene issues with their actual personal hygiene practices and the results are presented in Table 16.

On the whole, it was detected that there was a slight difference in respondents' personal hygiene knowledge (79.6%) and their actual practices (71.8%) of personal hygiene. Thus, the respondents' personal hygiene knowledge exceeded their practice (K/P gap of -7.8%). This suggests that, not all individuals put their personal hygiene knowledge into practice.

It is obvious from Table 16 that seven (7) of the items exhibited negative K/P gaps while the remaining four showed positive differences.

Table 16: Respondents' Personal Hygiene Knowledge versus Practice

Knowledge statements	n=60 (%)	Actual Practice	n=60 (%)	Gap (P-K) n (%)
Food handlers are at liberty to put on hair restraints/caps during food preparation and service	6 (10.0)	Food handler wore a cap or hair restraint during food preparation	29 (48.3)	23 (38.3)
Using aprons or overcoats during food preparation is a luxury	46(76.7)	Food handler wore clean apron/over coat	28 (46.7)	-18 (-30.0)
It is optional to wear hand gloves when preparing foods that are eaten raw/fresh	40 (66.7)	Food handler wore hand gloves during food preparation; especially during the preparation of food eaten raw	2 (3.3)	-38 (-63.4)
A food handler can continue to wear soiled clothing to work until he/she is off duty	48 (80.0)	Food handler wore clean and neat clothes during food preparation and service	55 (91.7)	7 (11.7)
It is compulsory for food handlers to have jewellery on during food preparation	58 (96.7)	Food handler did not wear jewelry during food preparation and service	44 (73.3)	-14 (-23.4)
Hand washing with soap and warm water before commencing and during cooking and service reduces the risk of food contamination	55 (91.7)	Food handler washed hands with soap and warm water before food preparation and service	60 (100.0)	5 (8.3)
Food handlers are at liberty to scratch skin, touch hair, nostrils and ears during food preparation and service	58 (96.7)	Food handler did not scratch parts of the body (hair, skin, nose, ears) during food preparation and service	56 (93.3)	-2 (-3.4)
Food handlers are obliged to wash hands when shifting from raw food to cooked or ready to eat foods	42 (70.0)	Food handler washed hands in between handling raw and cooked food	26 (43.3)	-16 (-26.7)

Table 17 Continued

Coughing or sneezing directly on food during preparation and service has no effect on the food	55 (91.7)	Food handler did not cough/sneeze directly on to food during food preparation and service	60 (100.0)	5 (8.3)
Food handlers are at liberty to taste food using fingers	59 (98.3)	Food handler did not lick fingers during food preparation and service	58 (96.7)	-1 (-1.6)
Food handlers are obliged to wear trimmed finger nails	58 (96.7)	Food handler wore trimmed finger nails	56 (93.3)	-2 (-3.4)
Overall	48 (79.6)		45 (71.8)	-3 (-7.8)

Note: P=Practice, K=Knowledge, P-K= Practice – Knowledge scores, Difference= Gap

Source: Field survey, Seidu, (2017)

The measures with negative K/P gaps indicate that the number of respondents who were knowledgeable in personal hygiene issues outweighed the number that put personal hygiene measures into practice. The few positive differences indicate that the number of respondents who practiced correctly exceeded those who are knowledgeable in the specific areas of personal hygiene.

The areas where respondents' practices exceeded the number with high knowledge included: putting on hair restraints (10% as against 48.3% practice), awareness of the inappropriateness of wearing soiled clothes during food preparation and service (80.0% as against 91.7% practice), washing hands with soap before and during cooking (91.7% against 100% actual practice) and inappropriate to cough and sneeze directly on food during food preparation (91.7% against 100% practice).

Evidence shows that more food handlers put on caps, scarfs or hair restraints as against the number that got the statement correct; hence they had the highest positive K/P gap (38.3%); followed by the wearing of neat clothes (11.7%), the washing of hands with soap and water before and during food preparation (8.3%) and awareness of the dangers associated with coughing and sneezing directly on food (8.3%). This means that the food handlers' practice of personal hygiene measures outweighed their knowledge. This could be attributed to the work place culture which compels individuals to carry out practices without really understanding the implications. It could also be that the practice has become a routine one and so it has become a normal practice for them.

Even though not all of the food handlers (91.7%) had good knowledge on the dangers of coughing and sneezing directly over food but in practice, none of them coughed nor sneezed directly on food. This means that even those who got the statement wrong acted appropriately; probably by observing others or by instinct. Additionally, 80% of the food handlers had knowledge on the need to wear clean clothing during food preparation as against 91.7% who actually put on clean clothing during food preparation and service.

As regards the use of hair restraints, only 10.0% (6) of the food handlers had the statement correct while 48.3% (29) of them put on hair restraints during food preparation and service. This suggests that the respondents did not actually know the importance of putting on hair restraints during food preparation and service. Thus, they felt it was optional for them. Nevertheless, 48% of them put on hair restraints (correct practice) probably due to the culture of the work place; thus they were just obeying rules at the

work place. The practice could also be as a result of the cultural and religious influence on individuals in the study area; where females are always expected to have their hair covered. Thus, the use of hair restraints has become a normal practice. The implication is that most of the respondents practiced the activities including hand washing as a routine.

The areas where differences or negative gaps were recorded included the use of aprons or overcoats (76.7%, against 46.7% practice) with a negative gap (-30.0%), the wearing of gloves (66.7 against 3.3% practice), the use of jewelry during food preparation was not compulsory (96.7% as against 73.3% practice). Other areas where negative differences were detected were the scratching and touching of body parts (96.7% against 93.3% practice), the need to wash hands when shifting from raw food to cooked food (70% as against 43.3% practice), the wearing of trimmed finger nails (96.7% against 93.3% practice) and the licking of fingers (98.3% as against 96.7% practice). This means that the food handlers' knowledge exceeded their practices; which means that although food handlers possessed high knowledge of food safety, they did not always put the knowledge into practice (Ramirez et al. 2010).

Food Hygiene Knowledge Versus Practice

The food hygiene knowledge of the respondents was compared with their practices and the results are presented in Table 17. On the whole, more respondents (79.2%) were knowledgeable in food hygiene measures as against 59.3% who put the measures into practice. It is evident from the results that the respondents who were knowledgeable in food hygiene issues outweighed those who practiced the measures; thus, indicating a negative gap (-20.0%).

Specific areas where most food handlers with high knowledge exceeded those who put the knowledge into practice were: reheating of leftover foods (85.0%) against 25% practice, the need to use thermometers for testing the temperature of food (50.0%) against the actual use of thermometers, the need to use separate chopping boards for food preparation (95.0%) as against 16.7% practice. Other areas included the importance of sanitizing serving dishes (78.3%) against the actual practice of sanitizing dishes and the importance of manipulating food with covered hands (90.0%) as against 78.3% in practice. The implication is that the food handlers may have the knowledge but will not be able to put it into practice if the facility management does not provide the logistics such as thermometers, gloves, dish washers and sanitizers. For instance, it was realised that none of the respondents used thermometers as well as sanitized any serving dishes and tools before use.

Though majority of the respondents know the importance of using separate chopping boards, only 16.7% actually used separate chopping boards. This could probably be because the facilities did not have many chopping boards as required or the food handlers felt it was a waste of time. These observations support the opinion that knowledge does not always translate into practice. This could be because some of the facilities did not have many chopping boards as required.

Table 17: Food Hygiene Knowledge versus Practice

Knowledge statements	n=60 (%)	Actual Practice	n=60 (%)	Gap (P-K) n (%)
Reheating / Microwaving leftover cooked food reduces the risk of food contamination	51 (85.0)	Food handler reheated/ microwaved cold leftover foods before service	15 (25.0)	-36 (60.0)
Thermometers are necessary for checking the temperatures of food	30 (50.0)	Food handler used calibrated food thermometer to check food temperatures	0 (0.0)	-30 (-50.0)
Raw food and cooked/ready to eat food cannot be put together during storage	57 (95.0)	Separated raw foods such as meat from cooked/ready to eat foods during storage	60(100.0)	3 (5.0)
Food items purchased from reliable sources need no cleaning before storage	47 (78.3)	Food items are washed before storage and use	58 (96.7)	11 (18.4)
Cooked food should be very hot (at a temperature of 65^{o}C) before serving	52 (86.7)	Cooked foods are served hot and cold foods are served cold	60(100.0)	8 (13.3)
It is compulsory to use separate chopping boards during food preparation	57 (95.0)	Food handler used separate chopping boards for raw meat and ready to eat foods	10 (16.7)	-47 (-78.3)
It is inappropriate to thaw frozen food in a bowl or plate/tray outside the storage facility	25 (41.7)	Food handler thawed frozen foods in a bowl outside the refrigerator or freezer	46 (76.7)	21 (35.0)
Serving dishes and equipment should not be washed and rinsed in basins	55 (91.7)	Equipment and serving dishes are washed and rinsed under running water	60(100.0)	5 (8.3)

Table 17: Continued

It is not optional to heat/sanitize serving dishes and tools before service	47 (78.3)	Plates and serving dishes were heated or sanitized before they were used for service	0 (00.0)	-47 (-78.3)
The manipulation of food with uncovered hands increases the risk of food contamination	54 (90.0)	Food handler manipulated cooked and ready to eat foods with covered hands/tongs	47 (78.3)	-7 (-11.7)
Overall	48 (79.2)	Overall	36 (59.3)	-12 (-19.9)

Note: P=Practice, K=Knowledge, P-K= Practice – Knowledge scores, Difference= Gap

Source: Field survey, Seidu (2017)

The food hygiene knowledge and practice gap identified include five negative and five positive areas. The areas where practice exceeded knowledge (indicating positive gaps) were the separation of raw food from cooked food during storage with a gap of (5.0%), washing food items before use/storage (18.4%), serving cooked food hot and cold food cold (13.3%), appropriate thawing of frozen foods (35.0%) and washing and rinsing serving dishes and equipment under running water (8.3%). The greatest gap was associated with the procedure of thawing frozen foods. The positive differences imply that practice exceeded knowledge. This suggests that, in some cases practice is not dependent on knowledge but acting according to the dictates of the work place.

The negative gaps identified in relation to food hygiene knowledge and practice were clearly exhibited in the use of thermometers (-50.0); as nobody used thermometers during food preparation even though about 30 respondents have knowledge on it. Other areas that showed negative gaps

include the respondents' awareness of the importance of reheating or microwaving leftover foods (-60.0%), using separate chopping boards (-78.3%), heating and sanitizing serving dishes (-78.3%), and manipulating foods with covered hands (-11.7%).

These observations support a number of studies that have shown that knowledge does not always result in a positive change or translate into practice of handling food safely (Arendt et al. 2015; Robertson et al. 2013; Strohbehn et al. 2011; Ko, 2011; Sanlier & Konaklioglu, 2010). For instance, though half (50%) of the food handlers have high knowledge on the need to use food thermometers to check the temperatures of foods, none of them practically made use of thermometers. This could probably be because the food handlers were not familiar with them and besides the tools were not available for use in any of the facilities.

Barriers to Respondents' Food Safety Practices

In consistent with the conceptual framework that was adapted to guide the study, it became necessary to assess the barriers that hinder food safety practices among food handlers in restaurants in the Tamale Metropolis. In several situations some form of obstacles often obstructed individuals including food handlers from putting whatever knowledge they had into practice. In this section fifteen (15) items were employed to gauge the barriers to food safety practices. This was examined in relation to the three domains of food safety (personal hygiene, environmental hygiene and food hygiene). However, due to multiple responses in this section, a multiple response set analysis was employed and Table 18 presents the results as well as the ranking order of the identified barriers to food safety.

The results identified six (6) elements including time constraints/busy work schedules, inadequate training and knowledge, poor enforcement of rules and regulations, inadequate resources and supplies, and forgetfulness or no reminders as barriers to food safety practices.

Table 18: Barriers to Respondents' Food Safety Practices

Construct	Frequency	N=214 Percentage (%)	Ranking
Time constraints	60	28.0	1st
Inadequate training or knowledge	54	25.2	2nd
Inadequate resources or supplies	31	14.5	3rd
Lack of enforcement of rules and regulations	23	10.7	4th
Lack of reminders/forgetfulness	16	7.5	5th
Criticism from colleagues	1	0.5	6th

Source: Field survey, Seidu (2017)

The findings confirm that of Arendt, Strohbehn and Jun, (2015), Howells et al. (2008) and Pragle, Harding and Mack, (2007) who observed similar barriers in a study on motivators and barriers to food safety practices in USA. In specific terms about 28% (60) out of the 214 respondents identified time constraints and busy work schedule as the predominant barrier to their food safety practices. For they just wipe hands insteaded of washing or picked cooked food (turnovers, meat) with bear hands onto serving trays. This supports Hertzman and Barrash's, (2007) findings that in the US, food handlers violated food safety practices whenever they had busy schedules carrying out their paramount responsibility of food preparation and service.

Thus, in trying to meet their target, they intentionally or unintentionally use inappropriate safety practices.

Similarly, the speed at which food service is carried out, especially during meal service can affect the food handlers' ability to practice safe food handling. For instance, Rajagopal and Strohbehn (2013) reported that higher non-compliance rates in relation to hand washing and the use of gloves was found to occur during peak hours. Similarly, Arendt et al. (2015) indicated, their respondents reported that, it was the need to save time that made them to deliberately ignore safe food handling practices. Thus, when food handlers or operators are busy they tend to forget or put aside standard practices.

The next popular and second ranking barrier was inadequate training and knowledge (4.3%; 51). This finding reinforced an observation by Arendt et al. (2015) that their respondents did not know the reason for putting on aprons and the need to wash their hands inspite of the fact that they put on gloves.

The emergence of inadequate training and knowledge as a second popular barrier could be linked to the fact that over a quarter (39%) of the respondents were found to be non-professionals and also more than half of them did not receive in-service training on food hygiene issues which impeded their compliance to food safety guide lines (York et al. 2009). Relating this to the conceptual framework guiding this study, the implication is that, when people are educated or receive training on how to ensure food safety practices in the restaurants, it is likely that they would adhere to such directives.

Furthermore, inadequate resources and supplies was also identified as the third ranking factor that prevented the respondents from adhering to food

safety practices. It was noticed that 2.5% (31) of the food handlers were unable to put their food safety knowledge into practice due to inadequate resources and supplies such as hand washing sinks, calibrated food thermometers and gloves. This is in consonance with Arendt et al.'s (2015) finding that the unavailability of hand washing sinks, supplies such as sanitizing wipes for use on thermometers prevented them from making use of them during food production. To promote food safety practices it is important to provide the needed resources and supplies in the reach of employees (Green et al. 2007).

Though food handlers are required to wash their hands at intervals during food preparation as well as keep the doors to the food preparation area shut always, most of them ignored the rules. Consequently, it was noticed that about 2.0% (23) of the respondents acknowledged lack of enforcement of rules and regulations as the fourth barrier to food safety; especially in keeping vermin out of food preparation and service area as well as proper hand washing practices during food preparation and service. This is in agreement with a report by Arendt, Strohbehn and Jun (2015) that their respondents did not follow safe food handling regulations and that nobody cared or checked that the right thing was done. This suggests that there is the need for managers, supervisors and regulatory agencies to have constant checks to ensure that the food handlers follow food safety measures.

In terms of forgetfulness and lack of reminders as barriers to food safety practices, it was noted that 1.3% (16) of the food handlers associated the barriers to the practice of wearing jewelry during food preparation and

service, inappropriate waste management, the laundering of kitchen linen and improper maintenance of finger nails.

Criticism from colleagues was the least patronized barrier among the respondents. Only one (1) food handler identified this as a barrier to food safety practices. This means that the respondents did not really care about whatever comments their colleagues made about their food safety practices; they continued to work the way they intended to work (Appendix D).

Barriers to Practices by Food Safety Domains

Segregating the food handlers' responses by the three food safety domains, it was generally realized that the food handlers identified time constraint or busy work schedule as the most prominent barrier to their personal hygiene (40.2%) and environmental hygiene (38%) practices. Inadequate knowledge was identified as the main barrier to food hygiene practices (30%); followed by time constraint (28.7%) and inadequate resources (28.5%). It was realized that criticisms from colleagues and lack of motivation were not popular barriers among food handlers in all the domains of food safety (Table 19).

With reference to the personal hygiene it was noted that time constraint was the most prominent barrier. Specifically over half (58%) of the food handlers indicated that time constraint prevented them from changing their work clothing as well as engaging in regular hand washing during food preparation and service (53%). This could probably be due to the fact that the facilities did not have enough hand washing sinks close by for food handlers to easily turn and wash their hands at regular intervals.

Time constraint or busy work schedule also inhibited food handlers to regularly maintain short finger nails (33%). Apart from lack of time, forty-two percent of the respondents linked their non-use of hair restraints during food preparation and service to inadequate knowledge. In terms of the use of jewelries during food preparation, 31% of the respondents indicated they usually forgot to remove them before the commencement of food preparation and there were no reminders, which could prompt them to remove the jewelries. No food handler identified criticism as barriers to personal hygiene practices.

As depicted in Table 19, seventy percent of the food handlers were of the view that poor enforcement of rules and regulations militated against keeping vermin out of the food preparation and service area. Thus, even though the rule is to always keep the doors shut, some food handlers moved in and out without ensuring that the trap doors are shut. Another 69 percent of the respondents were of the view that inadequate knowledge affected their waste management practices; thus, they left their waste bins opened for easy dropping of waste. Probably they were ignorant of the fact that such practice could bring about contamination of food. Similarly, 38% of the respondents flagged time constraint as the main barrier to environmental hygiene practices. Specifically, time constraint was identified as barrier to the cleaning of work surfaces (68%) and cleaning of equipment (64%). Thus, due to busy work schedule the food handlers could not pay attention to cleaning work surfaces and equipment as expected.

Table 19: Barriers to Practice by Food Safety Domains

Constructs	Time constraint/ Busy work schedule (%)	Inadequate Knowledge (%)	Poor enforcement of rules/regulations (%)	Inadequate resources/supplies (%)	Criticism from colleagues (%)	No reminders/ Forgotten (%)
Personal hygiene						
Hand washing	53.0	11.0	25.0	6.0	0.0	4.0
Use of hair restraints	29.0	42.0	8.0	4.0	0.0	17.0
Changing work clothing	58.0	21.0	11.0	11.0	0.0	0.0
Maintaining short finger nails	33.0	33.0	10.0	0.0	0.0	24.0
Removal of Jewelry	28.0	28.0	9.0	3.0	0.0	31.0
Overall	40.2	27.0	12.6	4.8	0.0	15.2
Environmental Hygiene						
Waste management	10.0	69.0	3.0	10.0	0.0	3.0
Cleaning of work surfaces	68.0	16.0	5.0	5.0	0.0	5.0
Cleaning/sanitizing equipt.	64.0	18.0	5.0	5.0	0.0	9.0
Keeping vermin out	10.0	13.0	70.0	3.0	0.0	3.0
Overall	38.0	29.0	20.8	5.8	0.0	5.0
Food hygiene						
Wearing gloves	11.0	16.0	5.0	62.0	0.0	5.0
Laundering Kitchen linen	62.0	8.0	12.0	4.0	0.0	19.0
Use of food thermometer	3.0	9.0	3.0	84.0	0.0	0.0
Storage of items	7.0	69.0	3.0	14.0	0.0	3.0
Storage temperatures	46.0	32.0	11.0	7.0	0.0	4.0
Preparation techniques	43.0	46.0	7.0	0.0	0.0	4.0
Overall	28.7	30.0	6.8	28.5	0.0	5.8

Source: Field survey, Seidu (2017)

As regards food hygiene domain, inadequate resources and supplies was identified as the dominant barrier to food hygiene practices. In specific terms, inadequate resources and supplies was flagged as the major barrier to the use of thermometers (84%) and gloves (62%) during food preparation. In addition, sixty-nine percent of the respondents linked inadequate knowledge as a barrier to their appropriate storage of food items (69%) and food preparation techniques (46%). This indicates that inadequate knowledge on the storage of the different food items is a constraint that could bring about food spoilage. Inadequate knowledge also affected the respondents' food preparation techniques (46%).

Barriers to Food Safety Practices by Facility Type

To assess the barriers to the respondents' food safety practices by the type of facility, fifteen food safety items were examined using the chi-square test and the results are presented in Table 20. The results, generally indicated that food handlers from both hotel-based-restaurants and independent restaurants showed no significant differences in the factors that posed as barriers to their food safety practices. Thus, the food handlers in both categories of restaurants experienced similar challenges in their attempt to follow food safety practices.

However, five of the items including: hand washing during food preparation ($p=0.001$), wearing of gloves ($p=0.001$), use of thermometer ($p=0.04$), laundering of kitchen linen ($p=0.001$) as well as food preparation and service techniques ($p=0.04$) showed significant differences at a significant levels of $p<0.005$. The rest of the items showed no significant differences.

The barriers to the food handlers' hand washing practices showed a significant difference of p=0.001. Whereas 63% of the food handlers in hotel restaurants identified time constraint as a major barrier to hand washing practices, only 16% of their counterparts in independent restaurants considered it as a barrier. On the contrary, seventy-six percent of the respondents identified poor enforcement of rules and regulations as the main constraint to regular hand washing; hence the significant difference.

In terms of the use of gloves and food thermometers, a greater percentage of respondents identified inadequate resources and supplies as a barrier to their use. For instance, more than half (66.3%) of respondents identified inadequate resources and supplies as a barrier to the use of gloves while 88.5% of the food handlers associated the factor with the use of food thermometers. However, significant differences existed between the respondents from independent restaurants and their counterparts in hotel restaurants. A greater percentage of the respondents from the independent restaurants identified inadequate resources and supplies as a barrier to the use of gloves (78%) and food thermometers (91%) as against 55% for the use of gloves and 86% for thermometers by the respondents from hotel restaurants. This showed a significant difference between those in hotel restaurants and independent restaurants ($p = 0.002$) as those from independent restaurants scored about 78% as against 55% from hotel restaurants. Similarly, the use of thermometers showed a significant difference ($p = 0.04$) with independent restaurants having 91% against 86% of food handlers in hotel restaurants.

Respondents from both types of facilities identified time constraint as a major barrier militating against food safety practices. The food handlers were specifically of the view that time constraint was a barrier to regular hand washing (63%; 16.0%) with a significant difference of p = 0.00, maintaining short finger nails, removal of waste and cleaning of equipment before use. The results revealed that independent restaurants had more respondents reacting in this regard. It is worth noting that it was only with the changing of work clothes that hotel restaurants scored higher (59.6%) than their counterparts in independent restaurants (54.1%). With the remaining items, the food handlers from the independent restaurants scored higher than the hotel restaurants.

Inadequate knowledge and training was recognized by food handlers in both categories of restaurants as a dominant factor that hindered food safety practices. They specifically indicated that inadequate knowledge and training was a barrier to the use of hair restraints, storage of food items, appropriate storage temperatures and inappropriate food preparation techniques. For instance, about 41% of the respondents from hotel restaurants and 37.3% from the independent restaurants saw knowledge and training as a barrier to the use of hair retraints. Whereas about 67% of respondents in hotel restaurants identified inadequate knowledge and training as a barrier to the storage of food items, 74.6% considered knowledge and training as such. However, a greater percentage of the respondents were from the independent restaurants while respondents from hotel restaurants said inadequate knowledge prevented them from wearing hand gloves and maintaining short nails. This buttresses Grujic et al's., (2013) finding as in Joseph, (2018) that lack of knowledge in one of

the stages of the chain can jeopardize all the efforts made to improve the safety of food products.

Finally, a significant difference was found between food handlers from hotel restaurants and independent restaurants in relation to the care of kitchen linen with a p-value at 0.001. The result showed that about 52% of the respondents from hotel restaurants and about 82% from independent restaurants identified time constraint as the main barrier to laundrying their kitchen linen. This suggests that the respondents in the hotel restaurants were more committed to washing and ironing their kitchen linen than their counterparts in independent restaurants. This could probably be because they were aware of the effects of using soiled kitchen linen and also, each food handler was responsible for taking care of his or her used kitchen linen. Inspite of the (5) significant differences that were noted, the respondents in both categories of restaurants faced similar challenges in their attempt to put food safety measures into practice.

Table 20: Barriers to Practices by Facility Type

Activities	n	Time Constraint (%)	Inadequate Knowledge (%)	Poor enforcement (%)	Inadequate resources or supplies (%)	Lack of motivation (%)	No reminder (%)	$\chi 2$(p-value)
Hand washing		53.20	11.10	24.60	6.30	0.80	4.00	44.97(0.00*)
Hotel restaurant	105	63.00	12.00	12.00	8.00	1.00	5.00	
Independent restaurant	23	16.00	8.00	76.00	0.00	0.00	0.00	
Using hair restraints		27.70	39.90	8.70	5.80	0.60	16.2	
Hotel restaurant	122	26.23	40.98	7.38	5.74	0.82	17.21	2.79(0.83)
Independent restaurant	51	31.27	37.25	11.76	5.88	0.00	13.71	
Changing work clothes								
Hotel restaurant	96	59.57	21.28	8.51	10.64	0.00	2.13	1.68(0.89)
Independent restaurant	37	54.05	24.32	8.11	13.51	0.00	0.00	
Maintaining short nails								
Hotel restaurant	83	30.12	36.14	12.05	1.20	0.00	20.48	8.35(0.30)
Independent restaurant	43	43.90	26.83	7.32	0.00	0.00	26.83	
Wearing of hand glove								
Hotel restaurant	138	12.41	21.17	7.30	54.74	0.00	5.11	21.74(0.002*)
Independent restaurant	81	11.69	7.79	0.00	77.92	0.00	7.79	
Removal of jewelry								
Hotel restaurant	130	28.57	28.57	10.32	3.17	1.59	30.59	7.80 (0.45)
Independent restaurant	61	30.51	25.42	8.47	0.00	0.00	38.89	
Use of thermometers								
Hotel restaurant	140	1.46	10.22	2.92	86.13	0.00	1.46	14.40(0.04*)
Independent restaurant	83	5.19	10.39	0.00	90.91	0.00	1.30	
Cleaning of equipment before use								
Hotel restaurant	106	56.00	20.75	6.60	3.77	0.00	12.26	6.33(0.71)
Independent restaurant	48	75.00	16.67	2.08	0.00	0.000	6.25	

Table 20 : Continued

Storage of food items								
Hotel restaurant	163	9.02	66.92	0.00	12.78	0.00	4.51	5.25(0.38)
Independent restaurant	67	7.46	74.63	5.26	11.94	0.00	5.96	
Appropriate storage temperatures								
Hotel restaurant	133	10.69	67.18	6.11	12.21	0.00	4.58	6.85(0.44)
Independent restaurant	67	7.46	74.63	0.00	11.94	0.00	5.96	
Food preparation and service techniques								
Hotel restaurant	128	36.72	51.56	7.03	1.56	0.78	2.34	14.33(0.04*)
Independent restaurant	69	59.70	32.84	4.48	1.49	0.00	4.48	
Appropriate storage facilities								
Hotel restaurant	132	43.65	34.92	12.70	5.56	0.79	4.76	10.43(0.23)
Independent restaurant	63	57.38	29.51	4.92	6.56	0.00	4.92	
Keeping out vermin								
Hotel restaurant	138	11.03	18.38	62.50	4.41	0.00	5.15	13.47(0.06)
Independent restaurant	74	9.59	6.85	80.82	4.11	0.00	0.00	
Cleaning of work area and surfaces								
Hotel restaurant	95	65.26	12.63	10.53	3.16	0.00	8.42	0.14(6.85)
Independent restaurant	41	78.05	14.63	0.00	4.88	0.00	2.44	
Laundering of kitchen linen								
Hotel restaurant	128	51.56	9.38	14.84	7.03	0.00	17.19	22.06(0.001*)
Independent restaurant	57	81.48	1.85	1.85	1.85	0.00	18.52	
Waste management								
Hotel restaurant	73	45.21	4.11	10.96	2.74	0.00	36.99	7.77(0.10)
Independent restaurant	35	68.57	0.00	2.86	5.71	0.00	22.86	

Source: Field survey, Seidu (2017) Asterisks (*) show areas of significant differences

Chapter Summary

This chapter presented the analysis of the food safety practices of food handlers and the related barriers to food safety practices in the selected restaurants in Tamale Metropolis. The report discussed the actual practices where activities were physically observed to verify the food handlers' food safety knowledge.

Consequently, the observed practices were compared with the respondents' knowledge scores to ascertain the relationship between food safety knowledge and practice. Specific mention has been made of the factors that militated against food safety practices among food handlers. It was noted that even though the surveyed food handlers had good food safety knowledge they did not put the knowledge into practice. However, there are a few instances where their practices exceeded what they knew; which could be due to the influence of significant others as well as past experiences and the culture at the work place which caused them to act as expected. The knowledge gap was also analyzed and the results showed gaps between knowledge and practice; indicating that knowledge does not always translate into practice.

This situation could be associated with the barriers the respondents identified to be impeding their ability to practice food safety fully. The next chapter gives a summary of the major findings of the study, draws conclusions and makes constructive recommendations and suggesting areas for further research.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents the summary of the main findings of the study, the conclusions drawn, and the recommendations in relation to respondents' food safety knowledge, practices and constraints in restaurants within the Tamale metropolis.

Summary

The study, which was based on a descriptive design with a mixed method of data collection and analysis, sought to assess the food safety knowledge and practices among food handlers in restaurants in the Tamale Metropolis. The study specifically aimed at assessing the food safety knowledge of food handlers in restaurants, identifying food handlers' sources of food safety information, examining the food safety practices of food handlers, analyzing the relationship (gaps) between food safety knowledge and practices of food handlers and assess (finding out) the barriers to food safety practices; assessing the food safety knowledge of food handlers.

The study was guided by a conceptual framework adapted from the food safety knowledge, attitude and HACCP practice model (KAP) by Ko (2013); with knowledge, practice and barriers as the main variables. The food safety knowledge and practices were examined in relation to personal hygiene, food hygiene and environmental hygiene issues.

It involved 214 respondents selected through a multi-stage sampling procedure. They included food handlers in one star and two star hotels with restaurants and grades two and three independent restaurants within the

Tamale metropolis. Data were gathered through questionnaire and observation checklist. The questionnaire was administered with the help of three trained field assistants while the researcher carried out the observation using an observation checklist. Simple random sampling was used to select twelve hotel restaurants and eleven independent restaurants for the study while accidental and purposive sampling were used to select the participants. Statistical analyses were conducted using STATA version 15 and both descriptive and inferential statistical techniques such as frequency, percentage, means, independent sample t-test, chi square and ANOVA were employed in analyzing the data.

Summary of Main Findings

The main findings of this study are summarized based on the objectives of the study and the conceptual framework that guided the study.

Food Safety Knowledge of Respondents

Overall, approximately 77% of the food handlers showed significant knowledge on food safety issues but in specific terms, it was noted that most of the respondents (78%) were more knowledgeable in environmental hygiene issues. Most (92%) of the food handlers were aware of the importance of washing hands with soap and warm water before commencing and during food preparation and service. They were however, not very informed about the need to use hair restraints.

Inspite of the fact that food hygiene knowledge score fell below the other areas of food safety, most of the respondents were aware of the need to

wash equipment under running water (95%) as well as the need to use separate chopping boards (89.9%).

In terms of respondents' knowledge levels, it was evident that 81 % of the respondents had high knowledge while 19% exhibited moderate levels.

The analysis showed no significant differences between the respondents' level of food safety knowledge and some of their socio-demographic characteristics. For instance, there was no significant difference in terms of the respondents' food hygiene knowledge and their religious affiliation. There was also no significance difference in the environmental hygiene knowledge and educational attainment of the respondents. On the contrary, there existed a significant difference between the personal hygiene knowledge and the sex of the respondents. It was realized that more male respondents (11.23) had high knowledge levels as compared to their female counterparts (10.35). This implies that the male respondents are passionate about the job and are putting in their best while their female counterparts probably hold the view that food preparation and service is a job for women so they know all. Also, a significant difference was noted between food safety knowledge and food safety practices of food handlers. This implies that the respondents' knowledge exceeded their practices.

The respondents within the age range of 18-37years demonstrated high levels of food safety knowledge. However, it was observed that the higher the age of the respondents, the less knowledgeable they were and vice versa.

No significant difference was realized between the levels of food safety knowledge and the food handlers' educational attainment. The

implication is that the educational programmes pursued by the food handlers were probably not related to the hospitality industry but they found themselves working there. As a result, the SHS holders were noted to have the highest level of knowledge as compared to the tertiary holders. Thus, in this study, knowledge did not increase with educational attainment.

As regards the level of the respondents' food safety knowledge and the type of facility, it was found that no significant differences existed in the overall food safety knowledge and the type of facility. However, majority of respondents (82%) in hotel restaurants were more informed on food safety issues than their counterparts in independent restaurants (79%). This suggests that food handlers from the hotel restaurants are likely to follow food safety measures than their counterparts who are less knowledgeable.

The appreciable number (84) of non-professional food handlers in the study area coupled with the percentage (58%) that had not received in-service training suggests that, there is a high chance of contaminating foods as they may not be in a position to apply the food safety standards as required.

Respondents' Sources of Food Safety Information

The respondents obtained food safety information from five prominent sources with lecturers/ teachers (42%) and in-service training (26.2%) being the most common sources. The least patronized sources were the media (6%) and the reading of books. None of the surveyed food handlers mentioned books or print media as sources of food safety information which suggests that they were not familiar with seeking for information through those means; or they were probably not enthusiastic about reading. This probably means that

the food handlers could be limited in current information since they are no longer in school to receive from lecturers or teachers.

Respondents' Food Safety Practices

On the whole, 63% of the respondents carried out acceptable practices of food safety measures. It was specifically noted that 75% of the food handlers exhibited correct practices of personal hygiene issues as against 53% on food hygiene issues.

Nevertheless, it was realized from the observation that over half (57%) of the respondents never washed their hands when shifting from handling raw food to cooked or ready to eat foods. In addition, less than half (43%) of the respondents who washed their hands never used soap. This could be a recipe for cross contamination and subsequently, cause food borne illness.

In terms of protection, it emerged that the respondents did not pay much attention to the use of protective clothing as less than half of them put on hair restraints/caps and aprons/over coats.

Inspite of the fact that gloves serve as barriers between the bare hands and especially ready-to-eat foods, it became evident that the food handlers were not familiar with the use of gloves as only three percent of them actually used them during food preparation. Most of the food handlers (78%) manipulated ready-to-eat foods (cooked foods and those eaten raw) with bare hands.

Although over half (58%) of the observed food handlers were aware that wearing jewelry during food preparation and service could be a source of contamination, over a quarter (27%) of them put on jewelry during food

preparation and service; indicating that, it is not always that food handlers put what they know into practice.

As regards food hygiene practices, it was noticed that all the selected facilities had adequate and good food storage facilities; thus food items were stored at appropriate compartments and temperatures. Food items were washed before storage.

The results revealed that none of the selected restaurants had a food thermometer; so no food handler used food thermometers to monitor or check critical control points or appropriate temperatures at which foods should be stored or cooked. Again, though all respondents washed and rinsed serving dishes under running water, none of them heated or sanitized equipment, plates and serving dishes before service.

It was observed that most often the foods were served hot in all the restaurants as they prepared and served foods on request. However, a few (15) respondents tried to maintain standard temperatures by microwaving foods that might have gone cold before service.

Even though it is a requirement to use separate chopping boards for different foods, majority (83%) of the respondents did not comply; while the knowledge results indicated majority (95%) of them were aware of the need to separate them. This situation indicates that knowledge does not always have an influence on practice as assumed by the KAP model and the conceptual framework guiding the study.

Inspite of the fact that kitchen linen have been identified among the top causes of cross contamination as well as perfect environment for the breeding of bacteria, only 27% of the respondents had adequate kitchen linen and they

washed and used them without ironing. This is a situation that may have a high chance of contaminating work surfaces, equipment and the food.

In addition, it was observed that about 77% of the respondents thawed frozen foods appropriately.

With regards to environmental hygiene practices, all selected restaurants had very clean environment; both inside and outside, with adequate and appropriate drainage, toilet facilities and waste collecting bins.

Although all the waste bins had fitting lids, only 16 % of them in the kitchens had their lids on. Most of the food handlers preferred leaving the waste bins opened for easy reach or accessibility. However, this practice could pollute the atmosphere with the odour from the waste as well as attract flies and other pests into the premises.

Most of the facilities (74%) had adequate and clean toilet facilities for both staff and customers; but none of the surveyed facilities had adequate hand washing stations (sinks) for the staff. This probably made it difficult for food handlers to carry out proper hand washing practices and also links to the influence of subjective norms (role of significant others as indicated in the TPA) in the food handlers preparedness to practice appropriately. The facility owners did not make enough provision for food handlers to practice as expected.

This situation coupled with the use of waste bins without fitting lids poses the risk of contamination and food poisoning. The areas that showed gaps between the respondents' food safety knowledge and practices suggests that there are grey areas to be worked on in the quest to improve food safety practices among food handlers in restaurants.

Food Safety Knowledge Versus Practice

Generally, most (80%) of the respondents were knowledgeable in food safety issues as against those who put the measures into practice (65%). Thus, there existed a negative gap (-15%) between the overall food safety knowledge and practice. This suggests a significant difference between the food safety knowledge and practices of the food handlers.

The number of food handlers who were knowledgeable on personal hygiene issues exceeded those who practiced personal hygiene by 5.5% while those knowledgeable in food hygiene issues surpassed those who put food hygiene measures into practice by 19.1%. This implies that, food handlers' knowledge exceeded their practices. For instance, the respodents with knowledge on the use of gloves far exceeded those who practically used them.

With reference to specific food safety areas, there existed significant differences between personal hygiene knowledge and personal hygiene practice ($p = 0.001$) as well as food hygiene knowledge and food hygiene practices ($p = 0.001$) of food handlers.

There was a positive relationship with regards to the food handlers' knowledge and their practices which indicates that practice exceeded knowledge. However, there was no significant difference between the respondents' food safety knowledge and their practices.

This suggests that practice does not always depend on knowledge as for instance, the food handlers' actual use of hair restraints (48.3%) far exceeded their knowledge (10%). This could mean that due to work culture, food handlers might carry out activities correctly without actually knowing the reason behind their action.

Barriers to Food Safety Practices

Six main barriers were identified to account for the inability of food handlers in restaurants to carry out food safety measures correctly. Prominent among the barriers were time constraints/busy work schedule (60; 4.8%), inadequate knowledge/training (54; 4.3%), inadequate resources or supplies (31; 2.5%) and lack of enforcement of rules and regulations (23; 1.8%). These affected the practice of a variety of food safety activities.

In specific terms, time constraints/busy work schedule was identified (28%) as the leading barrier to food safety practices such as the cleaning of work surfaces and equipment, regular hand washing, laundering of kitchen linen, changing of work clothes and proper waste management.

Inadequate training and knowledge was found to affect the storage of food items (70%): use of appropriate storage temperatures (69%), the use of appropriate food preparation techniques (45%) and the use of hair restraints during food preparation and service (40%).

Furthermore, inadequate provision of resources and supplies prevented respondents from using calibrated food thermometers (84%) and gloves (62%) during food preparation and service.

Also, lack of enforcement of rules and regulations affected the prevention of vermin from the food preparation and service area as well as prevented the respondents from being enthusiastic about washing their hands properly and regularly during food preparation and service.

Forgetfulness and lack of reminders hindered the removal of jewellery during food preparation and service, the proper management of waste, maintenance of short and neat finger nails (22%), and the washing of kitchen

linen regularly (17%). Respondents needed reminders to be able to comply with appropriate food safety practices.

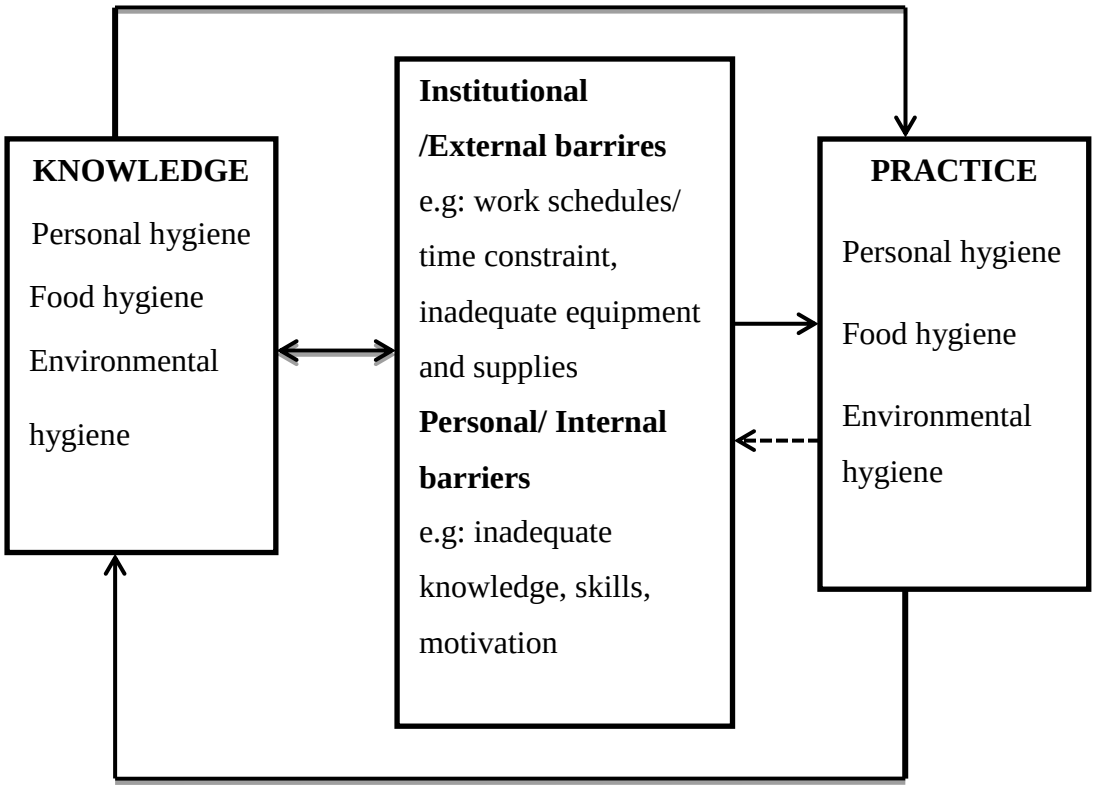
The finding that food handlers in the surveyed restaurants have high food safety knowledge levels gives an impression that foods from these facilities will be safe for consumption; nonetheless there is the need to put strategies in place for food handlers to put the knowledge into practice. There is the need for further and continuous education or awareness creation on the importance and regular use of protective clothing (hair restraints, aprons or overcoats, hand gloves) as well as the use of soap for hand washing at all times. As implied in the HBM guiding the study, when food handlers understand the health implications (perceived susceptibility, severity and benefits) of their actions and inactions they will act appropriately.

Relevance of Conceptual Framework

The findings of the study fitted well into the conceptual frame work that guided the study, particularly, in terms of the barriers that militated against practices of the food handlers in all the domains of food safety. The food handlers had good knowledge on all the domains of food safety but they could not put all the knowledge into practice due to the barriers identified.

This confirms the framework for the study which postulated that knowledge from all the areas could be obtained through education, training and experiences from practice but facility or institutional and personal barriers such as time constraint, inadequate supplies of logistics, lack of motivation and knowledge and skills could prevent employees from practicing appropriately. For instance, the food handlers' knowledge on the use of food thermometers, gloves and dish washers did not automatically allow them to

practice accordingly. Similarly, personal barriers such as inadequate knowledge, forgetfulness and intrinsic motivation could militate against food handlers' practices.



Source: Field survey, Seidu (2017)

Conclusions

Based on the findings of the study, the following conclusions were drawn:

Food handlers in restaurants in the Tamale Metropolis have high food safety knowledge compared to practice therefore they need more practice oriented training.

The food handlers were limited in their sources of information as their overriding sources of information were lecturers/teachers and training.

Food handlers carried out limited acceptable food safety practices.

Food safety practices among food handlers were more inclined to personal hygiene issues.

Though the restaurants operated in clean environment, there is the likelihood of contaminating food since food handlers manipulated ready-to-eat foods with bare hands.

There is the likelihood of attracting pestes into the premises as well as polluting the kitchen environment since waste bins were left open during food preparation.

In terms of the relationship between the food handlers' food safety knowledge and their practices, a significant difference was observed between the food handlers' food safety knowledge and their practices. Their food safety knowledge exceeded their practices; suggesting that their food safety knowledge did not always translate into practice.

Seggregating by the domains, there existed a significant difference in personal hygiene knowledge by the sex of the respondents. The male respondents were more knowledgeable than their female counterparts.

No significant difference was observed in terms of the respondents' food hygiene knowledge and their religious affiliation.

There was also no significant difference in the environmental hygiene knowledge and the educational attainment of the food handlers.

There was no significant difference in respondents' food safety knowledge and the type of restaurants they work in. Nevertheless respondents from hotel restaurants were more knowledgeable than their counterparts from the independent restaurants.

Time constraint/busy, inadequate supplies, inadequate knowledge and training and lack of enforcement of rules and regulations are barriers to food safety knowledge and practice.

Recommendations

Base on the major findings and the conclusions drawn, the following recommendations are made:

1. It is clear from the conclusions that most of the restaurant food handlers had high knowledge in food safety issues. Yet, they did not translate all the knowledge into practice due to poor enforcement of rules and regulations by supervisory agencies as elicited from the identified barriers. It is therefore recommended that the facility managers and supervisors and regulatory agencies (GTA, FDA and Environmental Health and Sanitation Unit (EHSU) of the Tamale Metropolis should intensify their regulatory and monitoring visits to restaurants to ensure that food handlers adhere to acceptable food safety practices.

2. GTA, in collaboration with FDA and EHSU should build the capacities of facility managers and unit supervisors to make them see supervision and monitoring as part of their duty and ensure that their employees follow good food safety practices.

3. The EHSU of Tamale Metropolis in collaboration with FDA and academia (FCS-UDS) plan and carry out regular (quarterly) health education for restaurant employees to remind them of the implications of their actions and inactions. They should be educated and linked to current sources of food safety information to enable them to be abreast with current principles and tecniques.

4. In accordance with the finding that most of the food handlers did not have in-service training on food safety, it is recommended that Tamale metropolis in collaboration with the Restaurant and Hoteliers' Association, facility

management and academia (UDS) plan and implement a mandatory well-structured practical food safety training programs (based on HACCP and the five keys to safer food) for restaurant employees to improve on their practices.

5. It is further recommended that the trainers develop a check list to ensure that all food safety components are covered during the training and orientation period.

6. Policy makers and curriculum planners in the Ministry of Education should give paramount attention to more practical (vocational) training from the JHS to the tertiary levels for the graduates to have appropriate skills for the job market.

7. Facility owners and managers, need to ensure that food handlers have appropriate and adequate tools, equipment and resources to carry out their work as expected; as lack or inadequate supplies mitigate against appropriate practice.

8. Finally, food handlers need to pay attention to food safety standards as well as bear in mind the perceived susceptibilty, perceived severity of their actions during food food prearation and service. They should also make conscious effort to regulary wash their hands with soap and water during food preparation. Furthermore, food handlers should seek to improve on their skills by taking short skill training courses to help them operate up to standard.

Contribution to Knowledge

The contribution this study makes to knowledge include the following:

This study has tested the usefulness of the theories and models in food safety context

The conceptual framework made the relationships that existed between the variables simple. It draws attention to the fact that there exist barriers mitigating practice.

The expansion of the knowledge base of food safety knowledge and practices of food handlers in restaurants within the African context such as Ghana. This is based on the fact that most of the studies related to food and safety practices have focused on restaurant employees in developed countries.

On the local scene most of the focus has been on street food venders, sanitation and hygiene practices of street food venders, street food vending and the quality of street foods against limited studies on restaurant employees. Specifically, through the data drawn from the Northern Region, the study contributes to existing literature on food safety knowledge and practice in Ghana.

The study has brought to light information on food safety knowledge and practices of food handlers from a practitioner's view point to complement the scientists' findings

In terms of evolving theories, models and concepts, the study's contribution lies in the development of a modified model which made the relationships that exist between the variables (Knowledge and Practice) simple and easy to follow. The relationship between food handlers' knowledge and practice with the barriers playing an intermediary role and mitigating against

practice draws attention to the fact that knowledge can not translate fully into practice unless the barriers (institutional and personal barriers) are removed.

Suggestions for Further Research

The study did not examine the wholesomeness of the end results of food handlers' practices, thus it is suggested that a further study should be conducted to ascertain the microbial quality of foods prepared and served in the restaurants in the Tamale metropolis.

The focus of this study was limited to food safety knowledge and practices of food handlers in restaurants in Tamale Metropolis in relation to the KAP model. It is thus proposed that a further study should focus on food handlers' attitudes towards food safety practices to allow for correlation of knowledge, attitude and practices of food handlers in restaurants.

The researcher employed the quantitative approach to the study, it is suggested that a further study should be carried out using qualitative or mixed method to be able to get detailed explanations to restaurant food handlers actions and inactions.

As regards the inclusion criteria, this study focused on star 1&2 hotel restaurants and grades 2 & 3 independent restaurants in Tamale metropolis. Consequently, a further study should include guest houses and budget categories so as to generate more data on the knowledge and practices of food handlers in that area of the hospitality industry.

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APPENDICES

APPENDIX A

UNIVERSITY OF CAPE COAST

FACULTY OF SOCIAL SCIENCES

DEPARTMENT OF HOSPITALITY AND TOURISM MANAGEMENT

Food Safety Knowledge and Practices in Restaurants in the Tamale Metropolis

Questionnaire for Food Handlers

Dear Sir/Madam,

This study aims at assessing the food safety knowledge and practices of food handlers in restaurants in the Tamale Metropolis of Ghana. It would be very much appreciated if you could take time off your busy schedule to complete this questionnaire. Your confidentiality is assured, as the information you provide will not be disclosed to any party. The information will be treated confidential, and will be used only for academic purposes.

Thank you

SECTION A: BACKGROUND OF RESPONDENTS

Socio-demographic Characteristics

Please make a tick (√) in the space provided and write out your response where required

1. Gender

i. Male [ ] ii. Female [ ]

2. Age……..

3. Marital status

i. Single [ ] ii. Married [ ] iii. Widowed [ ]

iv. Divorced [ ] v. Separated [ ]

4. Religion

i. Christianity [ ] ii. Islam [ ] iii. Traditional [ ]

iv. Others (Please Specify)……

5. Level of Education Attained

i. No formal education [ ]

ii. JHS /MSLC [ ]'

iii. SHS [ ]

v. Tertiary (University, Polytechnic, Teacher Training college) [ ]

vi. Others (Please specify)……

Work Related Characteristics

6. Professional Qualification

i. HND Hotel, Institutional management [ ]

ii. Advanced catering [ ]

iii. Intermediate catering [ ]

iv. NVTI [ ]

v. Others (please specify)……

7. Facility in which you are working:

i. Hotel restaurant [ ]

ii. Independent restaurant [ ]

8. Location……

9. What is your position in the facility?

…….

10. How long have you been working here?

……

11. How many times do you go for medical check-up in a year?

i. None [ ] ii. Once [ ]

iii. Twice [ ] iv. Three times [ ]

v. Four times [ ]

12. Have you received any in-service training on food safety and hygiene practices?

i. Yes [ ] ii. No [ ]

13. If yes, when (how long ago) and how many times in a year?

……

14. What is the area of in-service training you received?

……

15. Who or which organization/institution offered the training?

……

16. What was the duration of the training?

……

SECTION B:

KNOWLEDGE OF FOOD SAFETY ISSUES

Please indicate the extent to which you agree or disagree with the following statements by putting a tick (√) under True, False or Don't know

S/N	Statement	True	False	Don't know
	Personal Hygiene			
1	Food handlers are at liberty to put on hair restraints/caps during food preparation and service			
2	Using aprons or overcoats during food preparation is a luxury			
3	It is optional to wear hand gloves when preparing foods that are eaten raw/fresh			
4	A food handler can continue to wear soiled clothing to work until he/she is off			

	duty			
5	It is compulsory for food handlers to have jewelries on during food preparation			
6	Hand washing with soap and warm water before commencing and during cooking and service reduces the risk of food contamination			
7	Hand washing is necessary only after visiting the toilet			
8	Food handlers are at liberty to scratch skin, touch hair, nostrils and ears during food preparation and service			
9	Food handlers are at liberty to wear long finger nails			
10	A food handler is at liberty to lick fingers during food preparation and service			
11	Coughing or sneezing directly on food during preparation and service has no effect on the food			
12	Medical examination is a requirement for employment in the food production and service industry			
13	Regular or routine medical examination is optional in the food production and service unit			
	Environmental hygiene (Kitchen and Restaurant)			
14	Food preparation and service area should be free from pests and rodents			
15	Un-cleaned work surfaces and kitchen cloths are vehicles of contamination			
16	Proper cleaning and sanitization of utensils increase the risk of food			

	contamination			
17	All kitchen cloths must be washed once a week			
18	All garbage bins in the food preparation and service area should be left opened for easy usage			
19	Garbage bins should be emptied once a week			
20	Hand washing stations should be equipped with sanitary towels/drying services			
21	Good drainage system can limit the spread of micro-organisms			
	FOOD HYGIENE			
22	Foods prepared a day or more before they are served reduces the risk of food contamination			
23	Reheating cooked food contribute to food contamination			
24	Appropriate refrigeration temperatures (freezing) kills all bacteria that may cause food-borne illness			
25	Raw food and cooked food can be put together during storage			
26	Cooked meat can be left out of the fridge to cool overnight before refrigerating			
27	Cooked food should be very hot (at a temperature of 65^{o} C) before serving			
28	Food items purchased from reliable sources need no cleaning before storage			
29	The best way to thaw frozen food is to put it in a bowl and leave it in the open			
30	It is a luxury to use separate chopping boards during food preparation			

31	Food handlers are not obliged to wash and rinse equipment and serving dishes under running water			
32	It is not important to heat or sanitize serving plates and dishes before they are used for service			
33	The manipulation of food with uncovered hands increases the risk of food contamination			

Sources of Food Safety Information

21. Please tick the main source from which you got food safety information

i. Teachers [ ] ii. Lecturers [ ]

iii. Health personnel [ ] iv. Friends/colleagues [ ]

v. Media (TV, Radio) [ ] vi. Posters/billboards [ ]

vii. Internet [ ] viii. Training/workshops [ ]

22. Are you aware of the five keys to safer food?

i. Yes [ ] ii. No [ ]

23. Please if yes, name the five keys

i……

ii……

iii……

iv……

v……

SECTION C: BARRIERS TO FOOD SAFETY PRACTICES

Please indicate by ticking (√) in the appropriate column the barriers to food safety practices in your facility

PRACTICES	**BARRIERS**														
	Time constraints:		**Inadequate training / knowledge:**				**Poor enforcement of rules and regulations**		**Inadequate resources or supplies:**				**Criticism from colleagues**	**Little or Lack of staff motivation**	**No Reminders**
Hand washing															
Using hair restraints															
Changing work clothes															
Maintaining short nails															
Wearing hand gloves															

during food preparation															
Removal of jewelry during food preparation															
Use of thermometers															
Cleaning of equipment before use															
Storage of food items at appropriate storage temperatures															
Using appropriate food preparation and service techniques															
Managing storage facilities															
Keeping out vermin															
Cleaning of work area															

and surfaces															
Laundering of kitchen linen daily															
Appropriate waste management															

Others (Please Specify)

……

UNIVERSITY OF CAPE COAST

DEPARTMENT OF HOSPITALITY AND TOURISM MANAGEMENT

OBSERVATION CHECKLIST ON THE FOOD SAFETY PRACTICES OF FOOD HANDLERS IN RESTAURANTS IN THE TAMALE METROPOLIS

Date: …….

Time: ……

Type of Facility: ……..

Area: …….

Location……

	General Outlook of Facility and Personnel practices	**Yes**	**No**	**Comment**
A	**Facility (Environmental hygiene and Sanitation)**			
1	Food handlers operate in a clean environment (inside and outside)			
2	Adequate and appropriate drainage system provided			
3	Kitchen provided with self-closing doors			
4	Doors, windows and other openings protected to eliminate pests			
5	Adequate ventilation in kitchen to remove heat and odor			
6	Floors, Walls and Ceilings kept clean; free from dirt, stains and cobwebs			
7	Waste bins are large enough to handle volume of refuse generated in the facility provided			
8	Waste bins with Fitting lids available			

9	Waste bins in the kitchen are emptied regularly			
10	Main waste bins outside are emptied daily			
11	Provision of adequate toilet facilities and accessories (for staff and customers)			
12	Toilet facilities kept clean and in a good state of repair			
13	Provision of hand washing stations for use by kitchen staff			
14	Hand washing stations have been equipped with sanitary towel or suitable drying service			
15	Adequate refrigerators and freezers			
B	**Personal hygiene**			
16	Food handler wears a cap or hair restraint during food preparation and service			
17	Food handler wears clean apron/over coat during food preparation and service			
18	Food handler wears clean clothing (uniform/own outfit) during food preparation and service			
19	Food handler wears gloves during the preparation and serving of ready to eat foods or foods eaten raw			
20	Food handler wears jewelry during food preparation			
21	Food handler wears trimmed and neat finger nails			
22	Food handler washes hands with soap and warm water before and during food preparation and service			
23	Food handler washes hands in between handling raw and cooked food			
24	Food handler scratches parts of the body (hair, skin, ears, eyes, nose) during food preparation			

	and service			
25	Food handler coughs/sneezes directly on to food during food preparation and service			
26	Food handler licks fingers during food preparation and service			
C	**Food Hygiene Practices**			
27	Food handler reheats/microwaves cold/leftover foods before service			
28	Food handler separated raw foods such as meat, vegetables and salads from cooked foods during storage			
29	Cooked foods are served hot			
30	Food items are washed before use/storage			
31	Food handler thawed frozen foods in a bowl/basin outside refrigerator or freezer			
32	Food handler used separate chopping boards for raw meat/ fish and ready to eat foods			
33	Food handler manipulated cooked and ready to eat foods with covered hands/tongs			
34	Food handler used calibrated food thermometers for checking appropriate temperatures of food			
35	Serving dishes are washed in a dish washing machine			
36	Equipment and serving dishes are washed and rinsed under running water			
37	Serving plates and dishes are heated or sanitized before they are used for service			
38	Food handlers washed and ironed kitchen linen daily			

APPENDIX B

Barriers to food safety practices

	Yes response		No response			Yes response		No response	
Construct/ Item	N	%	N	%	Construct/ Item	N	%	N	%
Hand washing					**Storage of food items at appropriate storage temperatures**				
Time constraint	11	53	24	12.5	Time constraint	2	7	28	15
Inadequate training or knowledge	2	11	33	17.3	Inadequate training/ knowledge	20	69	11	6
Poor enforcement of rules and regulations	5	25	31	15.8	Poor enforcement of rules and regulations	1	3	30	16
Inadequate resources or supplies	1	6	34	17.8	Inadequate resources or supplies	4	14	27	15
Lack of motivation	0	1	36	18.4	Criticism from colleagues	0	0	30	16
No reminder/Forgotten	1	4	35	18.1	Lack of motivation	0	0	31	17
Using hair restraints					No reminder/Forgotten	1	3	29	16
Time constraint	7	29	24	13	**Using appropriate food preparation and service techniques**				
Inadequate training/ knowledge	10	42	21	11	Time constraint	12	43	18	10
Poor enforcement of rules and regulations	2	8	28	15	Inadequate training/ knowledge	13	46	18	10
Inadequate resources or supplies	1	4	29	15	Poor enforcement of rules and regulations	2	7	29	16
Criticism from colleagues	0	0	30	16	Inadequate resources or supplies	0	0	30	16

Lack of motivation	0	0	30	16	Criticism from colleagues	0	0	31	17
No reminder/Forgotten	4	17	27	14	Lack of motivation	0	0	30	16
Changing work clothes					No reminder/Forgotten	1	4	30	16
Time constraint	11	58	20	10	**Managing storage facilities**				
Inadequate training/ knowledge	4	21	26	13	Time constraint	13	46	18	10
Poor enforcement of rules and regulations	2	11	29	15	Inadequate training/ knowledge	9	32	22	12
Inadequate resources or supplies	2	11	28	14	Poor enforcement of rules and regulations	3	11	28	15
Criticism from colleagues	0	0	31	16	Inadequate resources or supplies	2	7	29	16
Lack of motivation	0	0	31	16	Criticism from colleagues	0	0	30	16
No reminder/Forgotten	0	0	30	15	Lack of motivation	0	0	30	16
Maintaining short nails					No reminder/Forgotten	1	4	29	16
Time constraint	7	33	29	15	**Keeping out vermin**				
Inadequate training/ knowledge	7	33	29	15	Time constraint	3	10	28	15
Poor enforcement of rules and regulations	2	10	33	17	Inadequate training/ knowledge	4	13	26	14
Inadequate resources or supplies	0	0	35	18	Poor enforcement of rules and regulations	21	70	10	5
Criticism from colleagues	0	0	0	0	Inadequate resources or supplies	1	3	29	16
Lack of motivation	0	0	36	19	Criticism from colleagues	0	0	31	17
No reminder/Forgotten	5	24	31	16	Lack of motivation	0	0	31	17
Wearing hand gloves during food preparation					No reminder/Forgotten	1	3	30	16
Time constraint	4	11	31	17	**Cleaning of work area and surfaces**				

Inadequate training/ knowledge	6	16	30	17	Time constraint	13	68	17	9
Poor enforcement of rules and regulations	2	5	34	19	Inadequate training/ knowledge	3	16	28	14
Inadequate resources or supplies	23	62	13	7	Poor enforcement of rules and regulations	1	5	29	15
Criticism from colleagues	0	0	36	20	Inadequate resources or supplies	1	5	30	15
Lack of motivation	0	0	0	0	Criticism from colleagues	0	0	31	16
No reminder/Forgotten	2	5	34	19	Lack of motivation	0	0	31	16
Removal of jewelry during food preparation					No reminder/Forgotten	1	5	29	15
Time constraint	9	28	27	15	**Laundering of kitchen linen daily**				
Inadequate training/ knowledge	9	28	27	15	Time constraint	16	62	15	8
Poor enforcement of rules and regulations	3	9	33	18	Inadequate training/ knowledge	2	8	29	15
Inadequate resources or supplies	1	3	35	19	Poor enforcement of rules and regulations	3	12	28	15
Criticism from colleagues	0	0	0	0	Inadequate resources or supplies	1	4	29	15
Lack of motivation	0	0	35	19	Criticism from colleagues	0	0	30	16
No reminder/Forgotten	10	31	25	14	Lack of motivation	0	0	31	16
Use of thermometers					No reminder/Forgotten	5	19	26	14
Time constraint	1	3	30	16	**Appropriate waste management**				
Inadequate training/ knowledge	3	9	27	15	Time constraint	3	10	28	15
Poor enforcement of rules and regulations	1	3	30	16	Inadequate training/ knowledge	20	69	11	6
Inadequate resources or supplies	27	84	4	2	Poor enforcement of rules and regulations	1	3	29	16

Criticism from colleagues	0	0	30	16	Inadequate resources or supplies	3	10	27	15
Lack of motivation	0	0	31	17	Criticism from colleagues	0	0	30	16
No reminder/Forgotten	0	0	30	16	Lack of motivation	0	0	30	16
Cleaning of equipment before use					No reminder/Forgotten	1	3	29	16
Time constraint	14	64	17	9					
Inadequate training/ knowledge	4	18	26	14					
Poor enforcement of rules and regulations	1	5	29	15					
Inadequate resources or supplies	1	5	30	16					
Criticism from colleagues	0	0	30	16					
Lack of motivation	0	0	31	16					
No reminder/Forgotten	2	9	28	15					

Table 21: Distribution of Sampled Restaurants by Zones

Zone	Hotel restaurant (1&2star-first strata)	Sample from first strata	Percentage Sampled (%)	Independent restaurant (Grade2&3-second strata)	Sample from second strata	Percentage Sampled (%)	Total Sample	Percentage (%)
Tamale North	13	7	58.4	8	4	36.3	11	47.83
Tamale Central	7	4	33.3	10	5	45.5	7	30.43
Tamale South	2	1	8.3	3	2	18.2	5	21.74
Total	22	12	100.0	21	11	100.0	23	100.0

Source: Field survey, Seidu (2017).

APPENDIX C

INTRODUCTORY LETTER

UNIVERSITY OF CAPE COAST

FACULTY OF SOCIAL SCIENCES

DEPARTMENT OF HOSPITALITY AND TOURISM MANAGEMENT

Telephone: 03321-93552
Fax: 233-3321-34072, UCC, GH.
Telex: 2552, UCC, GH.
Email: htmd@ucc.edu.gh
Homepage: http: ucc.edu.gh/academics/view/3/department/32

UNIVERSITY POST OFFICE
CAPE COAST, GHANA

Our Ref: SS/HMD/13/0001

Your Ref:

10th December, 2014

Dear Sir/Madam,

TO WHOM IT MAY CONCERN – LETTER OF INTRODUCTION

The bearer of this note, **Ms. Judith Amma Seidu** is a Ph.D student of this Department who is collecting data for her thesis as part of the requirement for the award of PhD degree in Hospitality Management. Her thesis topic is **"Food safety knowledge, attitudes and practices of food handlers in hotels and restaurants in Northern Region, Ghana".**

I shall be most grateful if you gave her your utmost assistant and co-operation by providing her any information/data within your means. The data she is collecting is purely for academic purposes and, in any case, your anonymity is assured.

Thank you for your anticipated co-operation.

Yours faithfully,

LINDA OBENG ANSONG (MRS.)
SNR. ADMIN. ASST.
for: HEAD

UNIVERSITY OF CAPE COAST
DEPARTMENT OF HOSPITALITY
AND TOURISM MANAGEMENT

APPENDIX D

FOOD AND DRUGS AUTHORITY

FOOD AND DRUGS AUTHORITY
FDA
GHANA

Food & Drugs Authority

P. O. Box TL 1763,
Tamale.
Location: Regional Admin.
Office Building.
Tel: (233-3720) 24935
Fax:(233-3720) 24889
www.fdaghana.gov.gh

11th March, 2015

Dear Client,

TO WHOM IT MAY CONCERN

I am writing to introduce you to Mrs. Judith Seidu. A PhD student from the department of Hospitality Management, University of Cape Coast.

Mrs. Judith is gathering data for her PhD degree thesis on the topic "**Food safety knowledge, attitudes and practices of food handlers in hotels and restaurants in Northern Region, Ghana"**

We kindly implore upon your outfit to offer her the necessary assistance to help her collect her data.

Let me know if you have any questions or you can reach me on 0243770874, 03720 24935

Yours faithfully,

SYLVESTER OTENG KYEI
REGIONAL DIRECTOR

FOR: CHIEF EXECUTIVE