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ASSESSING THE FOOD SAFETY PRACTICES AMONG HOMEMAKERS IN TEMA NEWTOWN, A SUBURB OF TEMA IN THE GREATER ACCRA REGION

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DECLARATION

STUDENT'S DECLARATION

I, JUSTINA NAA ADJELEY LARYEA declare that this dissertation, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE:…….....…….

DATE:…….....…….…….

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of dissertations as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: DR. MRS. ELLEN OLU

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DATE:…….....….

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DEDICATION

This work is dedicated to my husband Michael Donkor and my lovely children, Nyuiemedi, Etornam, and Klenam Naa Adjeley Donkor.

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LIST OF ABBREVIATIONS

AMC	Aerobic Mesophiles Counts
CC	Coliform Count
CDC	Centre for Disease Control and Prevention
CFU	Colony Forming Unit
ECDC	European Centre for Disease Prevention and Control
ETEC	Enterotoxigenic *E. coli*
FAO	Food and Agriculture Organisation
FDA	Food and Drugs Authority
GNA	Ghana News Agency
HACCP	Hazard Analysis and Critical Control Point
HND	Higher National Diploma
HUS	Haemolytic Uremic Syndrome
MOFA	Ministry of Food and Agriculture
MYC	Moulds and Yeast Count
RTE	Ready To Eat
SE	Staphylococcal Enterotoxins
STEC	Shigatoxigenic *E. coli*
TTP	Thrombotic Thrombocytopenic Purpura
UN	United Nations
UNICEF	United Nations International Children and Emergency Fund
USAID	United States Agency for International Development
WHO	World Health Organisation

ABSTRACT

This study was conducted in Tema Newtown, a suburb of Tema Metropolis in Ghana to investigate the food safety practices and hygiene among homemakers. The study sought to assess the knowledge level of homemakers in food safety and hygiene, investigate the practices of homemakers in handling food and identify the measures that can lead to improved food safety practices. The study used quantitative descriptive survey and selected 70 homemakers using systematic random sampling. Data collection was done using questionnaire which was later fed into SPSS software for analysis. The study revealed that with an overall mean value of 3.28, respondents were sufficiently knowledgeable in food safety and hygiene. With the exception of three items, that is, experiencing food borne illness, knowledge of potentially dangerous nature of foodborne illness and receiving education on food safety and hygiene, respondents showed appreciable knowledge of food safety and hygiene. Further, it was found that respondents observed good personal and kitchen hygiene by washing utensils, working surfaces before and after cooking and separating raw food from ready to eat food during storage. It was seen however that, 84.3% of respondents used the same cutting board for both raw and cooked food, 72.8% left cooked food at room temperature for more than 4 hours and 77% cooked or handled food during illness. In general, the study concludes that the overall food safety practices of homemakers was fairly below accepted standards. The study recommends that stakeholders invest in food safety education for homemakers since they are the 'last line' of defense against food borne diseases. Homemakers should also take personal responsibility for the food they prepare in their household and pay attention to practices like proper hand washing with soap under running water and cooking to the right temperature.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Food, together with clothing and shelter, is one of the basic necessities of man in order to survive in his environment. Food serves a lot of important functions in the human body and as such cannot be overlooked if one wants to live a healthy life free from health problems. In this regard, food that is consumed into the human body must be carefully considered to ensure that it is safe and free from disease causing organisms.

Food safety is defined as the degree of confidence that food will not cause harm to the consumer when it is prepared, served and eaten according to its intended use (FAO/WHO, 2003). Poor food handling and hygiene practices in the domestic kitchen are thought to cause a significant number of food borne illnesses. UNICEF (2009) reported that diarrhoea is the second leading killer of children under five which is an alarming reminder of the exceptional vulnerability of children in developing countries.

Studies on food borne disease outbreaks worldwide have shown that most cases of food borne diseases occur in handling food during preparation whether in homes or in the food service sector - food vendors, restaurants and hotels (WHO, 2000). Most cases of food borne diseases are preventable if food safety practices and principals are followed from production to consumption. It is currently impossible for food producers to ensure a pathogen-free food supply, and as such the home food handler/preparer plays a critical role in the chain to prevent food borne illnesses (Medeiros *et al.,* 2004).

According to Redmond and Griffith (2003), between 35 to 65 percent of the reported outbreaks of food borne illnesses are associated with food prepared at home. However, several other studies report that outbreaks relating to food borne diseases due to conscious or inadvertent contamination implicated food from commercial or institutions establishments (79%) and

(21%) from the domestic homes (Adams & Motarjemi, 1999; Omaye, 2004). Haapala and Probart, (2004) posits that an estimated 25% of these reports could have been avoided through safe food handling practices. There is difficulty in establishing the exact numbers of incidents of food borne illnesses related to the home as a significant number of these are not reported (McCarthy, Brennan, Kelly, Ritson, deBoer & Thompson, 2007). In the case of the Republic of Ireland, 17% of food-borne outbreaks were linked to home consumption (Tirado & Schmidt, 2001) with suggestions that, the actual proportion of incidents originating in the home are likely to be much higher than reported (Redmond & Griffith, 2003).

The issue of food safety is an increasingly important public health issue because food poisoning and food-related illnesses keep affecting many consumers with some resulting in deaths (Vijayeta, 2015). All these food related illnesses are contracted through means like poor cooking, preservation, seasoning and salting and poor washing of hands. In addition, the unsanitary operating conditions of foods in most homes poses an issue worth questioning because food poisoning outbreaks for instance generally occur when cooked foods are handled by persons who carry bacteria and pathogens in their bodies in which sense homemakers cannot be exempted. The foregoing makes it evident that, poor food safety plays a role in the epidemic of foodborne problems. It is therefore clear that homemakers have a part to play in ensuring food safety for their families.

1.2 Statement of the Problem

The importance of food goes well beyond it being the main source of energy and nutrition. Food plays the essential role of being a tool for the sustenance of life and health. Ghana being an agriculture-oriented nation boasts of abundant supplies of fresh and nutritious food commodities. Yet, despite the many precautions and processes in place to ensure safe food supply, food contamination and food borne outbreaks due to human practices are still reported.

Again, according to the Ministry of Food and Agriculture (MOFA) and the World Bank, one in every 40 Ghanaian suffer serious food borne illness per year; 420,000 cases are reported with an annual death rate of 65,000. The issue of food safety and hygiene covers a broad area including the selection and handling of raw foodstuffs, personal hygiene of food handlers, sanitation of place of cooking, waste management and treatment of leftovers as well as prevention of contamination. Poor food handling practices by homemakers in Ghana can have a lot of effects on the people who consume them. This contributes to the causes of food borne illnesses reported. In Ghana and specifically Tema Newtown, several reports of food borne outbreaks have been made. According to the Ghana News Agency, in 2011 for instance, there was a reported case of Scrombroid food poisoning resulting from eating spoiled or decayed fish which led to six (6) people being hospitalised. The positive side of the narrative is that, most diseases contracted through eating unsafe foods can be avoided when homemakers are meticulous in the preparation of food for consumption by adhering to food safety practices. It is against this backdrop that this study has become necessary to assess food safety practices among homemakers in Ghana with emphasis on Tema Newtown as the study case.

1.3 Purpose of the Study

Based on the significant role food plays in the wellbeing of the individual, a study on food safety practices and hygiene is very necessary in both academia and stakeholder organisations. This study was conducted with the main aim of assessing the knowledge level and practices of home makers in food safety in the Tema Newtown Community, a suburb of Accra Metropolis.

1.4 Objectives of the Study

Specifically, the study sought to achieve the following objectives:

1. Assess the knowledge level of homemakers in food safety and hygiene.
2. Investigate the practices of homemakers in food handling through selection, preparation and serving.
3. Identify measures that can lead to improved food safety practices and minimise the outbreaks of food-borne illnesses.

1.5 Research Questions

The following research questions were fashioned to guide the study to achieve the set objectives:

1. What is the knowledge level of Ghanaian homemakers in Tema Newtown concerning food safety and hygiene?
2. What are the food safety practices of homemakers when handling food through selection, preparation and serving?
3. What are the measures that can be instituted to improve food safety practices and minimise the occurrence of food borne outbreaks?

1.6 Significance of the Study

According to Medeiros *et al.*, (2004), studies on food-borne illnesses and food safety are concentrated on food establishment institutions such as vendors, canteens, restaurants and hotels, relegating that of the domestic home to the background. This is where the study becomes so significant. It is the hope of the researcher that the study in the end will be beneficial to homemakers in particular though other people like consumers and health service workers will find it useful and relevant.

Also, this research seeks to educate people especially the homemakers on the importance of good food handling practices and for that matter the need to check meals served to their families. Again, the outcome of the study will help encourage family members and the public at large to be conscious of the foods that they either eat form home or buy and consume. In addition the study outcome will provide a framework for further studies by merging the duty of homemakers and consumers for characterizing and understanding the type of food risks.

1.7 Scope of the Study

For practicability purposes, the study was delimited to households in the Tema Newtown suburb of Greater Accra Region. Commercial food vendors and street sellers were excluded from the study. The study was further restricted to the practices and knowledge of food safety and hygiene and not extended to the microbial content present in food that makes it unsafe.

1.8 Organisation of the Study

This work is made up of five chapters. Chapter One deals with the introduction of the study. It gives a brief background to the study and presents the very problem under study. The purpose of the work, the objectives of the study and the research questions on which the whole study revolves are also presented in this chapter. It also talks about the significance of the study, delimitations of the study, limitations of the study and the organization of the study. Chapter Two deals with the empirical, philosophical and theoretical review of literature. This helped the researcher to understand the views of other researchers and research works on food safety and hygiene practices. Chapter Three also looks at the research design and methodology for data collection. It also looks at the instruments for the collection of data. Chapter Four is the next chapter after chapter three. All the data collected for the purposes of the study were analyzed in this chapter. This analysis was done based on the research questions for the study.

Chapter Five is the final chapter of the study. Recommendations, suggestions and conclusions are made in this chapter.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

In recent years, headlines and news flashes on widespread outbreaks of foodborne disease caused by lapses in food safety or pathogens have provided vivid reminders that food not only nourishes and sustains us, but if handled unsafely, can be a major threat to our health and well-being. This study is conducted with the motive of investigating into the food safety practices of the Ghanaian homemaker with Tema Newtown as the study area. This chapter of the study presents a review of related literature from other authors and sources such as academic journals, masters and Ph.D theses, books, news items and online sources.

2.2 Food Safety in Perspective

Food safety is a scientific discipline describing handling, preparation, and storage of food in ways that prevent foodborne illness along the food chain. This includes a number of routines that should be followed to avoid potentially severe health hazards. In considering market to consumer practices, the usual thought is that food ought to be safe in the market and the concern is safe delivery and preparation of the food for the consumer (Omaye, 2004).

The food chain consists of the sequence of stages and operations involved in production, processing, distribution, storage & handling of a food and food ingredients from primary production to consumption (from farm to fork).

Food can transmit disease from person to person as well as serve as a growth medium for bacteria that can cause food poisoning. In developed countries there are intricate standards for food preparation, whereas in lesser developed countries the main issue is simply the availability

of adequate safe water, which is usually a critical item. In theory, food poisoning is 100% preventable.

Numerous studies conducted in Ghana concerning various aspects of food hygiene over the past decade, have revealed poor food hygiene knowledge and attitudes of street food vendors, with personal hygiene least observed by the least educated (Acheampong, 2005; King *et al*., 1998; Nuer, 2001) There is strong statistical evidence that 70% of all bacterial food poisoning is caused by caterers. This is greater than occurrences reported from any other food sector. Most of these food poison outbreaks are due to the inadequate time and temperature control of food, whereas the remaining thirty percent are as a result of cross contamination (Wilson *et al*., 1997).

Food safety is a vital issue both in developed and developing countries; given that food borne illnesses cause a lot of distress and thousands of deaths each year (Pilling *et al*, 2008). In view of this, the issue of food safety is becoming a key public health priority considering the large number of people who are affected in one way or another through consuming of contaminated food. Food contamination is highly possible during processing and preparation, where other food-borne microbes can be introduced from infected humans who handle the food or by cross contamination from some other raw agricultural product. For example, *Shigella bacteria*, *hepatitis* A virus and *Norwalk* virus can be introduced by the unwashed hands of infected food handlers. In the kitchen, microbes can be transferred from one food to another by means such as using the same knife, cutting board, or other utensil to prepare both without washing the surface or the utensil in between. Additionally, food that is fully cooked can become re-contaminated if it touches other raw foods or drippings from raw foods that contain pathogens (Center for Disease Control, CDC, 2005).

The way that food is handled after it is contaminated can also make a difference in whether or not an outbreak occurs. Many bacterial microbes need to multiply to a larger number before enough are present in food to cause disease. Given warm, moist conditions and an ample supply of nutrients, one bacterium that reproduces by dividing itself every half hour can produce 17 million progeny in 12 hours. As a result, lightly contaminated food left out overnight can be highly infectious by the next day. If the food were refrigerated promptly, the bacteria would not multiply at all. In general, refrigeration or freezing prevents virtually all bacteria from growing but basically maintains them in a state of suspended animation. The two exceptions to this rule are the food-borne bacteria *Listeria Monocytogenes* and *Yersinia enterocolitica*, which can actually grow at refrigerator temperatures. High salt, high sugar, or high acid levels keep bacteria from growing, which is why salted meats, jam, and pickled vegetables are traditional preserved foods (CDC, 2005).

Microbes are killed by heat. Heating food to an internal temperature above 160^0F, or 78^0C, for even a few seconds is sufficient to kill parasites, viruses, and bacteria. An exception to this, however, is the *Clostridium* bacteria, which produce a heat-resistant form called a spore. *Clostridium* spores are killed only at temperatures above boiling, which is why canned foods must be cooked to a high temperature under pressure as part of the canning process (CDC, 2005). The toxins produced by bacteria vary in heat sensitivity. The staphylococcal toxin, for example, which causes vomiting, is not affected by boiling. Conversely, boiling completely inactivates the potent toxin that causes botulism (CDC, 2005).

Fruits and vegetables consumed raw are particularly of concern. Although washing can decrease contamination, it cannot eliminate it, and thus consumers can do little to protect themselves. Fresh manure used to fertilize vegetables can also contaminate them. Alfalfa sprouts and other raw sprouts pose a particular challenge, as the conditions under which they

are sprouted are ideal for growing microbes, and because they are eaten without being cooked. That means that small amounts of bacteria found on the seeds have the ability to grow to high numbers of pathogens on the sprouts. Unpasteurized fruit juice is also a risk, as it can become contaminated if there are pathogens in or on the fruit that is used to make it (CDC, 2005).

2.3 Homemakers' Knowledge of Food Safety and Food Hygiene

Knowledge of the consequences of unsafe food hygiene practice can enhance adherence to food safety guidelines. Studies on food hygiene have been done worldwide. According to the WHO, food hygiene are the conditions and measures necessary to ensure the safety of food from production to consumption. In the Philippines, a survey of food safety knowledge and practice of food handlers was carried out by Azanza, Gatchalian and Ortega, (2000). The study found that, among the 54 food handlers surveyed, knowledge on food safety concepts was established particularly on topics that dealt with health and personal hygiene, food contamination and good preparation procedures. However, food handlers were reported not to be knowledgeable in food laws and waste management. The provision of food hygiene education, financial assistance through social service and basic water and waste management utilities were recommended to bridge the gap between knowledge and practices of safe food handling among food handlers.

A study conducted by Priyadarshini (2015) to assess the food safety awareness and practices by homemakers in Bhubaneswar city, India showed that respondents lacked food safety knowledge. The study selected 110 women of Bhubaneswar city who were responsible for preparing food at the home level and were assessed by using a structured questionnaire. From the study, the percentages of the right knowledge regarding causes of food poisoning ranged from 21.8% in leaving cooked food at room temperature, 85% in inadequate cooking and poor

handling and 61.8% in using the same cutting boards for raw and cooked food. Also, as a possible cause of food poisoning, 40.9% of respondents said that inadequate reheating of cooked food by homemakers was a possible cause.

In Italy, Langiano *et al.,* (2012) conducted a study titled food safety at home: knowledge and practices of consumers. Results of the study showed that there was an insufficient amount of knowledge regarding foodborne diseases and pathogens. In most households, there was a lack of correct adherence to food hygiene, mainly due to errors during food preparation and storage.

Food safety courses are administered worldwide as a means to inform food handlers and food service workers on matters of food safety. Furthermore, data suggest that the food service industries are more likely to hire workers trained in food safety (Hine, 2003). The expectation in providing these courses is ultimately to reduce the incidence of foodborne illness (Kassa, 2010). For instance, Hammond (2005) found that critical food violations actually increased after training. Furthermore, Ehiri (1997) suggest that there are no significant improvements after training on a number of critical concepts in food safety such as, food storage, cross-contamination, temperature control, and high risk foods. The authors further identify problems in training regimes that tend to rely merely on dissemination of information with no practical reinforcement. Powell, (1997) determined that there was no relationship between the level of knowledge of staff and hygiene standards in restaurants. Cates (2009), however, suggest that the presence of a certified kitchen manager is protective for the majority of critical food violations and therefore employing and properly training such a manager is essential to ensuring a safe food product. Kneller and Bierma (1990); Cook and Casey (1979); and Mathias *et al*., (1995) found that health inspection scores increased after food safety training, thereby

implying the knowledge imparted from food safety training is sufficient in achieving higher inspection scores.

In Ghana, Mensah, Yeboah-Manu, Owusu-Darko and Ablordey (2002), carried out a study entitled, Street food in Accra, Ghana how safe are they? The study investigated the microbial quality of food sold on street of Accra and factors predisposing food to contamination. They found out the 177 street vendors 79 (66.7%) were educated and these vendors exhibited good hygiene behaviour. The surroundings of the vending sites were clean but some sites (3.4%) were classified as very dirty. The cooking of food well in advance of consumption, exposure of food to flies and preparing food on the ground were likely risk factors for contamination.

Knowledge regarding some of the key principles in preventing foodborne outbreaks, such as use of thermometers to verify safe internal food temperatures, is often overlooked and could potentially result in illness. For instance, Green (2005) in her study of assessing food safety practices indicates that half of their respondents did not use a thermometer to properly ensure safe internal food temperatures. As such, this imposes a critical concern regarding food safety. Askarian (2004) assessed knowledge, attitudes, and practices of food service staff on food hygiene in government and private hospitals. The study illustrated that staff comprehension, regarding pathogens that cause disease and the correct temperature for the storage of hot and cold foods, was limited. They further suggest that additional food safety courses and manuals be easily available for staff, however, the validity of such a comment has not been successfully proven (Askarian, 2004). A similar study assessing food hygiene knowledge, attitudes, and practices in food businesses in Turkey revealed an immediate need for education and increasing awareness among food handlers on food safety practices (Bas, 2006).

Many studies have been conducted assessing consumers' knowledge, awareness and attitudes on issues regarding food safety and hygiene. Unlike questions on routine practices on food handling and hygiene, assessing knowledge is relatively uncomplicated (Redmond & Griffith, 2003). The result from a survey on food safety knowledge is likely to precisely represent the respondents' knowledge on the issues in question (Redmond & Griffith, 2003). In general, these studies show that some groups of consumers stand out as having poor knowledge about food safety and hygiene, but they have also revealed that there is a significant gap between knowledge and actual practice among the majority of consumers (Brennan, McCarthy & Ritson, 2007; Byrd-Bredbenner *et al*., 2007; Cates, *et al*., 2006; Dharod *et al*., 2007; Fischer *et al*., 2005).

In a study of consumer food safety knowledge in Ireland (n=1,020), the most important sources of food safety knowledge and safe food handling were ranked by the respondents as parents or grandparents (52%), school (28%), own experience (26%) and television (21%) (Kennedy *et al.*, 2005).

As it seems that cooking and food safety is more or less on its way out of the schools' curriculum, more and more people are probably relying on what they learn through television shows, which unfortunately is not sufficient to learn all the steps on how to prevent foodborne illness (Griffith, Mathias and Price, 1994; Irlbeck, 2009; Mathiasen, et al., 2004). A Canadian study evaluated 116 30-minutes television cooking shows from 2002 and 2003 and found 13 unsafe food handling practices for every one safe food handling practice (Mathiasen, et al., 2004). A similar study was conducted in the United States in 2007 by Irlbeck et al. In their sample of 49 30-minutes episodes of 5 popular television cooking shows, they found a total of 460 poor versus 118 positive food handling practices (Irlbeck, 2009). Both studies discuss the

fact that not every food safety handling can be performed or discussed during the show because of time restraint, but that such television shows could and should show safe and correct food handling more often than they do.

Little information exists on the food safety knowledge of Norwegian consumers, or where Norwegian consumers learn about safe handling of food. In the Norwegian primary and lower secondary school the aims concerning food safety are that the pupils shall be able to prepare safe food, practice rules for good hygiene and discuss what food safety and safe food mean (Norwegian Directorate for Education and Training, 2006). The terms "healthy eating", "healthy diet", "nutritionally good food", "relation between eating, health and lifestyle" and "how eating habits might influence diseases that are connected to lifestyle and eating" are much more emphasized in the Norwegian curriculum (Norwegian Directorate for Education and Training, 2006).

The WHO states that integrating food safety into school curricula is the key to prevent foodborne illness today and in the future (WHO, 2009). There is therefore a need to update and revise the schools' curriculum and the information and advices to the public in general when it comes to food safety and food hygiene.

2.4 Food Safety Practices in the Home Kitchen

Research findings (Bryan 1988; Scott *et al.*, 1982, Scott, 1996) indicate that a significant proportion of foodborne illness arises from practices in the home kitchen. In Europe, the home was one of the most frequent places of acquiring foodborne illness (WHO, 1992).

As stated by Green and Selman, (2005), the most common source of contamination is humans i.e. the source of food. In this regard, if a food handler is not clean, the food can become

contaminated (McSwane, Rue & Linton, 2003). Food handlers in the home may transmit pathogens to food with hands that are contaminated with organisms from their gastrointestinal tract. Thus, hand contact with ready to eat (RTE) food represents a potentially important mechanism by which pathogens may enter the food supply (Guzewich & Ross, 1999).

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

Chukuezi (2010) conducted a study on food safety and hygienic practices of food handlers in Owerri, Nigeria. Data collection was done with help of structured interviews, semi structured questionnaires as well as through observations. A descriptive survey design was used. Results shows that 23.81% of the food handlers prepared food in unhygienic conditions, 42.86% did not use aprons, 47.62% handled food with bare hands and 52.38% wore no hair coverings while 61-90% handled money while serving food. In all, 19.05% wore jewellery while serving foods and 28.57% blew air into polythene bag before use. Some (9.52%) of the vendors, stored food for serving openly in the stalls while 23.81% stored then in the wheel barrows. A good number (42.86%) of food vendors had left over‘s for serving the next day with poor storage facilities. In all, 47.62% of the vendors washed their utensils with dirty water which is recycled and used severally in 28.57% despite the fact that only 9.52% of them complained of water shortages. The researcher recommends that there is need for health education of those vendors in order to ensure food safety for the consumers.

The role of hands in transmission of disease has been established (Emery, 1990). From the study, it was found that 88.1% of consumers washed their hands thoroughly with soap and water before and after preparing meals, however 10.7% of consumers did so 'sometimes.' Most consumers (92.9%) reported of washing their hands after using the restroom and 84.5% consumers after handling raw foods, garbage, dirty dishes etc. Study results show that perceptions of what constitute safe hand-washing practices may be honest but inaccurate (Redmond et al., 2001). In a National Australian food safety telephone survey, most people (82.3 %) washed their hands with soap or detergents and 81.6 % felt it was very important to wash hands before and after preparing meals (Jay *et al*., 1999). In a video-survey of Australian domestic food handling practices, notably almost one-half (47%) of the persons observed did not wash their hands after handling raw meals, or when they did wash, they washed without soap (44%). Also hand washing was not performed for a long time period as was claimed by 22% of the household and 19% of households that claimed to have soap available in the kitchen did not have it available (Jay *et al*., 1999). Poor hand washing practices inevitably lead to retention on the hands of bacterial and viral pathogens, which are obtained from handling raw produce or from toilet activities (Ansari *et al*., 1989; Snelling *et al.*, 1991). These pathogens may then be transferred to prepared ready-to-eat foods directly to the mouth or to other household members. According to the Educational Foundation of the National Restaurant Association (NRA, 1995), and HACCP (2002), proper hand washing procedures include not only water, but the use of water as hot as the hands can comfortably stand, moisten hands, soap thoroughly, and latter to elbow, scrub thoroughly, use brush for nails, rub hands together, using friction for 20 seconds, rinse thoroughly under running water, and dry hands, using single service towels or hot air dryer.

Contaminated or uncooked raw foods can cause harmful microorganisms to be passed to safe foods and cause a foodborne illness (National Assessment Institute, 1998). From the survey most consumers (66.7%) stored cooked, ready to eat foods away from raw food always, while a disturbing 16.7% of consumers 'never' did. When asked why was it necessary to separate raw food from ready to eat or cooked foods, the following responses were given: to prevent cross contamination (31.0%), 'the food was 'not cooked' and 'could not have been eaten raw ' (3.6 %), ready to eat or cooked foods cannot be stored long (2.4 %) and the rest (1.2%) reported 'it was unhealthy, against public health training, to avoid mixing of odors of foods, not a necessary practice' and was easy. Some consumers (49.8 %) provided no answers to the related Unprompted, 49% of respondents in an Australian survey knew the meaning of the term 'cross-contamination' (Jay *et al.*, 1999). It has been suggested that up to 36% of United Kingdom consumers and up to 22% of United states consumers did not recognize the importance of using separate or adequately cleaned utensils for the preparation of ready-to-eat foods (Redmond and Griffith, 2003) after the utensils have been used in the preparation of raw meat and poultry. This practice could result in the potential transfer of harmful substances or disease - causing microorganisms from one food or food ingredient to another (NRA, 2001). Raw products should be kept in separate areas from cooked, ready to eat products to prevent contamination. The same utensils for raw and cooked products should never be used.

2.5 Food Borne Illnesses

Micro-organisms can cause a variety of effects in food products including spoilage, which primarily affects product quality, and food poisoning, which is generally caused by pathogens. A food borne illness (or disease) is a disease or illness caused by the consumption of contaminated foods or beverages (Bas *et al.*, 2004). More than 200 diseases are transmitted

through food (WHO, 2009). A foodborne disease can span from mild, self-limiting diarrhoea of short duration to severe chronic sequelae and even fatal outcomes.

The term 'food poisoning' can be divided into foodborne intoxication and foodborne infection. Food borne intoxications are caused by ingestion of food contaminated with toxins (Kotsonis, Burdock & Flamm, 2001). In this study, the term food borne intoxication will cover only the bacterial toxins such as *staphylococcal enterotoxins* (SEs) (Hennekinne *et al.*, 2012) and *Bacillus* spp. toxin (Arnesen *et al.*, 2009). A foodborne infection is caused by consumption of ineffective pathogenic microorganisms.

Most of these diseases are infections caused by a variety of bacteria, viruses and parasites. Other diseases are poisonings, caused by harmful toxins or chemicals that have contaminated the food, for example, poisonous mushrooms or lead/metal contamination (Thomas & Karl, 2008).

The foodborne pathogenic bacteria can be divided into five different groups based on the pathogenicity of the bacteria and their toxins (Table 2.1) (Granum, 2006). Group 1 consists of the bacteria that cause foodborne intoxications by producing toxins, enterotoxins or neurotoxins, in the food. Examples of such bacteria are *Staphylococcus aureus* and *Bacillus cereus* (emetic type). Also included in this group is *Clostridium botulinum*, which can produce the neurotoxin botulinum, the most toxic protein known (Montecucco & Molgo, 2005). One should be aware that intoxication can occur although the toxin producing bacteria are not present in the food at the time of consumption. Heat-stable toxins may persist even if the causative bacteria have been killed due to heat treatment (Arnesen *et al.*, 2009; Hennekime *et al*., 2012).

Group 2 contains bacteria which produce enterotoxins in the intestines without adhering to the epithel, such as *B. cereus* (diarrhoeal type) and *Clostridium perfringens*. Group 3 encompasses bacteria that adhere to the gut epithelial cells before producing enterotoxins, and examples are such as *Aeromonas* spp., enterotoxic *Escherichia coli* (ETEC), *shigatoxigenic E. coli* (STEC), *Vibrio cholerae* and *V. parahaemolyticus*. Diarrhoea and abdominal pain are the main symptoms of infections by species belonging to groups 2 and 3, which are almost solely caused by the toxins produced in the gut. Emesis and nausea can also occur, and sometimes low-grade fever. STEC infections often cause bloody diarrhoea, and can lead to sequelae such as haemolytic uremic syndrome (HUS) and thrombotic thrombocytopenic purpura (TTP) (Smith & Fratamico, 2012).

Invasive bacteria such as *Campylobacter jejuni coli*, the non-typhoid *Salmonella* spp., *Shigella* spp. and *Yersinia enterocolitica*, belong to Group 4, while Group 5 contains the bacteria that cause systemic infections, such as *Listeria monocytogenes*, *Salmonella typhi* and *Salmonella paratyphi*. The species in these last two groups usually cause the most severe diseases, and elevated fever is one of the main symptoms. Other symptoms in Group 4 infections are diarrhoea (*Campylobacter* spp. and *Shigella* spp. can cause bloody diarrhoea) and abdominal pain, together with varying degrees of emesis, nausea and headache (Granum, 2006). These infections can also give long-term sequelae such as reactive arthritis, Reiter's syndrome, Guillain-Barré syndrome, HUS and TTP, and immune-mediated conditions such as erythema nodosum, Chrohn's disease and ulcerative colitis (Smith & Fratamico, 2012). Of the systemic diseases caused by the species in Group 5, listeriosis is of particular importance in the developed world, and is described more in detail in the following section 'Bacterial food pathogens included in the studies'. The typhoid and paratyphoid *Salmonella* strains are more of concern in the developing countries, especially in Asia, and virtually all cases registered in

Norway have been acquired during visits in Pakistan and India (Norwegian Institute of Public Health, 2013). The typhoid fever and paratyphoid fever caused by these bacteria are therefore not further described.

Table 2.1 The most common foodborne pathogenic bacteria

Species	Ineffective dose	Incubation time	Symptoms*	Duration	Most common associated food source
INTOXICATIONS					
Group 1					
Staphylococcus aureus	toxin	1 – 6 h	N A V (D F)	8 – 24 h	Contamination from human or animal carriers
Bacillus cereus (emetic)	toxin	1 – 6 h	N V	6 – 24 h	Rice, pasta, pastry
Clostridium botulinum	toxin	12 – 72 h	Neurological	Days - months	Canned foods, fermented fish, honey
INFECTIONS					
Group 2					
Bacillus cereus (diarrhoeal)	$10^5 – 10^7$	6 – 12 h	A D	12 – 24 h	Sauces, vegetables, meat and dairy products
Clostridium perfringens	10^7 - 10^8	8 – 16 h	A D N (F)	16 – 24 h	Meat products and stews
Group 3					
Aeromonas spp	$10^6 – 10^8$	6 – 48 h	D A (F)	24 – 28 h	Water, fish and seafood, milk, poultry and meat
Escherichia coli – ETEC	$10^5 – 10^8$	16 – 48 h	D (A V F)	1 – 3 days	Various food sources and infected food handlers
Escherichia coli – STEC	1 – 10	1 – 7 days	D A B (H)	days – weeks	Hamburgers, raw vegetables, milk, juice
Vibrio cholera	10^8	2 – 5 days	D A (V)	4 – 6 days	Water and seafood
Vibrio parahemolyticus	10^5 - 10^7	3 – 76 days	D A (N V F)	3 – 7 days	Water and seafood
Group 4					
Campylobacter spp.	$\geq 10^3$	3 – 8 days	F A D B	Weeks	Poultry, water, unpasteurised milk
Salmonella spp. (non-typhoid)	$10^3 – 10^6$	6 – 72 h	D A F (V H)	2 – 7 days	Poultry and eggs, meat, vegetables, spices
Shigella spp.	$10^2 – 10^5$	1 – 7 days	A F D B (H N V)	Days – weeks	Contamination from human carriers, raw vegetables
Yersinia enterocolitica	$10^6 – 10^7$	3 – 5 days	F D A (V H)	Weeks	Pork
Group 5					
Listeria monocytogenes	$10^7 – 10^8$	Days	Systematic	Weeks	Diary, fish, vegetables, meat and RTE food products
Salmonella typhi	$1 – 10^2$	10 – 21 days	Systematic	Weeks	Contamination from human carriers
Salmonella paratyphi	$1 – 10^2$	10 – 21 days	Systematic	Weeks	Contamination from human carriers

*Symptoms in the order they usually appear. Abbreviations: A-Abdominal pain, B-Bloody diarrhoea, F-Fever, H-Headache, N-Nausea, V-Vomiting

Source: Adapted from Granum, (2006) and Lund, Baird-Parker and Gould (2000)

2.5.1 Food outbreaks due to *Listeria monocytogenes*

L. monocytogenes is a Gram-positive, catalase positive, non-spore forming food-borne bacterial pathogen responsible for a highly fatal disease called listeriosis. It is reported to cause an estimated 2,500 illnesses and 500 deaths annually in the United States of America alone (CDC, 2009), and is also considered the leading cause of death among food-borne bacterial pathogens, recording very high fatality:case ratios (Montville and Matthews, 2005; Jay, 2003). The organism is widely distributed in the environment (ubiquitous), has long survival periods in foods, grows under very low temperatures (-1.5^{0}C), tolerates high salinity (up to 10 – 12% NaCl), low pH (minimum 4.4), and low water activity (minimum 0.83) (Farber and Peterkin, 1991; Garbutt, 1997; Sutherland and Porritt, 1997; Jay 2003; Montville and Matthews, 2005). As a result of these unique properties, it has the potential to easily contaminate food and, when it does, to survive traditional methods employed to prevent microbial growth in foods, such as reduction in water activity, storage under cold temperatures, salting and acidification (Montville and Matthews, 2005).

When ingested, *L. monocytogenes* has the unique ability to enter and grow in human phagocytes, thereby bypassing the inherent defensive mechanisms of the circulatory system (Montville and Matthews, 2005). Another special feature of this pathogen is that it has an uncommonly long incubation period (the time between ingestion of the pathogen and the appearance of the first symptom of disease), reported to be typically between 1 – 70 days (Garbutt, 1997).

Listeriosis, the disease the organism causes, comes with adverse health conditions such as meningitis, encephalitis, corneal ulcer, pneumonia, and septicaemia (Jay, 2003). In pregnant women, intrauterine or cervical infections could occur and subsequently lead to spontaneous

abortion, pre-mature birth, still birth or prenatal sepsis that could cause neonatal meningitis or death of newborns within a week. It is estimated that generally, 20 – 30% of listeriosis victims die (Montville and Matthews, 2005).

There has been an increasing global concern about *L. monocytogenes* and its influence on food safety. Several outbreaks of listeriosis have been reported in different parts of the world, with high fatalities. In 1998, a listeriosis occurrence in Finland resulted in 25 illnesses, of which only one person survived. The implicated food was butter. In France, 31 out of 32 infected persons died when an outbreak occurred in the year 2000 through consumption of pork contaminated with the pathogen. Similarly, when a listeriosis outbreak occurred in Canada in 2009 through red meat consumption, close to 50% of the infected persons (20 out of 53 cases) died (CDC, 2009). In September 2011, a listeriosis outbreak claimed 16 lives in 18 states in the USA (CDC, 2011). Cantaloupes from an eastern Colorado farm were implicated. These statistics clearly illustrate the food safety significance of *L. monocytogenes*. They also show that outbreaks of listeriosis, although sporadic, record very high fatalities (Table 2.2).

Table 2.2 Annual outbreaks of food-borne illnesses from selected pathogens

Pathogen	**Cases**	**Illnesses**	**Deaths**	**% Deaths**
Campylobacter spp.	1,963,141	10,539	99	0.95
Mackerelella non-typhoidal	1,341,873	15,608	553	3.54
E. coli O157:H7	62,458	1,843	52	2.82
E. coli non-O157-STEC	31,229	921	26	2.82
L. monocytogenes	**2,493**	**2,298**	**499**	**21.71**

Source: (CDC, 2009). Data true for USA

The *listeria monocytogenes* pathogen is largely associated with foods such as ready-to-eat (RTE) meat product, milk and milk products, coleslaw and fish (particularly vacuum packed and cold-smoked fish) (Jay 2003; Adam and Moss, 2008).

2.5.2 Sources of food contamination and food-borne illnesses

Simple measures such as washing and peeling the food may reduce the risk of contamination with microorganisms from raw food. Also, proper cooking kills almost all dangerous microorganism, thus, studies have shown that cooking food to a temperature of 70^0C can help ensure it is safe for consumption (WHO, 2006).

Microorganisms can multiply very quickly if food is stored at room temperature. By holding at temperature below 5^0C or above 60^0C, the growth of microorganisms is slowed down or stopped but some dangerous microorganism will still grow below 5^0C (WHO, 2010). Depending on the nature of the food operations undertaken, adequate facilities should be available for heating, cooling, cooking refrigerating and freezing food , for storing refrigerated or frozen foods, monitoring food temperatures, and when necessary, controlling ambient temperatures to ensure the safety and suitability of food (FAO, 1999).

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

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

6. Cooking food thoroughly; make sure that the temperature has reached 70^0C.
7. Reheating cooked food thoroughly.
8. Avoid leaving cooked food at room temperatures for more than 2 hours.
9. Refrigerating promptly all cooked and perishable food (preferably below 5°C)

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

A study in Santa Fe de Bogota, Colombia showed that over 30% of a group of food handlers examined were carriers of pathogenic microorganism including *Salmonella typhi*, *Staphylococcus aureus*, *Salmonella enteritidis*, and *Shigella* (Buchanan and Whiting, 1998).

An important issue influencing food contamination and contributing to further increase in contamination is food storage temperature. The preparation of food long before its consumption, storage at ambient temperature, inadequate cooling and reheating, contaminated processed food, and undercooking are identified as the key factors that contribute to food poisoning outbreaks. Holding foods at high ambient temperatures for long periods of time have been reported to be a major contributor to the occurrence of food poisoning outbreaks (Rane, 2011). Foods are often held for several hours after cooking and this includes overnight holding at ambient temperatures, until sold, and thus can harbor high microbial populations. Besides,

some of the foods are held in the pans in which they are cooked, until sold or reheated, which results in longer holding time, hence creating favorable conditions for the growth of food borne pathogens.

In foods which are held under high ambient temperature, the counts of *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus* and *Clostridium perfringens* are reported to be high(Rane, 2011). *B. cereus* was isolated from 42 (26.3%) samples of fried fish, tuwo, soup, boiled rice and moin moin suggesting that their spores survived the cooking process. The presence of this bacterium coupled with the storage of these foods at ambient temperatures (room temperature) for several hours under high temperature and high relative humidity showed that the product could be hazardous (Rane, 2011). B. cereus has been responsible for outbreaks of foodborne illness because it produces heat stable (emetic) and heat sensitive (diarrheal) toxins when foods are held under conducive conditions for several hours (Rane, 2011).

Kaul and Agarwal (1988), reported high microbial count in fruit chat sold by a street vendor in Chandigarh, India where the counts ranged between 106 and 108 cfu/g, and a further increase in count by 1–3 log cycles was observed after 16 and 24 hours of storage at room temperature. A number of pathogens, such as *Esherichia coli*, *Salmonella typhimurium*, *Salmonella gallinarum*, *Shigella dysentriae*, *Pseudomonas fluorescens* and *Klebsiella pneumoniae* were also found to be present in these samples.

Mensah *et al.*, (2002) conducted a study on the safety of street foods in Accra to purposely investigate the microbial quality of foods sold on streets of Accra and factors predisposing to their contamination. Structured questionnaires were used to collect data from 117 street

vendors on their vital statistics, personal hygiene, food hygiene and knowledge of foodborne illness. Findings from the study indicate that most vendors were educated and exhibited good hygiene behaviour. Diarrheal was defined as the passage of 53 stools per day) by 110 vendors (94.0%), but none associated diarrhea with bloody stools; only 21 (17.9%) associated diarrhea with germs. The surroundings of the vending sites were clean, but four sites (3.4%) were classified as very dirty. The cooking of food well in advance of consumption, exposure of food to flies, and working with food at ground level and by hand were likely risk factors for contamination. This study by Mensah *et al.,* is similar to this study since the same parameters will be assessed to find out the similarities and differences in factors that affect microbial quality of street foods.

In the same study, examinations were made of 511 menu items, classified as breakfast/snack foods, main dishes, soups and sauces, and cold dishes. *Mesophilic* bacteria were detected in 356 foods (69.7%): 28 contained *Bacillus cereus* (5.5%), 163 contained *Staphylococcus aureus* (31.9%) and 172 contained En*terobacteriaceae* (33.7%). The microbial quality of most of the foods was within the acceptable limits but samples of salads, macaroni, fufu, rice balls and red pepper had unacceptable levels of contamination. *Shigella sonnei* and entero aggregative *Escherichia coli* were isolated from macaroni, rice, and tomato stew, and *Salmonella arizonae* from light soup.

In conclusion street foods can be sources of enteropathogens and vendors should therefore receive education in food hygiene. Special attention should be given to the causes of diarrheal, the transmission of diarrheal pathogens, the handling of equipment and cooked food, hand-washing practices and environmental hygiene. The microbiological quality of macaroni and vegetable salads served with waakye, was investigated. Aerobic mesophiles counts (AMC),

coliforms counts (CC) and moulds and yeasts counts (MYC) were estimated, and the coliform profiles for different samples of macaroni (raw, local/ imported, laboratory-cooked) served with *waakye*, and vegetable salads served with *waakye* were determined. Raw macaroni (local and imported) had AMC of 3.6 and 3.0 log10 CFU/g, MYC of 1.9 and 1.0 log10 CFU/g and no CC, respectively. Laboratory cooked local samples had AMC of 2.4 log10 CFU/g and 3.3 log10 CFU/g (after 4 h storage) and no MYC. Macaroni obtained from vendors had AMC mean of3.1-8.4, CC mean of 2.5-7.3 and MYC mean of 0- 4.1 log10 CFU/g depending on time of sampling. Vegetable salads sampled at early and late morning had AMC of 6.9 and 7.6, CC of 5.7 and 6.4, MYC of 4.9 and 5.4 log10 CFU/g, respectively. Six coliforms were detected on macaroni and three were detected in addition to *Salmonella* spp. on vegetable salads. No significant difference was recorded in the microbial load of raw local and imported macaroni.

Cooking improved the microbial quality of raw macaroni (AMC of 2.4 log10 CFU/g). Generally, there were increases of 3-5 log cycles in the AMC, CC and MYC in macaroni sampled from waakye vendors in the morning (early and late) compared to those at dawn. Although the nature of raw macaroni and its cooking are adequate, *c*ross-contamination from vegetable salads during the holding and bulk display periods cause deterioration in microbial quality of macaroni in *waakye*.

2.6 The Home Kitchen as a Source of Food Contamination

Unlike commercial enterprises, home kitchens are multipurpose areas and are much more than just food preparation and storage places (Redmond & Griffith, 2009; Byrd-Bredbenner *et al.*, 2008). For instance, researchers have observed women's purses that once sat on public ladies' restroom floors were sitting on kitchen counters (Byrd-Bredbenner *et al.*, 2008). Pets, old newspapers, dirty laundry, house plants, and soil all are common in home kitchens - one

research team even reported observing a home kitchen where automotive repairs were occurring (Redmond & Griffith, 2009; Byrd-Bredbenner *et al.,* 2008). Kitchen sinks are used for hand washing, produce washing, dishwashing, soaking clothing, washing children and pets, and wetting mops. Dirty dishes may be stacked alongside clean dishes on kitchen counters. Raw unwashed vegetables, dripping raw meat, as well as cooked ready-to-eat foods are common in home refrigerators. The multiple uses of home kitchens provide risky potential to introduce an array of pathogens that can spread to foods, proliferate, and result in illness. Some of the pathogens that have been confirmed in home kitchens include *Salmonella,* pathogenic *Escherichia coli*, *S. aureus*, and *Campylobacter* (Josephson, Rubino & Pepper, 1997; Rusin, Orosz-Coughlin & Gerba, 1998). At least two studies have reported that the kitchen is more heavily contaminated with fecal coliforms than bathrooms (Rusin, Orosz-Coughlin & Gerba, 1998; Ojima *et al.,* 2002).

Even though food handlers—including home food handlers—are the last line of defense in the food safety chain, most have not had a food safety course recently or at all (Byrd-Bredbenner *et al.,* 2008; Koeppl, 1998). Opportunities for children to learn safe food handling in schools have declined as family and consumer science courses have become less common (Koeppl, 1998; Beard, 1991). As a result, many teens and adults have limited food preparation experience, have not learned food safety strategies, and lack the basic knowledge needed to keep themselves and their families safe from foodborne illness (Byrd-Bredbenner *et al.,* 2008; Beard, 1991; Koeppl, 1998).

The goal of "kitchen hygiene" is to prevent cross contamination - or the transfer of disease causing microorganisms from one food, object, or surface to another food - by washing hands, food contact surfaces, and kitchen equipment (WHO, 2012). Hands are a major "vehicle" for

spreading pathogens around the kitchen (Fischer *et al.*, 2007; Kennedy *et al.*, 2011) - thus hand washing is critical to preventing cross contamination (Van-Asselt *et al.*, 2009).

Almost all consumers report washing their hands with soap for a full 20 seconds before preparing food all or most of the time (Kennedy *et al.*, 2011; Quick, Corda & Byrd-Bredbenner, 2013). Most consumers also report they often or always wash their hands after handling raw meat (Food Marketing Institute, 2011; De Jong *et al.*, 2008). Despite consumers' awareness of the importance of hand washing, they are not washing their hands thoroughly. For example, after handling raw chicken, 73 to 100% of hands of consumers who reported washing their hands after touching the meat in a research study) were contaminated with *Campylobacter jejuni* (De Jong *et al.*, 2008). None of the consumers sufficiently washed their hands to prevent *C. jejuni* transfer to salads after handling the raw chicken (De Jong et al., 2008).

Little is known about how *often* during meal preparation consumers wash their hands. Given how often the most heavily contaminated areas in the kitchen (*i.e.*, refrigerator handles, tea kettle handles, tap handles, sink drain areas, dishcloths, and sponges (Redmond & Griffith, 2008; Griffith, 2000) are touched during meal preparation, it is likely that hands are not washed frequently enough to prevent the transfer of pathogens to ready-to-eat food, food packaging, or equipment and contact surfaces used to prepare food (Redmond & Griffith, 2009). Table 2.3 shows pathogens that have been identified on frequently touched areas of the home kitchen (Redmond & Griffith, 2008; Griffith, 2000).

Table 2.3 Common microbes in the kitchen and where they are found

Site	*Campylobacter*	*Salmonella*	*S. aureus*	*E. coli*	*L. monocytogenes*
Dishcloth, sponge, towel	✓	✓	✓	✓	✓
Sink, tap handles		✓	✓	✓	✓
Refrigerator handle	✓		✓	✓	✓
Trash	✓		✓	✓	
Cutting board	✓		✓	✓	
Work surface	✓		✓	✓	
Floor	✓			✓	

Source: adapted from Redmond *et al.*, (2003) and Griffith (2000)

Dishcloths and sponges quickly become heavily contaminated with a diverse array of microbes, harboring and spreading contamination to hands, kitchen equipment, and contact surfaces (Hilton & Austin, 2000; Enriquez, *et al.*, 1997). High numbers of *E. coli* survive in dishcloths for at least 48 h (79). Consumers have room for improvement when using sponges and sanitizing dishcloths - of the 92% of consumers who use them, just 9% report changing dishcloths or sponges daily, 44% change them at least weekly, the remainder change them less often, with 5% waiting until they tear apart (American Dietetic Association, 2011).

Kitchen utensils and cutting boards also are key cross contamination routes (De Jong *et al.*, 2008). In fact, research in the U.K. suggests that 14% of all foodborne illnesses may be due to inadequately cleaned cutting boards and knives (Kennedy *et al.*, 2005). Although nearly all consumers report they wash these items after using them with raw meat or produce, observational data indicate that the vast majority of consumers do not clean cutting boards and utensils sufficiently to prevent cross contamination (Scott & Herbold, 2010).

Cleaning of food products prior to consumption and preparation is another important component of “Kitchen hygiene”. A recent study recommended that consumers use a 3% hydrogen peroxide solution (which is readily available at pharmacies) to wash cantaloupes prior to cutting (Ukuku *et al.*, 2012). A misperception remains that washing raw poultry

removes “germs” (Henley, Stein & Quinlan, 2012), hence providing clear and accurate information regarding which food products require washing (and how to properly do so) before preparation is needed.

2.7 Improving Food Safety Practices in the Home

Since the home kitchen, and home handling of food is considered as the last line of defence in the fight against food borne outbreaks, there is the need for concerted efforts in the strengthening of food safety, knowledge and practices among homemakers. Since the transmission of pathogens from food handlers to food is a significant contributor to food borne outbreaks, improvement of food handlers’ hygiene and safety practices is critical (Green *et al.*, 2006). Several studies have been conducted which have come out with a number of recommendations aimed at improving food safety knowledge and practices and reduce the cases of food borne outbreaks (Tjoa *et al.*, 1997).

2.7.1 Washing of hands

The FDA Food Code (2009) states that food employees should immediately wash their hands before engaging in food preparation and working with ready-to-eat food, clean equipment, and clean utensils. Food employees should wash hands after touching bare human body parts other than clean hands and clean, exposed portions of arms, after using the restroom, after caring for or handling service animals or aquatic animals, after coughing, sneezing, using a handkerchief or disposable tissue, using tobacco, eating or drinking, after handling soiled equipment or utensils, during food preparation when removing soil and contamination to prevent cross contamination when changing tasks, when switching between working with raw food and working with ready-to-eat food.

Washing hands prior to handling food is crucial in preventing foodborne illness from pathogens such as Norovirus and Salmonella. Norovirus can be transmitted from touching ready-to-eat food with hands contaminated with the pathogen. The Center for Disease Control and Prevention (2010) recommended washing hands before, during and after food preparation to prevent the spread of Norovirus. Food experts also recommended washing hands after touching a pet and before preparing food to prevent Salmonellosis (CDC, 2009). A study reported that only 66 percent washed their hands after handling raw meat or poultry, although 86 percent knew that hand-washing can lower the risk of foodborne illness (Altekruse, 1995). Another study indicated that 40 percent of the foodborne illness outbreaks in fresh produce were caused by poor personal hygiene and improper contact with sewerage (DeWaal, 2006).

The way that food is handled after it is contaminated can also make a difference in whether or not an outbreak occurs. Many bacterial microbes need to multiply to a larger number before enough are present in food to cause disease. Given warm, moist conditions and an ample supply of nutrients, one bacterium that reproduces by dividing itself every half hour can produce 17 million progeny in 12 hours. As a result, lightly contaminated food left out overnight can be highly infectious by the next day. If the food were refrigerated promptly, the bacteria would not multiply at all. In general, refrigeration or freezing prevents virtually all bacteria from growing but basically maintains them in a state of suspended animation. The two exceptions to this rule are the food-borne bacteria *Listeria Monocytogenes* and *Yersinia enterocolitica*, which can actually grow at refrigerator temperatures. High salt, high sugar, or high acid levels keep bacteria from growing, which is why salted meats, jam, and pickled vegetables are traditional preserved foods (CDC, 2005).

According to the National Restaurant Association Educational Foundation (2004), to ensure proper hand washing you must wet your hands under running water of at least 100ºF, apply soap, vigorously scrub hands and arms for at least 20 seconds, clean under fingernails and between fingers, rinse thoroughly under running water of at least 100ºF, then dry hands and arms with single-use paper towels.

Food handlers should wash their hands frequently and in the proper manner. Shockingly, research has shown that as many as 60% of food handlers do not wash their hands properly or often enough (Roberts, 2008). In a study that conducted research on catering food safety, hand hygiene malpractice occurred more frequently than malpractice for cleaning surfaces and equipment as well as malpractice of washing utensils (Clayton & Griffith, 2004).

Clayton & Griffith's (2004) study also found that: Hand washing was poorly carried out after food handlers touched their face/hair and on entering the kitchen. These actions were performed adequately only on 9% of occasions where food handlers touched their face/hair and 14% of required occasions where food handlers entered the kitchen.

2.7.2 Cooking to the right temperature/ Reheating

Inadequate cooking is a common cause of foodborne illness (Bruhn *et al.*, 1999). Food handlers are recommended to avoid eating raw or uncooked eggs to prevent illnesses from *Salmonella enteridities* (Hillers, 2003). Undercooked meat could contain harmful bacteria, such as *Salmonella spp.*, *Campylobacter jejuni* and *E.coli O157:H7* which contribute to foodborne illness outbreaks (Hillers *et al.*, 2003). DeWaal (2006) speculated that 43 percent of beef-associated outbreaks were caused by undercooked meat. One-fourth to three-fourth of all meat and poultry sold in 1999 was contaminated with at least one pathogen (Medeiros, 2004). Hence, it is important to cook food until the proper temperature to kill these pathogens. A study

reported that approximately 60 to 70 percent of food handlers cooked their hamburgers to the proper temperature (Altekruse, 1995).

Microbes are killed by heat. Heating food to an internal temperature above 160 degrees F, or 78C, for even a few seconds is sufficient to kill parasites, viruses, and bacteria. An exception to this, however, is the Clostridium bacteria, which produce a heat-resistant form called a spore. *Clostridium* spores are killed only at temperatures above boiling, which is why canned foods must be cooked to a high temperature under pressure as part of the canning process (CDC, 2005). The toxins produced by bacteria vary in heat sensitivity. The *staphylococcal* toxin, for example, which causes vomiting, is not affected by boiling. Conversely, boiling completely inactivates the potent toxin that causes botulism (CDC, 2005).

2.7.3 Separation of raw food from ready to eat food

Separating raw food from cooked food is vital to preventing cross-contamination. Separating raw products from ready-to-eat food is important to prevent cross-contamination from bacteria such as *Campylobacter*. Ways to separate food include separating fresh produce and raw meat into different grocery bags and wrapping meat in a container or bag to prevent dripping of raw meat's liquid residue on ready-to-eat foods.

Most cases of *campylobacteriosis* occurred from cross-contamination or ingestion of raw meat (CDC, 2009b). A small dosage of juice from raw meat is sufficient to cause illness from *Campylobacter* (CDC, 2009). Cleaning any surface or utensils after contact with raw meat or poultry is important to prevent foodborne illnesses outbreak from pathogens such as *Campylobacter jejuni* and *Salmonella* (Hillers, 2003). Researchers reported that only about two thirds of food handlers clean their cutting board after handling raw meat or poultry (Bruhn, 1999).

About three-quarters of consumers report keeping raw meat, poultry, and seafood separate from ready-to-eat food products and nine in ten use different plates for raw and cooked meat (American Dietetic Association, 2011). However, there is room for improvement especially considering that meat, poultry, and seafood are the leading causes of foodborne illness (CDC 2008, Painter *et al*., 2013).

2.7.4 Refrigerating

The refrigerator plays a critical role in the temperature control of food under storage. When using the refrigerator, it is important to also note that the refrigerator should be clean and raw food should not be mixed with cooked food.

Studies indicate that refrigerators in many households are not clean. One study from Ireland reported that more than half of the refrigerators swabbed had at least one of these pathogens: *S. aureus, Salmonella enterica, E. coli, Listeria monocytogenes* and *Yersinia enterocolitica* (Kennedy *et al*., 2005).

Mishandling of leftovers was identified as the most common cause of foodborne illness (Fein, 1993; Bruhn, 1999). Food left at room temperature for more than two hours can result in harmful bacteria, such as *Bacillus cereus* to grow in high enough numbers to cause foodborne illness (Hillers, 2003).

Many refrigerators are also not cool enough, with average temperatures exceeding the recommended 5 °C (40 °F). This problem has been noted in the U.S., U.K., Ireland, New Zealand, and Australia (Kennedy *et al*., 2005; Redmond & Griffith, 2009; Byrd-Bredbenner *et al.*, 2007). Compounding the cooling problem is that refrigerators often are packed so tightly with food that air circulation is restricted (Byrd-Bredbenner *et al.*, 2007). Tight packing also increases food-to-food cross-contamination risk (Byrd-Bredbenner *et al.*, 2007). Only one-quarter of consumers report regularly checking refrigerator temperatures, and another quarter

do not even have a refrigerator thermometer (Kennedy *et al.*, 2005). One positive note is that nearly 60% of those in the U.S. know the safe temperature for refrigerators to be less than 5 °C (40 °F) (CDC 2008)

Another aspect of refrigerating is keeping perishable foods out of danger zone temperatures. Most consumers (79%) reported leaving prepared perishable food at room temperature no longer than the recommended two hour timeframe and nearly two-thirds report thawing food in the refrigerator (CDC 2008). There also is a common misconception that cooked foods should be cooled to a room temperature before being placed in the refrigerator (Bruhn & Schultz, 1999).

2.8 Personal Hygiene of Food Handlers

Personal hygiene refers to the strict adherence of food handlers/homemakers to hygiene principles when handling food (WHO, 2007). Food hygiene is concerned with the hygiene practices that prevent food poisoning. Bas *et al.*, (2004) in their study pointed out that the lack of knowledge of microbiological food hazards, temperature ranges of refrigerators, cross contamination and personal hygiene cause food-borne illnesses. Food safety is dependent upon the significant roles played by food handlers along the food service system. Food handlers may introduce pathogenic microbes to the food during the process of preparation, distribution and serving (Green, 2007). This is through inoculation of the food with infected excreta, pus, exhalations and other body discharges. Hence in such instances food handlers are the source of contamination and eventual health consequences (Kaferstein, 2003). Research findings from the food industry suggest that hands may play the role of a vehicle in the transmission of enteric pathogens. Food handlers with poor personal hygiene (i.e. no hand washing) especially after visiting the restrooms pose the risk of carrying high loads of microbes such as E. coli and S. aureus on their hands (Shojoei, 2006).

Staphylococcus and *E. coli* pathogenic microbes have been linked with foodborne morbidity and even mortality in many world populations each year (Borch & Arinda, 2002). Workers may also carry the microbial pathogens on their skin, hair, digestive systems or respiratory tracts. These pathogens are associated with poor personal hygiene practices. Deficiency of knowledge among food handlers/consumers and negligence are contributing factors to unhygienic practices (WHO, 2002). However, other studies have shown that improved knowledge of food hygiene practices does not always result to the required transformation in food handling behavior (Howes, 1996). The findings of a research done at Kenyatta National Hospital in Kenya elucidate on a case study of food handlers who scored highly in a questionnaire on hygiene practices whereas each contaminated a sample of food he/she had handled (Githiri, 2009). Safe hygienic practice among food handlers in hospitals is an outcome of their intrinsic knowledge and attitudes on food safety. Experience from developed countries has depicted that prevention of foodborne nasocomial diseases may be successful with the combined strategies in enforcement of educational and regulatory measures. Educational measures facilitate on capacity building and therefore raise the knowledge base of the food handler; while regulatory measures may impact the workers' attitude (El Derea, 2008).

Food handlers should maintain a high level of personal cleanliness and wear suitable protective clothing, head gear and footwear. People involved in food handling should refrain from smoking, spitting, chewing and sneezing or coughing over unprotected food. Personal effects like jewellery, pins and other adornments should not be brought into food handing areas. A food handler implicated to be a carrier of a disease illness should neither be allowed to go into food handling areas or handle food. Food handlers should undergo full medical examinations and issued with a certificate before allowed handling food. Food hygiene training is basically significant to equip the handlers with the knowledge and skills to handle food safely. Regular

appraisals of the effectiveness of training and instruction activities should be made together with periodic supervision to enforce adherence to hygienic procedures (WHO, 2001).

The five key principles of food hygiene according to WHO are;

- Prevent contaminating food with pathogens spreading from people, pets and pests
- Separate raw food and cooked foods to prevent contaminating the cooked foods
- Cook foods for the appropriate length of time and at the appropriate temperature to kill pathogens
- Store food at the proper temperature
- Use safe water and raw materials in preparing meals

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents a discussion on the methods and methodology employed by the researcher in the conduct of the study. Methods in research refers to the range of approaches used to gather data which provides basis for analysis, inference and interpretation, explanation and prediction. On the other hand, methodology is also a description of the approaches and kinds of research paradigms used in a particular research (Kusi, 2012). This section therefore focuses primarily on the methodology used and the methods employed in collecting data for the study. It gives a description of how data was collected, discusses the research design, the population, sample and sampling procedure, data collection instruments and techniques, and the instruments used in the analysis of the data collected.

3.2 Research Design

The research design used in this study is the quantitative descriptive survey. A descriptive survey is a type of research that has its major objective as description of phenomena associated with a subject, population or to estimate proportions of population that have certain characteristics (Malhotra, 1996). Quantitative approach was used in gathering the necessary information for the study. The descriptive survey technique was used in this study because the researcher, per the nature of the study being conducted, judged it to be the most appropriate technique in order to achieve the study objectives. In this regards, the methods of data collection and data analysis were all done in line with principles laid down for quantitative descriptive surveys.

3.3 The Study Area

The study was conducted in the Tema NewTown community which is located in the Tema Metropolis. Tema is a city on the Bight of Benin and Atlantic coast of Ghana. It is located 25Kilometres (16miles) east of the capital city, Accra in the Greater Accra Region. Tema is the eleventh most populous settlement in Ghana with a population of approximately 161,612 people. It lies on the between latitude 5^0 40''N, 0^0 0''W. The Greenwich Meridian (Longitude 00^0) passes directly through the city.

The history of Tema Newtown is the history of Tema itself. Before independence, the government identified a small fishing village called Torman, as the site for an ultra-modern seaport for the new Ghana. Torman residents grew the calabash plant known as Torma in the local language hence the name of the village which was corrupted to TEMA. For the project to kick off, the residents were ejected to make way for the grand project. They quickly migrated to a new site about one and a half miles away which they later named NewTown. Tema Newtown which is a suburb of the larger Tema community was created as part of the plan developed by the Tema Development Corporation, for the modern development of the area as a whole. However, the quick influx of people attracted to the place with the promise of employment overwhelmed the planners which thwarted the plans of developing the area. Tema Newtown therefore became a shantytown with slums and no good housing, roads or social amenities (Andoh, 2008).

Due to this, environmental sanitation is one of the numerous problems facing the residents with no proper drainage systems and rubbish dumps. This exposes the residents to greater threats of outbreaks such as cholera, malaria, diarrhea, etc. The researcher therefore found it prudent to conduct the study in this area to find out the food safety practices and hygiene observed by

residents (homemakers) in this area and hopefully provide recommendations that will help increase the awareness of food safety and safety practices of residents of the community and the region at large.

3.4 The Population

The population for this study covers the entire adult population residing in the Tema Newtown Township. Of particular interest to this study are homemakers who are responsible for the handling and preparation of meals to the members of their households. The population is estimated to be about 140,000 according to the Ghana Statistical Service, Census 2010. This includes both males and females, educated and uneducated.

3.5 Sample and Sampling Technique

A sample is a subset of a population that is used to represent the entire group. It is often impractical to survey every member of a particular population because the sheer numbers of people spread across an area that is large poses accessibility problems (Agyedu, Donkor & Obeng, 2013). In all, 70 homemakers were sampled from the Tema Newtown Community using systematic random sampling. In order to make fair inference about characteristic of a population, the sampling technique adopted for the study was systematic random sampling. One of the best ways to achieve unbiased results in a study is through random sampling. Random sampling includes choosing subjects from a population through unpredictable means. This sampling procedure ensures that every possible element of the population has an equal chance of being selected for the study. In utilising the systematic random sampling, the researcher numbered all the households in the study area and wrote these numbers on a sheet of paper. The total number of households numbered about 700 from which a sampling interval of 10 was calculated. The researcher then randomly selected the first element from the list, and

subsequently added the sampling interval (K) which was 10, repeatedly to obtain the sample size of 70.

3.6 Data Collection Instruments

As a means of collecting reliable data for the study, the researcher used questionnaire as the data collection instrument. The researcher devised structured questionnaire to elicit information about the knowledge levels and food safety practices of homemakers. The questionnaire was structured based on the objectives of the study and utilized the Likert scale type items and multiple response options.

3.7 Data Collection Procedure

The study relied on primary data sources. The researcher collected the primary data using a structured questionnaire and semi-structured interview. The questionnaire made use of multiple response options and Likert scale items. The researcher visited the households sampled for the study and briefed the homemakers on the purpose of the study and its educational implications after permission was sought and granted. The respondents were approached and informed of the study and its purpose. The researcher chose to administer the questionnaires to the respondents herself since it had the lowest cost and it gave respondents the opportunity to ask questions for clarification. On the whole, the researcher spent about two weeks for the collection of the data. The data collection yielded a 100% response rate since all the respondents selected for the study responded to the questionnaires.

3.8 Validity and Reliability

Validity and reliability in research is the degree of stability exhibited when measurement is repeated under identical conditions (Burns & Grove 1997). Research validity refers to the

researcher's objectivity in actually measuring what was supposed to be measured and not something else. The researcher in an attempt to come up with a very good work presented a draft of the questionnaires to her course mates to critique the questions. The comments and suggestions were taken in good faith and subsequently made the necessary modifications. The questionnaire was based on the research objectives and information obtained from literature review. This was to ensure that it was from a representation of elements from the topic under discussion (Polit & Hunger, 1993). Finally, the questionnaire was presented to the researcher's supervisor to look through and make the necessary corrections and modifications appropriately. All these processes ensured that the questionnaires were both reliable and valid.

3.9 Data Analysis

The data collected was sorted and coded to ensure it was complete for analysis. The organized and coded data was then fed into the Statistical Package for Social Sciences (SPSS Software version 20) for analysis and interpretation. To answer the research questions simple frequencies, percentages and means were applied to analyse the data using descriptive statistics. This gave the researcher the opportunity to present detailed information on the collected data and described the results which is consistent with the focus of this study. The analysis and interpretation is presented under Chapter Four of this study.

3.10 Ethical Considerations

The study paid attention to the ethics of research. Before the study took off, the researcher wrote officially to the department to seek permission and a cover letter to start the study. The researcher also ensured that the information provided was used only for the purposes of the study. Again, in line with ethical principles in research, respondents' rights to self-determination, anonymity, confidentiality and informed consent were observed. The

respondents were informed of their rights to voluntarily participate or decline in the study. They were informed about the purpose of the study and were assured of not reporting any aspect of the information they provided in a way that will identify them. They were assured that there were no potential risks involved in the process. Finally, plagiarism has become a thorn in the flesh of researchers these days. To this end, the researcher made references to works that are not the original work of the researcher. Such works were acknowledged for easy reference and also to make the study more credible.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF RESULTS

4.1 Introduction

This study was conducted in Tema Newtown situated in the Greater Accra Region under the Tema Metropolis to investigate the food safety knowledge and practices of homemakers in the area. This section of the study presents the results emanating from the data collected from the field survey which also served as a basis for discussion. It deals with the presentation and analysis of data gathered from the field through questionnaire administration. The researcher used descriptive statistics such as frequencies, percentages and means for the analysis. The analyses were guided by the research objectives.

This chapter is made up of four parts. The first part contains the presentation and discussion of demographic characteristics of the respondents. The second deals with the knowledge level of Ghanaian homemakers living in Tema Newtown concerning food safety and hygiene. Part three of this chapter presents analysis and discussion of the various food safety practices that homemakers employ when handing and preparing food for domestic consumption. The final part provides measures that can be utilised to improve food safety knowledge and practices of homemakers thereby minimising the occurrence of food borne outbreaks.

4.2 Demography of Respondents

As a means of understanding the demographic dynamics of the respondents selected for the study, the researcher collected such information as gender, age, educational level, occupation, number of persons in household and marital status of respondents. This was done to further establish the suitability of the participants for the study and provide a basis for further discussion and inferences.

Table 4.1 Demographic data of homemakers

Variables	Frequency (*f*)	Percentage (%)
Gender		
Male	3	4.3
Female	67	95.7
Total	70	100.0
Age		
Below 25 years	2	2.9
26 – 30 years	5	7.1
31 – 39 years	43	61.4
40 – 49 years	12	17.1
50 – 59 years	8	11.4
60 years and above	-	-
Total	70	100.0
Educational Level		
No formal education	8	11.4
Basic school	45	64.3
Senior high school	13	18.6
Certificate/Diploma/HND	2	2.9
1st Degree	2	2.9
Post Graduate	0	0
Total	70	100.0
Occupation		
Student	0	0
Civil servant	6	8.6
Business/Trading	13	18.6
Housewife	13	18.6
Teacher	4	5.8
Farmer	7	10
Fishmonger	23	32.9
Pensioner	4	5.7
Total	70	100.0
Number of persons in household		
One	3	4.3
Two – five	41	58.6
Six and above	26	37.1
Total	70	100.0
Marital Status		
Single	15	21.4
Married/co-living	53	75.7
Separated	2	2.9
Widowed	0	0.0
Total	70	100.0

Source: Author's field survey, 2016

Table 4.1 depicts the demographic profile of the respondents who fall under different categories of groupings. From the data shown in the table, it is seen that the greater majority of homemakers in the study area were females which recorded a frequency representation of 67 out of the total 70. This in percentage terms was 95.7% whilst the remaining 4.3% with a frequency representation of 3 out of 70 were males. This goes to support the common view that women are the homemakers in every household. The 4.3% male homemakers recorded in the table is attributed to the fact that these males were single and living in a one-person household as such making them the de-facto homemakers.

The age information collected on respondents as shown in the table reveals that majority 43(61.4%) of homemakers were aged between 31 and 39 years whilst 12(17.1%) were between 40 – 49 years. It is also seen that the least age group recorded for homemakers was 25years and below which had 2(2.9%) respondents. This information clearly shows that, the respondent homemakers in this study were matured as majority of them were either in their thirties or above thirty.

A look at the educational level of respondents presented in the table shows that the majority of homemakers are basic school leavers. This is because 45 respondents representing 64.3% was recorded for basic school whilst 13 representing 18.6% of respondents had senior high school education as their highest education level. From the data, it is seen that only 4(5.8%) of respondents have tertiary education; 2.9% each for Certificate/Diploma/HND and University 1st degree. It is further seen that 8 respondents representing 11.4% have no formal education which is worrying. From the above, it can be deduced that the educational level of respondents in the study area was very low. It actually indicates that 64% of respondents had education up to basic school level or below.

The demographics on occupational status of respondents as reported in Table 4.1 shows that 32.9% of respondents were fishmongers. This is particularly because the study area is

predominantly a fishing community. Also, carefully looking at the data, it is seen that 18.6% of respondents were housewives whilst another 18.6% were engaged in business or trading activities. From the table, only 4(5.8%) of respondents were teachers with 6(8.6%) being civil servants. The dynamics in the occupation of respondents showed that, only a small percentage of respondents were engaged in white collar jobs or in professions that required specialized skill/training. This is probably due to the low educational qualification of respondents as earlier discussed above.

A further look at Table 4.1 reveals that only 3(4.3%) of households in the study area were one-man households whilst the majority 41(58.6%) of households consisted of two – five persons. It is again seen that the remaining 26(37.1%) of respondents lived in a household consisting of six or more members. This data indicates that the households in this study were moderately populated since the majority of them had a maximum of five members.

From the data presented in Table 4.1 with regards to the marital status of participants in this study, it is evident that majority of respondents 53(75.7%) were either married or co-living, that is living together as a couple/family. However, 15(21.4%) of respondents were single whilst 2(2.9%) respondents reported that they were separated after some time of marriage. Again, this results indicate that most of the respondents in this study were married and as such had a household of more than one person.

4.3 Knowledge Level on Food Safety and Hygiene among Homemakers in Tema Newtown

Food safety knowledge is a critical factor in ensuring that food prepared and served is safe for consumption. It is therefore consequential to establish the level of knowledge of homemakers on food safety and hygiene in this study. There are several studies conducted on food safety knowledge of food handlers which report varying findings. To this end, the knowledge level of homemakers on food safety and hygiene was solicited through questionnaire and the results are presented below in Table 4.2. Respondents were asked several questions pertaining to food safety and whether they had specific key information or knowledge on food safety and food borne diseases.

For the purpose of easy analysis, the scaling values for the questionnaire data as presented in Table 4.2 is given as, Strongly Disagree (SD) = 1, Disagree (D) = 2, Not Sure (N) = 3, Not sure, Agree (A) = 4 and Strongly Agree (SA) = 5. Again, for brevity and conciseness the researcher condensed the 'strongly disagree' and 'disagree' categories to mean Disagree; and 'strongly agree' + 'agree' to mean Agree. Based on the five-point Likert scale used, a computed mid-point mean value of 3.0 was used (Cohen, Manion & Morrison, 2007). The mean values range from 1.0 to 5.0. Any variable whose responses record a mean value less than 3.0 ($\bar{x}$ < 3.0) is considered rejected or disagreed to whilst a mean value above 3.0 ($\bar{x}$ > 3.0) signifies general agreement or acceptance of the statement and a mean value of 3.0 indicate neutrality.

Table 4.2 Food safety knowledge level of homemakers in Tema Newtown

Variables	SD		D		N		A		SA		Mean
	f	%	*f*	%	*f*	%	*f*	%	*f*	%	($\bar{x}$)
I have experienced food poisoning before (taken ill due to eating unsafe food)	20	28.6%	21	30%	10	14.3%	14	20%	5	7.1%	2.47
I am aware that food when not handled /cooked well can cause illness	0	0%	10	14.3%	14	20%	31	44.3%	15	21.4%	3.73
Food borne illnesses can be life threatening	15	21.4%	25	35.7%	18	25.7%	6	8.6%	6	8.6%	2.47
I know that temperature has a role in keeping food safe or unsafe	9	12.9%	14	20%	9	12.9%	24	34.3%	14	20%	3.29
I know that food inherently carry pathogens/microbes that can cause diseases	6	8.6%	7	10%	10	14.3%	22	31.4%	25	35.7%	3.76
I have received education on food safety and hygiene	18	25.7%	26	37.1%	13	18.6%	7	10%	6	8.6%	2.39
I know that humans transmit germs/pathogens into food through inappropriate handling	2	2.9%	7	10%	14	20%	29	41.4%	18	25.7%	3.77
I am aware that diseases like diarrhea and cholera are caused by consuming contaminated food/water	5	7.1%	3	4.3%	14	20%	25	35.7%	23	32.9%	3.83
I am aware that raw food carry pathogens that can be transmitted to cooked food	2	2.9%	8	11.4%	11	15.7	30	42.9%	19	27.1%	3.80

Source: Author's field survey, 2016

The data presented in Table 4.2 presents the food safety knowledge of homemakers or food handlers in Tema Newtown. From the data, a combination of 58.6% disagreed that they had experienced food poisoning before whilst only 27.1% accepted that they have been taken ill due to food-borne illness. The remaining 14.3% were not sure whether any illness they might have fell in the past was attributable to consuming contaminated food. A mean score of ($\bar{x}$=2.47) which is less than the midpoint value of 3.0 gives further support to the fact that a little over half of respondents had not experienced food poisoning before. In essence, this indicates that at least, one out of every four respondents had fell ill due to eating unsafe food before. This result is in consonance with several findings from other studies. For instance,

Surujlal and Badrie (2004) found in their study that, one-third of the inhabitants of Trinidad had been taken ill by food borne diseases in their life. Also, in the USA, Scallan, *et al.,* (2011) reported that an estimated 1 in 6 Americans experience foodborne illness each year resulting in the known hospitalization of 56,000 and 1,300 deaths annually.

With regards to whether respondents were aware that inappropriate handling/cooking of food can cause food-borne diseases, only 10(14.3%) disagreed whilst 46(65.7%) agreed with the remaining 14(20%) being unsure and thus staying neutral. With a mean value of 3.73, significantly higher than the accepted mean value of 3.0, this indicates that respondents were aware that food when not handled or cooked well can cause food borne illnesses or outbreaks. Azanza *et al.,* (2000) reported a similar finding in their study conducted in the Philippines. They established that, food handlers were particularly knowledgeable in food safety concepts such as mishandling and inappropriate cooking. Priyadarshini (2015) also found in her study that, 85% of consumers were aware that inadequate cooking of food can cause food poisoning. According to Rane, (2011), mishandling and disregard of hygienic measures on the part of food handlers may enable pathogens to come into contact with food and in some cases survive and multiply in sufficient numbers to cause illness in the consumer.

When asked whether food borne illnesses can be life threatening, only 12(17.2%) agreed whilst 40(57.1%) disagreed. Again, 18(25.7%) of respondents were unsure whether food borne diseases can be life threatening. This suggests that most homemakers and consumers in the study area are of the view that food borne-illnesses are mild and therefore not life-threatening. Available literature evidence is however inconclusive as various studies report varying results. For instance, Priyaadarshini (2015) reports in her study that, 70.9% of respondents agreed that food poisoning can be life threatening whilst 21.87% disagreed. In contrast, Langiano, *et al.,* (2012) found in their study that, most respondents (50.7%) viewed food poisoning and food borne diseases as mild since they associate it with diarrhea and stomach upsets.

It is further seen from the table that, 54.3% of respondents know that temperature has a role in food safety whilst 32.9% did not. Also, a majority of 67.1% of respondents reportedly know that food inherently carry pathogens or microbes that can cause diseases whilst 18.6 were oblivious of this fact. This is in consonance with literature as Langiano *et al.,* (2012) found in their study that 66.7% of respondents believed that microorganisms contaminate food during production or during storage while 26.4% knew the role of temperature in keeping food safe.

In order to assess respondents' knowledge on food safety and hygiene, the researcher asked whether respondents had received any form of education/training or information on food safety and hygiene. To this item, 62.8% of respondents responded in the negative whilst only 13% responded in the affirmative whilst 18.6% of respondents remained neutral. This statement received a mean rating of 2.39 which indicates a low level of education or information on food safety. This can be attributed to the fact that the educational level of respondents in this study was very low as majority had only basic education. This is in line with findings reported by other authors.

According to Langiano *et al.,* (2012), Priyadarshini (2015), Byrd-Bredbenner *et al.,* (2013) and Surujlal and Badrie (2004), there is insufficient knowledge of food safety and hygiene among food handlers and homemakers. Numerous studies conducted in Ghana and other parts of the world concerning various aspects of food hygiene over the past decade, have revealed poor food hygiene knowledge and attitudes of street food vendors, with personal hygiene least observed by the least educated (Acheampong, 2005; King et al., 1998; Nuer, 2001). Also, Wilson *et al.,* (1997) report that there is strong statistical evidence that 70% of all bacterial food poisoning is caused by food handlers.

Also, a critical look at the table reveals that with mean values of 3.77, 3.83 and 3.80 respectively, respondents accepted that they had knowledge of the fact that humans transmit germs/pathogens into food through inappropriate handling, the causes of diseases such as diarrhoea and cholera are through ingestion of contaminated food and water and that raw food carry pathogens that can be transmitted to cooked food. These statements received respective combined agreement percentages of 61.7%, 68.6% and 70%

The foregoing discussion indicates that overall, with the exception of three items presented, that is experiencing food borne illness, food borne illness being potentially life threatening and receiving education or information on food safety and hygiene, majority of respondents had sufficient knowledge on food safety and hygiene.

An overall mean or average for the variables under food safety and knowledge was computed to be (x=3.28). This was found to be above the midpoint mean value of 3.0 which further suggests that respondents were aware of the food safety issues presented under this study. This however is not in line with previously reported literature which indicate that there is a sufficient lack of food safety knowledge among food handlers, homemakers and consumers (Langiano, *et al.,* 2012; Priyadarshini, 2015; Byrd-Bredbenner, *et al.*, 2013; and Surujlal & Badrie, 2004). Rossvoll (2013) however reported that there is a large variation in the knowledge, attitudes and behaviour regarding food safety and safe food handling practices among consumers in Norway.

4.4 Food Safety Practices of Homemakers

Food borne illness constitute a significant burden both socially and economically on the society and their health systems. As such, food safety is becoming increasingly important to health experts and dieticians alike. Research findings (Bryan 1988; Scott *et al.,* 1982; Scott, 1996) indicate that a significant proportion of foodborne illnesses arise from practices in the home

kitchen. According to Medeiros *et al.,* (2004), most cases of food borne illnesses are preventable if food safety principles are followed from production to consumption. In this regard, the various food handling and safety practices of homemakers in the study area was assessed with results presented in Table 4.3.

Table 4.3 Food safety practices of homemakers

Variables	**SD**		**D**		**N**		**A**		**SA**		**Mean**
	f	***%***	***f***	***%***	***f***	***%***	***f***	***%***	***f***	***%***	**($\bar{x}$)**
I wash utensils before and after cooking	2	2.9%	7	10%	10	14.3%	28	40%	23	32.9%	3.90
I serve my meals when they are hot	0	0%	7	10%	2	2.9%	16	22.9%	45	64.3%	4.41
I store leftover foods in covered containers	0	0%	0	0%	6	8.6%	41	58.6%	23	32.9%	4.24
I store raw and cooked food in the refrigerator	11	15.7%	9	12.9%	0	0%	17	24.3%	33	47.1%	3.74
I separate cooked and raw food during storage	7	10%	4	5.7%	9	12.9%	22	31.4%	28	40%	3.86
I store cooked food in room temperature for more than 4 hours	5	7.1%	5	7.1%	9	12.9	22	31.4%	29	41.4%	3.93
I consume stored food with the next meal	4	5.7%	6	8.6%	7	10%	29	41.4%	24	34.3%	3.90
I cook and handle food when I am ill	9	12.9%	5	7.1%	2	2.9%	36	51.4%	18	25.7%	3.70
I wash my hands thoroughly before and after cooking	0	0%	0	0%	0	0%	70	100%	0	0%	4.00
I wash my hands after touching raw meat, poultry, fish, eggs and unwashed vegetables	10	14.3%	15	21.4%	14	20%	25	35.7%	6	8.6%	3.03
I wash my hands after sneezing, visiting toilet, coughing or touching other parts of my body	5	7.1%	5	7.1%	16	22.9%	32	45.7%	12	17.1%	3.59
I reheat food thoroughly before serving	5	7.1%	7	10%	10	14.3%	35	50%	13	18.6%	3.63
I do not use food that has fallen to the floor	18	25.7%	14	20%	0	0%	22	31.4%	16	22.9%	3.06
I use the same cutting board for raw and cooked food	3	4.3%	3	4.3%	5	7.1%	43	61.4%	16	22.9%	3.94
I clean working surfaces before and after cooking	0	0%	13	18.6%	13	18.6%	24	34.3%	20	28.6%	3.73
I cook or boil food to the right temperature before serving	2	2.9%	5	7.1%	13	18.6%	28	40%	22	31.4%	3.90

Source: Author's field survey, 2016

From the table, a large percentage of respondents answered that they wash their utensils and equipment before and after use in cooking. This was accepted by 51 respondents out of the total 70 representing a percentage of 72.9%. Also, this statement recorded a mean rating of 3.90. A conflicting finding is reported by Priyadarshini (2015), as in her study it was found that washed and stored utensils were not rewashed before using and that only 21.8% of respondents rewashed utensils before use.

The next food safety practice of homemakers as presented in the table was serving meals when they are hot. This variable received an overwhelming agreement percentage of 87.2% and disagreement percentage of 10% with a mean value of 4.41. This is an indication that most of the participants in this study served their meals when they were hot which is a good practice. This is because it reduces the risk of ingested food containing active disease causing microbes. It is further seen that, 91.4% of respondents agreed that they stored their leftover foods in covered containers whilst 8.6% were unsure. This is supported by research evidence from Priyadarshini, (2015) that 97.2% of homemakers stored foods in covered containers.

Also, it was revealed that 81.4% of respondents stored food in refrigerators. As a follow up, 71.4% of respondents indicated that they separated cooked food from raw food during storage. This is corroborated by research findings from the National Assessment Institute, (1998) which reported that most consumers (66.7%) stored cooked, ready to eat foods away from raw food always whilst 16.7% of consumers did not.

When the researcher asked whether participants stored cooked food at room temperature for more than 4 hours, a majority of 51(72.8%) responded in the affirmative whilst only 10(14.2%) did not. This practice by homemakers is worrying since it can lead to food pathogens to

multiply quickly enough to cause food borne-diseases. Evidence from literature supports this finding as most consumers (79%) in a study by Byrd-Bredbenner *et al.,* (2013) reported leaving prepared perishable food at room temperature for more than the recommended two-hour timeframe. This could be attributed to the common misconception that cooked foods should be cooled to a room temperature before being placed in the refrigerator (Bruhn & Schultz, 1999).

From the table, a majority of 75.7% respondents consumed the stored food with the next meal. This is practice is encouraged because cooked ready to eat foods are perishable and have a short life span. In a similar study by Medeiros *et al.,* (2001) 66.36% of the respondents informed that they consume the leftover foods with the next meal and 22.72 per cent stored it till next day. Similar results were found by Sudershan *et al.,* (2009). In their study they found 86% of the respondents stored the leftover food and 99 per cent stored it in covered containers. Most of them (89%) leave stored food at room temperature and consume stored food with next meal (67.8%). 21 per cent consume stored food the next day (Sudershan *et al.*, 2009).

Another result from the study which was worrying is that, majority of respondents (77.1%) reported that they handled and cooked food when they were ill whereas only 20% did not. The remaining 2.9% were unsure. This is probably due to the fact that the homemakers in this study are the only ones solely responsible for food preparation for their family members. As such when suffering from an illness which is not considered 'serious' enough, they have to handle and prepare food for the household, increasing the risk of cross-contamination. Medeiros *et al.,* (2001) report varying findings where significant number of homemakers recognized that diseased persons are highly likely to contaminate food with poisoning micro-organisms, however, only 10% mentioned that they always avoid food handling during illness.

The data from the table further shows that, 100% of respondents answered positively to the statement that they thoroughly wash their hands before and after cooking. However, only 44.3% reported to wash their hands after touching raw meat, poultry, fish, eggs and unwashed vegetables. The American Dietetic Association (2011) also reports that only 37% of respondents claimed to wash their hands after touching raw food. This is worrying because it is established that raw food contains pathogens and harmful organisms that can be transferred to cooked food. As stated by Green and Selman (2005), the most common source of contamination is humans i.e. the source of food. In this regard, if a food handler is not clean, the food can become contaminated (McSwane, Rue & Linton, 2003). Food handlers in the home may transmit pathogens to food with hands that are contaminated with organisms from their gastrointestinal tract. Thus, hand contact with ready to eat (RTE) food represents a potentially important mechanism by which pathogens may enter the food supply (Guzewich & Ross, 1999).

On the issue of reheating food thoroughly before serving, 68.6% of respondents, yielding a mean value of 3.63 responded affirmatively whilst 17.1% responded in the negative. One issue of concern is the use of food that has fallen to the floor. To this, 54.3% responded that they do not use food that has fallen to the floor whist 45.7% responded in the negative. The issue of using food that falls to the ground is of course dependent on the kind of food involved. Food like vegetables, fruits and raw fish/meat that can be washed thoroughly after picking from the floor do not pose significant health risks, however it is not encouraged.

On the other hand, 84.3% of respondents said they used the same cutting board for raw and cooked food whilst 8.6% did not. With mean values of 3.73 and 3.90 respectively, respondents affirmed that they clean working surfaces before and after cooking and they boil food to the

right temperatures before serving. These constitute good food handling and safety practices which reduce risk of food contamination or poisoning.

The foregoing discussion shows that, homemakers engaged in several unsafe food handling practices such as storing cooked food in room temperature for more than four hours, cooking or handling food when ill, not washing hands after handling raw food like meat, poultry, fish and vegetables and using food that has fallen to the floor. All these contribute to the risk of making food unsafe during preparation.

The above notwithstanding, respondents showed that they followed a number of safe food handling principles such as washing and rewashing utensils before and after cooking, serving meals when they are hot, storing leftover foods covered, separating raw and ready to eat foods during storage, cleaning work surfaces before and after cooking and boiling food to the right temperature before serving.

4.5 Measures to Improve Food Safety and Handling Practices

Homemakers and food handlers hold the key to ensuring food safety to all since they are the last line of defense in the food safety chain. In this light, food handlers and homemakers need to be empowered with enabling environment and supported by awareness creation avenues in order to practice safe food handling. Table 4.4 presents measures to increase the food safety awareness and handling practices of homemakers.

Table 4.4 Measures to increase food safety practices and awareness of homemakers

Variables	**SD**		**D**		**N**		**A**		**SA**		**Mean**
	f	***%***	***f***	***%***	***f***	***%***	***f***	***%***	***f***	***%***	**($\bar{x}$)**
Cleaning of salad vegetables by soaking in water with lemon or vinegar	3	4.3%	3	4.3%	6	8.6%	31	44.3%	27	38.6%	4.09

Washing of hands after touching raw food	2	2.9%	8	11.4%	10	14.3%	28	40%	22	31.4%	3.86
Cleaning working surfaces before and after cooking	0	0%	0	0%	0	0%	18	25.7%	52	74.3%	4.74
Storing cooked foods at the right temperature	3	4.3%	3	4.3%	5	7.1%	35	50%	24	34.3%	4.06
Not leaving cooked food at room temperature for more than 2hours	5	7.1%	7	10%	14	20%	21	30%	23	32.9%	3.71
Adequate reheating of food before consuming	0	0%	3	4.3%	9	12.9%	16	22.9%	42	60%	4.39
Intensive education on food poisoning and food safety for homemakers	0	0%	2	2.9%	10	14.3%	41	58.6%	17	24.3%	4.04
Washing of hands with soap or sanitizer after visiting toilet, sneezing, coughing or touching the body	0	0%	0	0%	11	15.7%	51	72.9%	8	11.4%	3.96
Avoid tasting of cooked food with fingers or unclean spoon	2	2.9%	2	2.9%	20	28.6%	40	57.1%	6	8.6%	3.66
Avoid handling food during illness	0	0%	11	15.7%	19	27.1%	15	21.4%	25	35.7%	3.77

Source: Author's field survey, 2016

The data from Table 4.4 shows that respondents accepted all the measures presented as having the potential to improve the food safety awareness and handling of homemakers when utilized. A careful look at the table reveals however that, some of the measures were strongly accepted than others.

From the table, it is evident that with a mean value of 4.09 and a percentage agreement of 82.9%, respondents agreed that cleaning of salad vegetables by soaking in water with lemon or vinegar would reduce it not eliminate all the risk of disease causing pathogens found on such vegetables. This is because salad vegetables are not cooked before consumption and as such require other means of ensuring that they are free of disease causing microbes.

Also, 81.4% of respondents positively responded that washing of hands after touching raw food is a good way of reducing microbial cross-contamination from raw food to ready-to-eat foods. This was however disagreed to by 14.3% of respondents and yielded a mean value of 3.86 which is above the acceptable midpoint mean value.

Cleaning of work surfaces before and after cooking received the highest ratings in terms of mean and percentages. To this item, a mean value of 4.74 was obtained whilst a combined percentage of 100% was also attained. This indicates that no respondent disagreed to this statement. This is reiterated by the FDA in its Food Code (2009) which states that food employees should immediately wash their hands before engaging in food preparation and working with ready-to-eat foods. The CDC (2010) also recommended the washing of hands before, during and after food preparation to prevent the spread of norovirus.

Respondents were also affirmative in their response to the statement that cooked foods be stored at the right temperature to prevent spoilage due to its high perishability. This was followed by respondents' acceptance that cooked food should not be left at room temperature for more than 2 hours. Research evidence supports this assertion as Fein (1993) and Bruhn, (1999) maintain that mishandling of leftovers was identified as the most common cause of foodborne illnesses. Food left at room temperatures for more than two hours can result in harmful bacteria such as *Bacillus cereus* to grow in high enough numbers to cause foodborne illness (Hillers, 2003).

Respondents further massively supported the measure that leftover food should be adequately reheated before consumption. To this assertion, 82.9% of respondents agreed yielding a mean value of 4.04.

Intensive education on food poisoning and food safety for homemakers received 82.9% positive response indicating that respondents accepted it. This is further supported by literature as Priyadarshini (2015) recommended in her study that investing in food safety education for homemakers, particularly women is an essential and wise investment in human capital. She

further stressed that food safety education should be launched to women and repeated at specific intervals to ensure that learnt information is put into daily life practices. It is also seen from the table that, respondents answered in favour of proper and thorough washing of hands with soap or sanitizer after vising the toilet, sneezing, coughing or touching other parts of the body.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study sought to investigate the food safety practices and knowledge among homemakers in Tema Newtown, a suburb of Tema in the Greater Accra Region. This section of the study presents a summary of the key findings from the results of the study, concludes on the findings and provides recommendations and suggestions for future researchers.

5.2 Summary of Key Findings

From the analysis of the data collected through questionnaire administration, several findings were arrived at. These findings are presented in a summarized manner in accordance with the research objectives.

5.2.1 Knowledge level of Ghanaian homemakers in Tema Newtown on Food Safety and Hygiene

From the analysis of data collected and discussion provided, it came to the fore that homemakers in this study were sufficiently knowledgeable on food safety and hygiene. This is evidenced by the overall mean value of 3.28 calculated for all the variables under this section. The analysis indicates that, with the exception of three items; experiencing food borne illness which was affirmed by 58.6% of respondents, knowledge of the potentially dangerous nature of food borne illnesses which was only privy to 17.2% of respondents and receiving education on food safety and hygiene, majority of respondents had a somewhat sufficient knowledge on food safety and hygiene. Perhaps, this accounted for the relative low percentage of respondents who claimed have experienced food borne illness before.

In general, respondents had adequate knowledge on food causing diseases due to inappropriate handling and/or cooking, the role of temperature in keeping food safe, the inherent pathogenic nature of food, human cross-contamination of food, diseases like cholera and diarrhea being resultant of unsafe food handling practices and cross-contamination of cooked food from raw food.

5.2.2 Food Safety Practices of Homemakers

With regards to the food safety practices of homemakers in the study area, the study found the following:

Respondents observed good personal and kitchen hygiene by washing utensils, before and after cooking, washing hands before and after cooking, storing leftover food in covered containers, cleaning work surfaces before and after cooking and separating raw food from ready to eat food during storage. Also, several safe handling practices were adhered to such as serving food while it is still hot, consuming leftover food with the next meal, cooking or reheating food adequately before consumption.

This notwithstanding, several unsafe practices were also reported. It was seen that 84.3% of respondents used the same cutting board for both raw and cooked food, 72.8% left cooked food at room temperature for more than 4 hours and 77.1% cooked or handled food during illness. Also, a worrying 45.7% used food that fall to the floor. In general, homemakers in Tema Newtown moderately observed food safety practices in the handling and preparation of food for their household members.

5.2.3 Measures to Improve Food Safety Practices

The data analysis and discussion showed that respondents approved of several measures which could lead to improved food safety and handling. These were;

Cleaning working surfaces before and after cooking, adequate reheating of food before consumption, cleaning of salad vegetables with lemon water or vinegar, storing cooked foods at the right temperature and washing of hands with soap or sanitizer after visiting the toilet, sneezing, coughing or touching other parts of the body.

Other measures which were also agreed to were; washing of hands after touching raw food, not leaving cooked food at room temperature for more than 2hours, avoid handling food during illness and avoiding tasting of cooked food with unclean spoon or hand.

5.3 Conclusion

Based on the analysis and findings of this study, the research concludes that with an overall mean value of 3.28, homemakers had adequate or moderate knowledge of food safety and hygiene.

On food safety practices and handling, good personal hygiene was adhered to. However, some bad food safety practices were reported such as using food which fall to the floor and leaving food at room temperature above the recommended time of 2hours. On the whole, safe food handling practices were satisfactory.

Measures aimed at improving food safety awareness and safe food handling practices as suggested by the study include cleaning working surfaces before and after cooking, adequate reheating of food before consumption, cleaning of salad vegetables with lemon water or vinegar, storing cooked foods at the right temperature and washing of hands with soap or sanitizer after visiting the toilet, sneezing, coughing or touching other parts of the body.

5.4 Recommendations

The following recommendations are made based on the discussion of results and findings from this study:

i. The Ghana Health Service (GHS) and Food and Drugs Authority (FDA) should invest in food safety education for homemakers since they are the 'last line' of defense against food borne diseases. The knowledge level of respondents on microbes, and temperature in food safety should be boosted through education and sensitization.

ii. Even though homemakers' knowledge on food safety was optimal, safety practices were below sub-standard. Monitoring programmes should be instituted to ensure that safe and wholesome produce are sold on the market to ensure that food poisoning and food borne outbreaks are reduced to the minimum so that consumers do not buy already contaminated foods unknowingly.

iii. Homemakers should also take personal responsibility for the food they prepare for their household members and pay conscious attention to important food safety practices like proper hand washing with soap under running water and cooking food to the right temperature.

5.5 Suggestions for Further Studies

For future researchers who wish to conduct similar studies into this field, the researcher wishes to make the following suggestions:

i. Since little is known of how prolonged exposure of small amounts of bacterial toxins affect the human body, more studies are needed to investigate the production of bacterial toxins in different food products exposed to temperature fluctuations.

ii. Future studies can concentrate on food waste reduction and as such study how consumers handle leftover foods.

iii. Finally, a similar study like this one could be conducted on a wider sample in a different geographic location to investigate how demographics affect the results of such studies.

REFERENCES

Ababio, F. P., & Lovatt, P. (2015). A review on food safety and food hygiene studies in Ghana. *Food Control.* 47(2015) 92-97.

Acheampong, I. (2005). Food Hygiene of the Cafeteria Facilities of the University of Ghana, BSc Project Report, Department of Nutrition and Food Science, University of Ghana, Legon.

Adam, M. and Moss, Y. (2008). Basic Food Safety for Health Workers, World Health Organization, Geneva, 1999, pp. 113-114.

Adams, O. & Motarjemi, W. (1999). Street food in Venza: A source of income, but not without hazards. Available at www.iita.org/info/phnews5/mr8.htm Accessed on 01.03.2011.

Agyedu, G. O., Donkor, F. & Obeng, S. (2013). Teach yourself research methods. Kumasi: Ash-Metro Press.

Altekruse, S. (1995). A multi-state survey of consumer food-handling and food-consumption practices. *Am. J. Prev. Med., 16,* 216–221.

American Dietetic Association, (ADA, 2011). ConAgra Foods. A Benchmark Survey: Consumer Knowledge of Home Safety Practices. Available online at http://homefoodsafety.org/vault/2499/web/files/111121812-Desktop-Dining-Survey-2011.pdf (accessed on 30 March 2016).

Andoh, D. (2008). Poverty in the midst of riches: The story of Tema Newtown. Retrieved from http://www.ghanaweb.com/GhanaHomePage/NewsArchive/Poverty-In-The-Mist-of-Riches-143811

Ansari S.A., Sattar, S.A., Springthorpe V.S., Wells G.A. and Tostowaryk W. (1989). In vivo protocol for testing efficacy of hand-washing against viruses and bacteria: experiments with rotavirus and Escherichia coli. *Appl. Environ Microbiology*. 55: 3113-3118.

Arnesen, L. P. S., Fagerlund, A., and Granum, P. E. (2008). From soil to gut: Bacillus cereus and its food poisoning toxins. *Fems Microbiology Reviews*. 32:579-606.

Askarian (2004). Emerging foodborne pathogens. *Int J Food Microbiol* 78:31–41. doi:10.1016/S0168-1605 (02) 00232-5.

Azanza, M. P. V., Gatchalion, C. F., and Ortega, M. P. (2000). _Food Safety Knowledge and Practices of Street Food Vendors in a Philippines University Campus. *International Journal of Food Science and Nutrition*.4 (1).19-31.

Bas, M. (2006). Consumer food safety knowledge and practices in the home in Turkey. *Food Control* 18:45-51.doi:10.10.1016/jfoodcont.2005.08.006.

Bas, M., Ersun, A.S. and Kivanc, G. (2004). The evaluation of food hygiene knowledge, attitudes and practices of food handlers in food businesses in Turkey. *J. Food Control*, 17:317-322.

Beard, T. D. (1991). HACCP and the home - the need for consumer education. *Food Technology*. 45:123-124.

Borch, W. H. & Arinda, V. (2002). Why consumers behave as they do with respect to food safety and risk information. *Analytica Chim Acta.* 586:2-7. Doi:10.10106/jaca.2003.07.065.

Brennan, M., McCarthy, M. and Ritson. C., (2007). Why do consumers deviate from best microbiological food safety advice? An examination of 'high-risk' consumers on the island of Ireland. *Appetite*. 49:405-418.

Bruhn, C. & Schultz, H. (1999). Consumer food safety knowledge and practices. *J. Food Safety* 1999, *19*, 73–87.

Bruhn, E., Swing, K. & Alitalia, U., (1999). WHO surveillance programme for control of foodborne infections and intoxications in Europe, 7th report, 1993-1998. BGVV-FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses. Available at: http://www.bgvv.de/index - e.htm.

Bryan, F. (1988). Risks of practices, procedures and processes that lead to outbreaks of foodborne diseases. *J. Food Prot.* 1988, *51*, 663–673.

Buchanan, R.L and Whiting, R.C (1998) Risk assessment: a means for linking HACCP plans and public health. *Journal of Food Protection* 61 (supplement 4):1531–1534).

Burns, N. & Grove, S. K. (1997). The practice of Nursing Research. Blackwell Publishing Limited. New York.

Burt, B. M., Volel, C., & Finkel, M. (2003). Safety of Vendors-Prepared Foods. Evaluation of 10 Processing Mobile Food Vendors in Manhattan. *Public Heath Rep*. 118 (5) 470-6.

Byrd-Bredbenner, C., Maurer, J., Wheatley, V., Cottone, E, Clancy, M. (2008). Food safety hazards lurk in the kitchens of young adults. *J. Food Prot.* 2008, *70*, 991–996.

Byrd-Bredbenner, C., Maurer, J., Wheatley, V., Schaffner, D., Bruhn, C., and Blalock, L. (2007). Food safety self-reported behaviors and cognitions of young adults: Results of a national study. *Journal of Food Protection*. 70:1917-1926.

Cates, S. (2009). Consumer home refrigeration practices: results of a web-based survey. *Journal of Food Protection*. 70:1640-1649.

Cates, S. C., Morales, R. A., Karns, S. A., Jaykus, L. A., Kosa, K. M., Teneyck, T., Moore, C. M., and Cowen. P. (2006). Consumer knowledge, storage, and handling practices

regarding Listeria in frankfurters and deli meats: Results of a web-based survey. *Journal of Food Protection*. 69:1630-1639.

CDC, (2005). Reported cases of Communicable diseases for CAREC member countries - A quarterly review of selected diseases - Weeks 40 -52 of 2001. Caribbean Epidemiology Centre Communicable Disease Feedback Report**.** 6 (4): 1-9

CDC, (2009). Use of luminescent strains of Salmonella enteridis to monitor contamination and survival in eggs. Journal of Food Protection. **59** (9): 915-921.

CDC, (2011). Consumer. Agricultural Counselor, Caracas, Venezuela. Report code TD662v. http://www/tradeport/org. 03-04-03. 5 pp.

Centers for Disease Control and Prevention (CDC) (2008). Number of Reported Foodborne Disease Outbreaks and Outbreak-Associated Illnesses, by Etiology and Place Where Food Was Eaten— United States, 2008. Available online: ttp://www.cdc.gov/outbreaknet/pdf/2008MMWR-

Centers for Disease Control and Prevention (CDC) (2010). Food Safety Epidemiology Capacity in State Health Departments—United States, 2010. *MMWR*. 2011, *60*, 1701–1704.

Chukuezi, C.O. (2010). Food Safety and Hygienic Practices of Street Food Vendors in Owerri, Nigeria. *Studies in Sociology of Science*, vol – 1, 2010, PP 50 – 57

Clayton, D. & Griffith, C. (2004). An investigation of the factors underlying consumers' implementation of specific food safety practices. *Br. Food J.* 2003, *105*, 434–453.

Cohen, L, Manion, L. &Morrison, K. (2007). Research methods in education. (6th ed.). New York, NY: Routledge Publishing.

De Jong, A. E. I., Verhoeff-Bakkenes, L., Nauta, M. J., and de Jonge. R. (2008). Cross-contamination in the kitchen: effect of hygiene measures. *Journal of Applied Microbiology*. 105:615-624.

DeWaal, Y. (2006). New directions in foodborne disease prevention. *Int J Food Microbiol* 78:3–17. doi:10.1016/S0168-1605(02)00234-9

Dharod, J. M., Perez-Escamilla, R., Paciello, S., Bermudez-Millan, A., Venkitanarayanan, K., and Damio, G. (2007). Comparison between self-reported and observed food handling behaviors among Latinas. *Journal of Food Protection*. 70:1927-1932.

Ehiri (1997). Meeting consumer concerns for food safety in South Korea: the importance of food safety and ethics in a globalizing market. J Agric Environ Ethics 22:141–152. doi:10.1007/s10806- 008-9130-9.

El Derea, C. (2008). Emerging foodborne pathogens: keeping your patients and your families safe. Rev Gastroenterol Disord 1:177–178.

Emery, H. C. (1990). Changing poor hand washing habits—A continuing challenge for sanitarians. *Dairy Food Environ. Sanitat.*, *10*, 8–9.

Enriquez, C., Enriquez-Gordillo, D., Kennedy, D. & Gerba, C. (1997). Bacteriological survey of used cellulose sponges and cotton dishcloths from domestic kitchens. *Dairy Food Environ. Sanitat.* 1997, *17*, 20–24.

FAO Corporate Document Repository (1999). Recommended International Code of Practice General Principles of Food Hygiene. Retrieved September, 20, 2016, from http://www.fao.org/docrep/005/Y1579E/y1579e02.htm

Farber, J. & Peterkin, M. (1991). Microbiological aspects of modified-atmosphere Packaging Technology. A Review. *Journal of Food Protection*. 54:58-70.

Fein, S. (1993). Foodborne illness: Perceptions, experience and preventive behaviors in the United States. *J. Food Prot.* Vol. *58*, 1405–1411.

Fischer, A. R. H., de Jong, A. E. I., de Jonge, R., Frewer, L. J., and Nauta, M. J. (2005). Improving food safety in the domestic environment: The need for a transdisciplinary approach. *Risk Analysis*. 25:503-517.

Fischer, A. R. H., De Jong, A. E. I., Van Asselt, E. D., De Jonge, R., Frewer, L. J., and Nauta, M. J. (2007). Food safety in the domestic environment: An interdisciplinary investigation of microbial hazards during food preparation. *Risk Analysis*. 27:1065-1082.

Food Marketing Institute, (2011). *U.S. Grocery Shopper Trends 2011*; Food Marketing Institute: Arlington, VA, USA, 2011.

Garbutt, J. (1997). Essentials of food microbiology. London: Hodder Headline Group.

Ghana Statistical Service, (2010). Population and housing census, 2012, Ghana Statistical Service.

Githiri, M. (2009) Current issues in the understanding of consumer food choice. Trends Food Sci Technol 13:275–285. doi:10.1016/S0924-2244(02)00137-1

Granum, P. E. (2006). Bacterial toxins as food poisons. p. 949-958. *In* M.R. Poppoff, and J.E. Alouf (ed.), The Comprehensive Sourcebook of Bacterial Protein Toxins. Academic Press, London.

Green (2005). Public worry about specific food safety issues. Br Food J 106:9–22. doi:10.1108/00070700410515172

Greene, L. and Selman, C. (2005). Food service workers' self-reported food preparation practices. An EHS-Net Study. *International Journal of Hygiene and Environmental Health*. Vol 208, No.1-2, 2005 pp 27-35. Doi:10.1016/j.ijheh.2005.01.005

Griffith, C. (2000). Food Safety in Catering Establishments. In *Safe Handling of Foods*; Farber, J., Todd, E., Eds.; Marcel Dekker: New York, NY, USA.

Griffith, C. J., Mathias, K. A., and Price, P. E. (1994). The Mass Media and Food Hygiene Education. *British Food Journal*. 96:16-21.

Griffith, C., and Redmond, E. (2006). Consumer food safety education - Guest editorial. *British Food Journal*. 108:705-705.

Grunert, K. G. (2002). Current issues in the understanding of consumer food choice. Trends Food Sci Technol 13:275–285. doi:10.1016/S0924-2244(02)00137-1

Guzewich, U. & Ross, K. (1999). The role of the home environment in the transmission of infectious diseases. J. Community Health 27:247–267. doi:10.1023/A:1016378226861.

Haapala, I. and Probart, C. (2004). Food safety knowledge, Perceptions and behaviours among Middle School Students. *Journal of Nutrition Education Behaviour*. Vol. 36, No. 2, 2004. Doi:10.1016/S1499-4046(06)60136-X.

Hazards Analysis and Critical Control Point (HACCP) (2002). Newsletter. Important Wash Hands. Source: http://www.ohio.com/newsletter33.html

Henley, S., Stein, S.E. & Quinlan, J.J. (2012). Identification of unique food handling practices that could represent food safety risks for minority consumers. *J. Food Prot.* 2012, *75*, 2050–2054.

Hennekinne, J.-A., De Buyser, M.-L., and Dragacci. S. (2012). Staphylococcus aureus and its food poisoning toxins: characterization and outbreak investigation. *Fems Microbiology Reviews*. 36:815-836.

Hillers, N.V., Medeiros, L., Kendall, P., Chen, G., Di Mascola, S. (2003). Consumer food-handling behaviors associated with prevention of 13 foodborne illnesses. J Food Prot 66:1893–1899.

Hilton, A. & Austin, E. (2000). The kitchen dishcloth as a source of vehicle for food-borne pathogens in a domestic setting. *Int. J. Environ. Health Res.* 2000, *10*, 257–261.

Hine, J. A. (2003). Food safety knowledge and practices of consumers in the USA. J. Consumer Studies Home Economics. 19: 119-134.

Howes, A. (1996). Understanding Food: Principles and Preparation. Wadsworth, Thomson Learning, Stamford, USA. 238-254.

Irlbeck, E. G. (2009). A Content Analysis of Food Safety Measures on Television's Food Network. *Food Protection Trends*. 29:16-20.

Jay, L. S., (2003). A national Australian food safety telephone survey. J. Food Protection. 62 (8): 921-928.

Jay, L. S., Comar, D. and Govenlock. L. D. (1999). A video study of Australian domestic food-handling practices. *Journal of Food Protection*. 62:1285-1296.

Josephson, K., Rubino, J. & Pepper, I. (1997). Characterization and quantification of bacterial pathogens and indicator organisms in household kitchens with and without the use of a disinfectant cleaner. *J. Appl. Microbiol.* 1997, *83*, 737–750.

Kaferstein, F. K. (2003). Food safety: a commonly underestimated public health issue (introduction). World Health Statistics Q. 50: 3-4.

Kassa, W. (2010). Disease risks from foods: England and Wales, 1996–2000. *Emerg Infect Dis* 11:365–372.

Kaul, M. and Agarwal, G. (1988) Microbial load of common 'chat' products. *The Indian Journal of nutrition and dietetics*.25,197-199.

Kennedy, J., Gibney, S., Nolan, A., O'Brien, S., McMahon, M. A. S., McDowell, D., Fanning, S. and Wall, P. G. (2011). Identification of critical points during domestic food preparation: an observational study. *British Food Journal*. 113:766-783.

Kennedy, J., Jackson, V., Blair, I. S., McDowell, D. A., Cowan, C. and Bolton, D. J. (2005). Food safety knowledge of consumers and the microbiological and temperature status of their refrigerators. *Journal of Food Protection*. 68:1421-1430.

King, L. K. Awumbila, B., Canacoo, E. A. & Ofosu-Amaah, S. (1998). An Assessment of Safety of Street Foods in the Ga District of Ghana; Implications for Spread of Zoo-noses, *Acta Tropica*, Vol. 76, No. 1, 1998, pp. 39-43. doi:10.1016/S0001-706X(00)00087-5

Kneller, S. and Bierma, U. (1990). Outbreaks of food borne diseases in the Lazio region, Italy: the results of epidemiological field investigations. *Eur J Epidemiol* 18:699–702. doi:10.1023/A:1024884416468.

Koeppl, P. (1998). Focus Groups on Barriers that Limit Consumers' Use of Thermometers when Cooking Meat and Poultry Products. Calverton, MD, USA: Macro International Inc.

Kotsonis, F. N., Burdock, G. A., and Flamm, W. G. (2001). Food Toxicology. p. 1049-1088. *In* C.D. Klaassen (ed.), Casarett and Doull's Toxicology: The Basic Science of Poisons. McGraw-Hill, Medical Publishing Division, USA.

Kusi, H. (2012). Doing qualitative research, a guide for researchers. Emmpong Press. Accra.

Langiano, E., Ferrara, M., Lanni, L., Viscardi, V., Abbatecola, A. M., & De Vito, E. (2012). Food safety at home: knowledge and practices of consumers. *Journal of Public Health.* (2012)20:47-57

Lund, B. M., Baird-Parker, T. C., and Gould, G. W. (ed.). (2000). The Microbiological Safety and Quality of Food. Aspen Publishers, Inc, USA.

Malhotra, L. (1996). Capacity of state and territorial health agencies to prevent foodborne illness. Emerg Infect Dis 11:11–16

Mathiasen, L. A., Chapman, B. J., Lacroix, B. J. and. Powell, D. A. (2004). Spot the mistake: television cooking shows as a source of food safety information. *Food Protection Trends*. 24:328-334. McSwane, Rue & Linton, 2003

McCarthy, M., Brennan, M., Kelly, A. L., Ritson, C., deBoer, M., & Thompson, N. (2007). Who is at risk and what do they know? Segmenting a population on their food safety knowledge. *Journal of Food Quality and Preference*. Vol. 18, No. 2, 2007. 205-217.

Medeiros, L.C., Hillers, V.N., Chen, G., Bergmann, V. and Kendall, P. (2004). Schroeder M. Design and development of food safety knowledge and attitude scales for consumer food safety education. *J. Am. Diet. Assoc.*, 104:1671-1677.

Mensah, P., Yeboah-Manu, D., Owusu-Darko, K., & Ablordey, A. (2002). Street foods in Accra, Ghana: how safe are they? Bulletin of World Health Organisation, 80(7), 546e554.

Montecucco, Y. & Molgo, G. (2005). Food Safety within the Household. Food Science and Human Nutrition Department, Florida Cooperative Extension Service, Institute of Food and agricultural Sciences, University of Florida.

Montville, K. and Matthews, L. (2005). Impact of nutrition counselling on food safety awareness and attitude of the respondents belonging to slum areas of Ludhiana. *Internat. J. Agric. & Food Sci. Technol.*, 5 (3):163-170.

Norwegian Directorate for Education and Training, (2006). Curriculum in "Food and Health" for primary and lower secondary schools. Available at: http://www.udir.no/kl06/MHE1-01/. Accessed 19.09.2013.

NRA (1995). ServSafe® Serving Safe Food Certification Course book. Educational Foundation. National Restaurant Association Education Foundation, Washington, D.C.

NRA (2001). Servsafe Essentials, National Restaurant Association, Educational Foundation, Washington, D.C.

Nuer, T. (2001). Knowledge, attitudes and practices of Fan Milk product vendors on food hygiene and food borne illness. B.Sc project report. Department of Nutrition and Food Science, University of Ghana. Legon 2001.

Ojima, M., Toshima, Y., Koya, E., Ara, K., Tokuda, H., Kawai, S., Kasuga, F., and Ueda, N. (2002). Hygiene measures considering actual distributions of microorganisms in Japanese households. *Journal of Applied Microbiology*. 93:800-809.

Omaye, S. T. (2004). Food and Nutritional Toxicology. CRC Press LLC: Boca Raton.

Painter, J., Hoekstra, R., Ayers, T., Tauxe, R., Braden, C., Angulo, F. & Griffin, P. (2013). Attribution of foodborne illnesses, hospitilizations, and deaths to food commodities by using outbreak data, United States, 1998–2008. *Emerg. Infect. Dis.* 2013, doi:10.3201/eid1903.111866.

Pilling, M., Escania, V., & Nunnery, P., (2008). Estimated number of cases of foodborne infections disease in New Zealand. New Zealand Journal. 113: 278-281.

Polit, K. M. & Hunger, G. S. (1993). Research design and methods. Yale University Press. Australia.

Powell, (1997). Prevalence and correlates of acute respiratory infections in children less than two years of age. *Saudi Med. J.*, 21:1152–1156.

Priyadarshini, V. (2015). Food safety awareness and practices by homemakers in Bhubaneswar city. *Food Sci. Res. J.*, 6(2): 310-315

Quick, V., Corda, K., Byrd-Bredbenner, C. (2013). Determinants of safe food handling behaviors among middle school youth. *Nutr. Food Sci.* 2013, in press.

Rane, B. (2011). Food microbiology: An introduction (2nd. ed.). England: Academic press The United Nations World Water Development Report 'Water for people Water for life' p.102.

Redmond, E. & Griffith, C. (2009). Consumer perceptions of food safety risk, control and responsibility. *Appetite*, *43*, 309–313.

Redmond, E. C. & Griffith, C. J. (2008). Assessment of risk of introduction of Echinococcus multilocularis to mainland Norway - Opinion of the Panel on biological hazards of the Norweigan Scientific Committee for Food Safety. Norwegian Scientific Committee for Food Safety.

Redmond, E. C. and Griffith, C. J. (2003). Consumer food handling in the home: A review of food safety studies. *J. Fd. Pro.*, 66:130-161.

Redmond, E. C., Griffith, C. J, Slader, J., and Humphrey, T.J. (2001). The evaluation and application of information on consumer hazard and risk to food safety education. CSA 5107. Food Standards Agency, London.

Roberts, I. (2008). Home food safety. Food Technology. 52 (2): 54 - 56.

Rossvoll, E. (2013). Food handling practices and knowledge of food safety among Norwegian consumers. Accessed online at https://www.researchgate.net/publications/258808850

Rusin, P., Orosz-Coughlin, P. & Gerba, C. (1998). Reduction of faecal coliform and heterotropic plate count bacterial in the household kitchen and bathroom by disinfection with hypochlorite cleaners. *J. Appl. Microbiol.* 1998, *85*, 819–828.

Scallan, E., Hoekstra, R., Angulo, F., Tauxe, R.; Widdowson, M., Roy, S., Jones, J. & Griffin, P. (2011). Foodborne illness acquired in the U.S.—Major pathogens. *Emerg. Infect. Dis.* 2011, *17*, 1–15.

Scott, E. & Herbold, N. (2010). An in-home video study and questionnaire survey of food preparation, kitchen sanitation, and hand washing practices. *J. Environ. Health* 2010, *72*, 8–13.

Scott, E. (1996). A review: foodborne disease and other hygienic issues in the home. J. Applied Bacteriology. 80: 5-9.

Scott, E., Bloomfield, S.F. and Barlow, C.G. (1982). An investigation of microbial contamination in the home. J. Hygiene. 89: 279-293.

Shojoei, C. (2006). Antimicrobial effectiveness of hand washing for food establishment. Dairy Food Environmental Sanitation 10: 136-141.

Smith & Fratamico, (2012). Food poisoning in England and Wales during 1993. Environ. Health. 94: 57.

Snelling, A.M. Kerr, K.G., and Heritage J. (1991). The survival of Listeria monoctogenes on fingertips and factors affecting elimination of the organism by hand washing and disinfection. J. Food Protection. 54: 343-348.

Sudershan, R.V., Subba Rao, G.M., Vishnu Rao, V.M. and Polasa, K. (2009). Food safety awareness, practices and enabling assets in India – A nation-wide needs assessment study, Abstracts Book – Page-8; SO2-3.pdf.

Surujlal, M. & Badrie, N. (2004). Household consumer food safety in Trinidad, West Indies. *Journal of Food Safety*. Vol. 3, 8 – 14.

Sutherland, W. E. and Porritt, M. N. (1997). Eggs - Understanding Food:Principles and Preparation. Wadsworth, Thomson Learning, Stamford, USA. 238-254.

Thomas, J. M. and Karl, R. M. (2008). Food microbiology: An introduction (2nd. ed.). England: Academic press The United Nations World Water Development Report 'Water for people Water for life' p.102.

Tirado, C., and Schmidt, K. (2001). WHO surveillance programme for control of foodborne infections and intoxications: preliminary results and trends across greater Europe. *J Infect* 43:80–84

Tjoa, W.S, DuPont, H.L, Sullivan P, Pickering, L.K, Holguin, A.H, Olarte J, (1997). Location of food consumption and travellers' diarrhoea. *American Journal of Epidemiology* 106:61-6.

Ukuku, D.O., Olanya, M., Geveke, D.J., & Sommers, C. H. (2012). Effect of microflora, waiting period, and storage temperatures on Listeria monocytogenes Serovars transferred from cantaloupe rind to fresh cut pieces during preparation. *J. Food Prot.* 2012, *75*, 1912–1919.

Van Asselt, E., Fischer, A., de Jong, A., Nauta, M., and de Jong, R. (1999). Cooking practices in the kitchen-Observed *versus* predicted behavior. *Risk Anal.* 2009, *29*, 533–540.

WHO (1992) Surveillance programme for control of foodborne infections and intoxications in Europe. Fifth Report, 1985-1989, pp. 1 -235. Institute of Veterinary Medicine, Robert von Ostertag Institute, Berlin, Germany.

WHO (2002).*Global strategy for food safety: safer food for better health*. World Health Organization, Geneva, 2002.

WHO (2006). Five Keys to Safer Foods Manual. Department of Food Safety, Zoonoses, And Foodborne Diseases.

WHO (2010).Five Keys to safer food.www.who.int/food safety/consumer /5keys Visited 01.04.2010].

WHO (2012). Global Strategy for Food Safety: Safer Food for Better Health. Available online: http://www.who.int/foodsafety/publications/general/en/strategy_en.pdf (accessed on 15 March 2016).

WHO, (2009) *Food and Health in Europe: A New Basis For Action*, WHO regional publications European series, no. 96.

Wilson, M., Murray, A. E., Black, M. A., & McDowell, D. A. (1997). The implementation of Hazard Analysis and Critical Control Points in Hospital catering. *Managing Service Quality*. Vol.7, No. 3, pp 150 – 156. Doi:10.1108/09604529710166941.

APPENDIX

QUESTIONNAIRE

I am a Masters student offering M.Tech Catering and hospitality programme at the University of Education, Winneba – Kumasi Campus. I am currently conducting a study on the topic "Assessing the food safety practices among homemakers in Tema Newtown". Your responses are required for the successful completion of this thesis. You are assured that information obtained from you will be used strictly for academic purposes and will not be reported in any way that will reveal your identity. Please tick [✓] in the spaces provided against the option that best indicates your answer to the questions.

SECTION A: SOCIO-DEMOGRAPHIC DATA

1. Sex: a) Male [ ] b) Female [ ]

2. Age (in years)

a) 18 – 25 [ ]
b) 26 – 30 [ ]
c) 31 – 39 [ ]
d) 40 – 49 [ ]
e) 50 – 59 [ ]
f) 60 and above [ ]

3. Educational level:

a) No formal education [ ]
b) Basic school [ ]
c) Senior High School [ ]
d) Certificate/Diploma/HND [ ]
g) 1st Degree [ ]
h) Post-Graduate [ ]

4. Occupation:

a) Student [ ]

b) Civil servant [ ]

c) Business [ ]

d) Housewife [ ]

e) Teacher [ ]

f) Farmer [ ]

g) Fishing/monger [ ]

h) Retired [ ]

i) Other: …….

5. Number of persons in household

   a) 1 [ ]

   b) 2 – 5 [ ]

   c) 6 and more [ ]

6. Marital status

   Single [ ]

   Married / co-living [ ]

   Separated [ ]

   Widowed [ ]

SECTION B: KNOWLEDGE LEVEL OF HOMEMAKERS IN TEMA NEWTOWN CONCERNING FOOD SAFETY AND HYGIENE

Please tick (✓) in the appropriate box to indicate the extent to which you agree or disagree to the following statements regarding your knowledge level in food safety and hygiene
Key: SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree.

No.	**Statement**	**SD**	**D**	**N**	**A**	**SA**
7	I have experienced food poisoning before (taken ill due to eating unsafe food)					
8	I am aware that food when not handled/cooked well can cause illness					
9	Food borne illnesses can be life threatening					
10	I am aware that food borne-illnesses can be life threatening					
10	I know that food inherently carry pathogens/microbes that can cause diseases					
11	I have received education on food safety and hygiene					
12	I know that humans transmit germs/pathogens into food through inappropriate handling					
13	I am aware that diseases like diarrhoea and cholera are caused by consuming contaminated food/water					
14	I am aware that raw food carry pathogens that can be transmitted to cooked food					

SECTION C: FOOD SAFETY PRACTICES OF HOMEMAKERS IN THE HANDLING AND PREPARATION OF FOOD

Please tick (✓) in the appropriate box to indicate the extent to which you agree or disagree to the following statements the food safety practices that you use when cooking and handling food

Key: SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree.

No.	Statement	SD	D	N	A	SA
15	I wash/rewash utensils before cooking and after cooking					
16	I serve my meals when they are hot					
17	I store leftover foods in covered containers					
18	I store raw and cooked food in the refrigerator					
19	I store cooked food in room temperature for more than 4 hours					
20	I consume the stored food with the next meal					
21	I cook and handle food when I am ill					
22	I wash my hands before cooking and after cooking					
23	I wash my hands after touching raw meat, poultry, fish, eggs and unwashed vegetables					
24	I wash my hands after sneezing, visiting toilet, coughing or touching other parts of my body					
25	I reheat food thoroughly before serving/consuming					
26	I do not use food that has fallen to the floor					
27	I use the same cutting board for raw and cooked food					
28	I clean working surfaces before and after cooking					
29	I cook or boil food to the right temperature before consuming					
30	I separate cooked food from raw food during storage					

SECTION D: MEASURES TO IMPROVE FOOD SAFETY PRACTICES AMONG HOMEMAKERS

Please tick (✓) in the appropriate box to indicate the extent to which you agree or disagree to the following statements which can be utilised to improve food safety practices among homemakers

Key: SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree.

No.	Statement	SD	D	N	A	SA
31	Cleaning of salad vegetables by soaking in water with lemon or vinegar					
32	Washing of hands after touching raw food					
33	Cleaning working surfaces before and after cooking					
34	Storing cooked foods at the right temperature					
35	Not leaving cooked food at room temperature for more than 2 hours					
36	Adequate reheating of foods before consuming					
37	Intensive education of food poisoning or food borne diseases for homemakers					
38	Washing of hands with soap/sanitizer after attending nature's call, sneezing, coughing, or touching other parts of the body					
39	Avoid tasting of cooked food with fingers or unclean spoon					
40	Avoid handling food during illness					