FOOD SAFETY IN THE SCHOOL FEEDING PROGRAMME IN THE GA EAST MUNICIPAL AREA

BY

PAULINA SAAH OWUSU

THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF PHILOSOPHY (MPHIL) APPLIED HEALTH SOCIAL SCIENCE DEGREE

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DECLARATION

I, Paulina Saah Owusu, declare that except for the other people’s investigations which have been duly acknowledged, this work is the result of my own original research undertaken under supervision, and that this thesis, either in whole or in part has not been presented elsewhere for another degree.

SIGNATURE:

Paulina Saah Owusu (Student)

Dr. Mrs. Matilda Steiner-Asiedu (Primary supervisor)

Dr. Collins Stephen Ahorlu (Secondary supervisor)
DEDICATION

Ebenezer: “Thus far has the Lord brought us”!

Dedicate this thesis to my parents, Mr. and Mrs. G.B.K. Owusu of Madina, Accra for their love, prayers and financial support.
ACKNOWLEDGEMENTS

I wish to thank all those who helped in diverse ways in producing this work.

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May the Lord richly bless everyone who has made this possible, thank you all!
ABSTRACT

Objective: This study assessed current food safety measures of food handlers in the school feeding programme.

Methods: A cross-sectional descriptive study design was employed where a questionnaire was used to collect data from 75 food handlers’ on their demographic characteristics, knowledge, attitude and practices on food safety. An interview guide was used to assess eight matrons or caterers’ in-depth knowledge on food safety, a non-participant observation was made on the personal and environmental hygiene practices of food handlers as well as the manner of services they provide using a checklist adopted from the Public Health Unit of the Accra Metropolitan Assembly. This was followed by a laboratory assessment of the microbiological status of food samples collected at the point of serving in schools. Chi-square test for independence as well as frequency distributions was used to analyze quantitative data from the field survey. All qualitative data were coded and categorized into themes for presentation. Data obtained from the laboratory analysis were also compared with standard values of microbiological counts of cooked foods.

Findings: Most respondents had basic knowledge on food safety issues with some socio-demographic factors being contributory factors. However, this did not translate well into their activities when observations were made and the presence of coliform counts (total & faecal) in some foods sampled did not make food wholesome.

Conclusion: Food safety measures of food handlers in the school feeding programme were inadequate and could lead to food borne diseases. Special attention should be given to manner of services, personal and environmental hygiene.
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LIST OF ACRONYMS

CERSGIS………………Centre for Remote Sensing and Geographic Information Services

CDC……………………Centre for Disease Control and Prevention

FAO……………………Food and Agriculture Organization

FSA……………………Food Safety Agency

GSFP……………………Ghana School Feeding Secretariat

IDI………………………In-Depth Interview

MDGs……………………Millennium Development Goals

SEND…………………..Social Enterprise Development Organization

SFP……………………School Feeding Programme

UNICEF……………….United Nations International Children Educational Fund

UNESCO……………..United Nations Educational Scientific and Cultural Organization

WHO…………………..World Health Organization

WFP…………………..World Food Programme
CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

There are about 75 million school-aged children who do not attend school due to poverty, while 66 million primary school-aged children attend school hungry across the developing world, with 23 million in Africa alone (FAO, 2009). Studies show that it is more difficult for children to learn without adequate food and nutrition (Partnership for Child Development, 1999; Condon et al., 2009). A daily school meal provides a portion of children’s nutritional needs and also a strong incentive to children to attend school. In 2007, over 70 countries were providing school meals or take home rations to 19.3 million children through the World Food Programme (WFP), of which Ghana was a beneficiary (WFP School Feeding Programme, 2007). Nevertheless, the food safety aspects, the quality of the meals and food service have not been studied in most countries.

In Ghana, the national school feeding programme began in late 2005 with 10 pilot schools drawn from the ten regions of the country. By August 2006, it had been expanded to 200 schools, covering 69,000 pupils in all the 138 districts with a goal to reach a total of 500 schools and 155,000 children by the end of the year 2009. Currently, the Ghana School Feeding Programme (GSFP) covers approximately 987 public schools throughout the country and the number of pupils fed daily is approximately 477,714. The Ghana School Feeding Programme is an initiative of the Comprehensive Africa Agricultural Development Programme (CAADP) Pillar 3 which seeks to enhance food security and
reduce hunger in line with the United Nations (UN) Millennium Development Goals (MDGs) on hunger, poverty and malnutrition. The basic concept of the programme is to provide children in public primary schools and kindergarten with one hot, nutritious meal prepared from locally grown food stuffs on every school going day. The GSFP has engaged the services of caterers to prepare meals off school premises for the school children. Caterers are expected to be in the position to cook food on large scale basis under hygienic conditions and demonstrate basic understanding of the nutritional needs of children (District Operations Manual, 2008).

In providing the meals it is important that the precautionary principle is applied with respect to food handling and preparation safety to ensure not just a nutritious meal but a meal free of harmful pathogens. It is only when the food is wholesome that the children will obtain the full nutritional benefit. Unfortunately, because of insufficient food to meet demands on the African continent majority of people are being led to be concerned with satisfying hunger with little or no attention to food safety (WHO, 2007).

Food safety refers to the conditions and practices that preserve the quality of food to prevent contamination and food borne illnesses that may occur along the food path (growing, harvesting, processing, transporting, distributing, retailing, preparing, storing and consumption) (WHO, 2007); in other words from farm to table (until ingestion of food). Along this path every person is at risk of food borne illnesses due to improper food handling. In school feeding programmes preparation of food, transporting, serving
cleanliness of personnel and the environment are of importance in ensuring that food is safe for consumption.

Food quality is an integral part in ensuring proper nutrition and health which are the determinants of food and nutrition security. Food quality is an index of both nutrient content and food safety. Food safety is an increasing public health concern world-wide. In 2007, WHO reported that about 1.8 million people died from diarrheal diseases in 2005 which resulted from contaminated food and drinking water? The impact of food borne illness on social, health care cost and burden on families and communities cannot be over emphasized (WHO, 1999). In developed countries, although very difficult they are able to document most of these food borne disease outbreaks but there is very limited documentation in developing countries, including Ghana (WHO, 2007). The high prevalence of diarrheal diseases in developing countries which inevitable claims the lives of many children has been linked to food and water safety issues (WHO, 2007).

The inception of school feeding programmes has been documented to have impact on child’s learning and performance capabilities (Partnership for Child’s Development, 1998b). For example, in Jamaica, providing breakfast to primary school pupils significantly increased attendance and arithmetic score. Children who benefited most were previously wasted, stunted or malnourished (Simeon and Gratham – McGregor, 1989). However, a poorly organized school feeding programme, particularly one for which hygienic standards were very low, caused health problems, and prevented the
provision of the food in regular basis which was supposed to help children to be more alert in class (UNESCO-UNICEF-WFP, 1986).

Since School Feeding Programmes are one of several interventions that can address some of the nutrition and health problems of school-aged children, it is imperative that the benefits of such nutritional support programme are not compromised by food borne illnesses. This calls for the training of food handlers of school feeding programmes in proper food handling and safety (Weaver et al., 1989).

1.2. Statement of the Problem

Although some existing studies have examined the nutritional composition of foods fed to pupils under the school feeding programme in most developing countries (Simeon and Gratham – McGregor, 1989; Newman, 2007), not much has been done to evaluate the safety of foods served. Recent media reports have indicated that food quality assurance has been neglected in schools of which Ghana is no exception. The Wednesday May 30, 2007 edition of the Daily Graphic reported incidents of food poisoning in the GSFP in the Ga East Municipality. Thousand three hundred school children suffered various degrees of food poisoning after consuming food from the programme with 100 being detained at the University of Ghana hospital. According to Bomfah (2008), this is very common in mass feeding programmes such as the GSFP since these feeding programmes stand a higher risk of microbiological contamination than foods prepared on small scale owing to engagement of food handlers with inadequate food handling practices which often lead to cases of food borne diseases.
A study conducted since the inception of the programme in Ghana by SEND-Ghana (2009), a non-governmental organization indicated poor food handling practices amongst food handlers in the Gushegu district as shown in figure 1.1.

![Figure 1.1 Serving of food in Zori Yapala Primary school in Gushegu District (SEND- Ghana, 2009)](image)

Bomfeh (2008) also assessed the microbiological safety of foods served under the national school feeding programme and discovered that there was a high potential of food poisoning in most of the sampled schools involved in the programme. He indicated that future studies should be directed towards assessing the knowledge, attitude and practices of food handlers on food safety in the feeding programme. Clearly, food handlers play an important role in the transmission and, ultimately, prevention of food borne diseases.
Therefore information regarding food handling practices is key to addressing and curbing food borne illnesses in schools through School Feeding Programmes.

1.3. Conceptual Framework

The conceptual framework (figure 1.2) for this study was adopted from (Buccheri et.al. 2007; DeBess et. al.2009) and modified to suit this study. In Buccheri’s study on food safety amongst food handlers, he noted food handlers knowledge, attitudes and practices to food safety to a large extent depended upon their level of education, how long they had worked in a food service establishment and food safety training programmes attended.

DeBess (2009) also agreed with the factors mentioned by Buccheri to play a role in ensuring food safety amongst food service personnel but further suggested that significant others also mattered in achieving this. Observations made also indicate that the personal and environmental conditions of the food handler cannot be ignored since they can influence the microbial safety of foods served. Based on the model developed, the outcome or dependent variables that are knowledge, attitude and practices are determined by the independent variables: demographic and work related characteristics.
Figure 1.2. Conceptual Framework

Adapted from (Buccheri et.al. 2007; DeBess et. al.2009).

Adapted from (Buccheri et.al. 2007; DeBess et. al.2009).
1.4. Justification

Since the introduction of the Ghana School Feeding Programme, it seems not much work has been done on food safety issues in the programme and very little is known about food handlers knowledge, attitude and practices in relation to food safety. This study was designed to address this and to stimulate further studies to better understand food handling and safety in the programme. The study will also contribute to some existing knowledge on:

a. the hygiene and sanitation situation of food premises

b. challenges that exist in the food preparation environment, and

c. make recommendations for interventions that will reduce food contaminations and food borne illnesses in the school feeding programmes to improve nutrition and health (nutrition security) of the pupils.

1.5. Study Objectives

1.5.1. General Objective:

The main aim of the study was to assess current food safety measures of food handlers in the school feeding programme.

1.5.2. Specific Objectives:

Specifically, the study sought to:

1. Determine food handler’s knowledge, attitude and practices in relation to food safety.

2. Determine factors associated with knowledge, attitude and practices on food safety.
3. Determine food handlers’ sources of information about food safety.

4. Investigate the personal and environmental hygiene and manner of services of food handlers.

5. Determine the microbiological loads of foods served.

1.6. Hypotheses:

1. There is no association between food handlers’ socio-demographic information and their knowledge on food safety.

2. There is no association between food handlers’ socio-demographic information and their attitude on food safety.

3. There is no association between food handlers’ socio-demographic information and their practices on food safety.

4. There is no difference between the time food is served (feeding times) and microbial count.

5. There is no difference between where food is coming from and microbial count.

1.7. Operational Definitions

1. Matron or Caterer- this is used interchangeably to represent the head of catering services in the school feeding programme.

2. Food handlers – these are the people employed by the caterers to provide meals
3. Food safety measures- ways of ensuring food is safe for consumption. Through knowledge acquisition, having a healthy attitude and observing good personal and environmental hygiene to improve the quality of food.

4. Socio- demographic characteristics- it includes demographic characteristic and work related characteristics.

5. Catering services- these are food services provided by caterers and their staff to the school children in the SFP.
CHAPTER TWO

2.0. LITERATURE REVIEW

2.1. Global Perspective on Food Safety: Knowledge and Practices of Food Handlers

Food safety is an important part of public health linking health to agriculture and other food production sectors. An FAO report (2006) defines food safety as protecting the food supply from microbial, chemical and physical hazards that may occur during all stages of food production, including growing, harvesting, processing, transporting, retailing, distributing, preparing, storing and consumption, in order to prevent food borne illnesses. For over a century, developments in food production and the control systems have contributed to food safety systems in most developed countries (Schlundt, 2002). Food safety and food handling requirements cover personal hygiene practices, food preparation practices and food storage (CDC, 1998).

According to FSA (2001), food safety involves more than just cleanliness; it includes all practices involved with:

- Protecting food from the risk of contamination, by harmful bacteria, poisons and foreign objects.
- Preventing any bacteria present in the food multiplying to a level that would result in food poisoning, or the early spoilage of the food.
- Destroying any harmful bacteria in the food by thorough cooking or processing.
A good knowledge of safe food handling practices is essential for all those involved in food processing, storage, distribution and sale.

There is literature regarding various aspects of food safety amongst food handlers especially in the hospitality industry with a few in “Care settings” such as hospitals, children’s nurseries, pre-schools. A survey conducted by Bolton et al., (2007) in Ireland assessed the knowledge and practices of head chefs and catering managers responsible for food safety in catering establishments. It was revealed that about 20% of kitchen staff had no formal training on food safety issues. Among those who had some formal training, it was identified that the formal education did not result in improved food safety practices. Most of the head chefs were unaware of current food safety legislation as well as their specific responsibilities.

Buccheri et al., (2007) studied some factors that influence knowledge, attitudes, and practices concerning food safety of the nursing staff in two hospitals in Palermo, Italy. The study showed that there was a generalized lack of knowledge about etiologic agents and food vehicles associated to food borne diseases and proper temperatures of storage of hot and cold ready to eat foods. The study also established that, there was a positive attitude towards temperature control and using clothing and gloves, when handling food. Results from the study indicate that performance on practices was better answered by respondents. Age, sex, educational level and length of service were inconsistently associated with their practices.
In a similar study Baş et al., (2006) evaluated knowledge, attitudes, and practices concerning food safety issues among food handlers in Turkey. Of the 764 food handlers who responded, 9.6% were involved in touching or distributing unwrapped foods routinely and use protective gloves during their working activity. A majority of participants (47.8%) had not taken basic food safety training. The study demonstrated that food handlers in Turkish food businesses often have lack of knowledge regarding the basic food hygiene (critical temperatures of hot or cold ready-to-eat foods, acceptable refrigerator temperature ranges, and cross-contamination etc.).

In 2001, a study was conducted on the knowledge, attitudes and practices on food hygiene of food handlers in food businesses in Ghana. Most of the respondents were found to have satisfactory food hygiene knowledge and attitudes; however this did not reflect in their practices (Baiden, 2009).

Rheinländer et al., (2008) studied some local perceptions of food safety among street food vendors and their consumers in Kumasi, Ghana in order to identify the most important aspects to be included in future public health interventions concerning street food safety. The study found that although vendors and consumers demonstrated basic knowledge of food safety, the criteria did not emphasize basic hygiene practices such as hand washing, cleaning of utensils, washing of raw vegetables, and quality of ingredients.

Several authors have suggested that most managers in food industry have limited understanding of the global food safety strategy (Moatimore et al., (1998); Khandke and
Mayes (1998); Williams et al., (2003). FSA (2001) have suggested the need for all food handlers to receive adequate food safety education and training that ensures that:

- they are aware of the dangers of poor food handling,
- they have the knowledge to break the chain of events that results in food poisoning.

2.2. Personal Hygiene of Food Handlers

The food handler has an important role to play in the prevention of food poisoning and other food borne diseases. Even healthy people carry food poisoning bacteria on their bodies. By touching parts of your body such as your nose, mouth, hair as well as your clothes, you can spread bacteria from your hands to the food (Hobbs and Robert 1987). The hands are rarely free from bacteria, which may be transient or semi-permanent in the skin. These bacteria may be staphylococci of the food poisoning types, Escherichia coli, or other bacteria species (Nickerson and Sinskey, 1972).

Hobbs and Robert (1987) stated that the commensal flora of the hands usually consists of staphylococci which cling to the skin surface and persist in hair follicles, pores, crevices and lesions caused by breaks in the skin and are not easily moved. Deutsch (1971) emphasized that food handlers should wash their hands with soap before touching food, since the hands, mouth and nose easily transmit infections to food. The hands must be washed carefully before touching any sort of food especially after handling raw food.
ingredients which will introduce bacteria daily. They must be washed after visits to the toilet (Hobbs et al., 1987).

According to Nickerson and Sinskey (1972), hair of all workers handling foods should be covered by hairnets, bands or caps. These coverings should be provided for the workers and it is the responsibility of supervisors that they are worn. Regular bathing also helps in reducing bacteria transfer to food and the wearing of clean clothes by food handlers. A food handler must wear protective clothing which should be light coloured, light in weight and changed frequently to make it look clean always (figure 2.1).

Figure 2.1. 2.1 Food handlers wearing appropriate clothing to reduce the risk of food poisoning in a SFP.
Most ordinances require that all food handlers be free of infectious diseases. Periodic, complete and thorough medical examination should be required to attempt to avoid development of any infectious disease (Guthrie and Rufus, 1980).

2.3. Food Preparation Activities

Microbes are everywhere and enter food by endless routes. According to Deutsch (1971) they can be seen by growth of fungus and moulds but in most cases, microbes cannot be seen. It is important to consider the food preparation premises and equipment used in any food services. All food contact surfaces should be smooth, free from pits, crevices, and non-toxic.

Utensils used in food preparation could serve as a contaminant when not handled properly. Kitchen equipments that are not properly washed and sanitized could also serve as contaminants (Gates, 1987). Christchurch city council (1998) also asserts that equipment and utensils such as knives and cutting boards should be used separately for handling raw foods since raw foods especially meat, poultry and seafood and their juices can contain dangerous microorganisms which may be transferred onto other foods during food preparation.
2.4. Food Storage

Food is an excellent medium for growth of microorganisms and so a very high standard of hygiene is necessary in maintaining quality of food. Foods that are not preserved by canning or drying need to be kept at the correct temperature to prevent bacteria from multiplying or toxins from forming (Food Standard Agency, 2001). Despite improved technology in refrigeration, freezing and other preservation techniques, a high incidence of food borne illness, either bacterial contamination of foods or from toxins, still occurs (Gates, 1987).

Pathogenic or harmful organisms are known to grow best at the temperature of the body, which is 37ºc. Except for Clostridium perfringens, which grow well at a temperature up to 47ºc and even up to 50 ºc. The ability of most bacteria to multiply fall off from rapidly above 45 ºc and only a few group can grow at temperatures above 50 °c (Hobbs et al., 1987). Non- sporing cells of food poisoning bacteria are killed at temperature above 60 ºc, the length of time 10 to 30 minutes or more required depending on the type of organism. Boiling kills most living cells with the exception of spores in a few seconds. However, spores may require to be boiled for five or more hours before they are killed.

According to Food Research Institute (1980), freezing kills a proportion of cells. Growth of all these organisms may be prevented by holding foods at temperature below 5 ºc or above 60 ºc with the occasional exception of salmonella these organisms must usually be present in very high number (10^6 g⁻¹ or more) to cause food poisoning.
2.5. Food Borne Diseases

WHO (2004) defines food borne illnesses as diseases, usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food. This is colloquially referred to as food poisoning. Bacteria, parasites or viruses which are the causal agents of food borne diseases are due to the breakdown in sanitation and/or improper food handling practices (Fox and Cameron, 1989).

2.5.1. Causes of food borne diseases

Food naturally contains safe levels of both harmful and safe bacteria. The severity of food borne disease depends on the particular pathogen ingested and the physical condition of the person who eats it (WHO, 1997). Food can be contaminated with bacteria when mishandled which can cause food poisoning. Guthrie (1987) noted that the disease produced as a result of food contamination begins in the intestinal tract and either the toxin is absorbed to do its damage or that the microorganisms grow, reproduce, and cause distress to the human. According to Tomlins et al., (2006) the common causes of food borne illness include the following:

i. Food prepared too far in advance of service.

ii. Storing cooked food at ambient temperature

iii. Cooling food rapidly

iv. Not reheating food to a high enough temperature to destroy food poisoning bacteria.

v. Contaminating cooked food with food poisoning bacteria

vi. Under cooking meat and meat products
vii. Cross contamination from raw to cooked foods

viii. Infected food handlers.

The authors further asserts that majority of the above causes of food borne illness could occur at any point during preparation, cooking and serving.

2.5.2. Epidemiology of food borne disease

Food borne illness is a major public health problem in the United States and globally. Both developed and developing countries suffer the consequences of food borne illness, but to varying degrees. Recent U.S. estimates indicate that incidence of 76 million and 5,000 deaths are attributed annually to food borne illness (WHO, 2007). In the African region, it is difficult to surmise but available data on contaminated food and water estimate mortality to be around 700,000 persons per year in all ages (WHO, 2007). Among all illnesses attributed to food borne causes, 30% are caused by bacteria, 3% by parasites, and 67% by viruses (Mead et al., 1999).

The incidence of food borne illness in developing countries is less well-understood than in the U.S. In Ghana, data on the prevalence of food borne illness is not available therefore its extent cannot be established. However, according to MoH (2006), diarrhoea ranks the second most frequent cause of death next to malaria.) The high prevalence of diarrhoeal diseases in many developing countries are major underlying food safety problem (WHO, 1997).
In the last decade, the epidemiology of food borne diseases has changed with several emerging and re-emerging pathogens globally. Some of them present few risks to most individuals but may be life threatening to others among which are children (Tauxe and Hughes, 1996). These changes may be attributed to several factors, including consumer demographics and lifestyles development in food processing preparation and food handling practices, and perception and awareness of food hazards (Angelillo et al., 2000).

2.5.3. Food borne disease outbreaks in School Feeding Programmes

In February 2009, USDA reported a salmonella outbreak in a school lunch programme where a peanut butter manufacturer company was said to have served contaminated peanut butter to school children. As a result of this the USDA suspended and proposed to debar the Peanut Corporation of America from doing business with the USDA feeding programmes, including the school lunch programmes and food banks.

GAO (2003) recorded that eleven children were infected by E.coli O157: H7 in a school lunch in Finley, Washington in October, 1998. Three of these children developed haemolytic uremic syndrome, a potentially fatal disease that can result in anaemia and kidney failure. The school district was convicted of providing contaminated food to the school children and fined. The affected school children were each awarded at least $3.8 million.

Weaver et al., (1989) described a small epidemic of Salmonella typhi infection association with a school feeding programme, in which the source was traced to a cook.
The feeding programme which was introduced by Action Aid to the people of Manduar at Kenebar, Gambia, had three cooks providing a daily meal to 134 children of 8-15 years of age. Two months later, a case of typhoid infection was reported at the MRC clinic, followed over the next 10 years by 27 more. The patients included 26 children (12 male and 14 females ranging in age from 3 to 10 years), whose chief symptoms were fever, headache, constipation, and malaise. It was recorded that no patients had been immunized against typhoid fever, and 19 of the children infected attended the school feeding programme. The source of the infection was traced to the school feeding programme and stool cultures identified one of the cooks to be a carrier of Salmonella typhi.

Even though the GSFP reported of food poisoning in the school feeding programme in May 2007, currently there has been a report filed by Joy fm in February 2010 stating over one hundred (100) students of the Archbishop Porter Girls Senior high school in Takoradi being rushed to the Effiakwanta hospital after suspected food poisoning. Most of the students were reported to have complained of diarrhea, headache or both. Reports indicate contamination of grinding mill for tomatoes due to negligence of kitchen staff to clean or sanitise mill before reusing it.
2.6. Microbiological Hazards

Food borne disease with microbial origin is believed to be the most serious food safety problem (Nuer, 2001). The emergence of increased antimicrobial resistance in bacteria causing disease is aggravating this (FAO-WHO, 2007). Many raw ingredients are naturally contaminated with bacteria which may be capable of causing food poisoning for example Salmonella specie, Clostridium perfringens, Campylobacter, faecal coliforms and others (Tomlins et al., 2006). The authors elaborated that these bacteria may be present in raw foods such as meat and chicken and given the right conditions can cause illness.

2.6.1 Pathogenicity of Salmonella species

Salmonella a member of the family Enterobacteriaceae is a Gram negative bacilli growing aerobically and anaerobically at an optimum temperature of 37°C (98°F), readily killed by temperatures above 55°C (131°F) (Edward et al., 1978). It may be isolated from the intestines of man and animals from foods of animal origin. Salmonella organisms of various types are spread through contamination of water and food as well as by direct contact. An infection with salmonellae most commonly is rather acute, involving nausea, vomiting and diarrhea, and may develop into an enteric fever similar to typhoid (Guthrie, 1980). Diarrhoea may persist for several days, however, individuals differ in the resistance to this infection but generally morbidity is high in an outbreak (Frazier, 1967). The Centers for Disease Control and Prevention (2008) found that a large variety of high protein foods are involved in causing outbreaks of Salmonella infections. These include eggs, milk and milk products, meat and their products, chocolate.
Salmonellosis remains a significant public health problem. Both well-known and new food vehicles have recently been implicated in outbreaks in Europe and the United States (Ethelberg et al., 2008; O’Flanagan et al., 2008; Soler et al., 2008).

Recently, an outbreak occurred in the United Kingdom and Ireland and was caused by Salmonella enterica serotype Agona (O’Flanagan et al., 2008). It was reported that 119 patients in the United Kingdom and Ireland plus one case in Finland during the period of February to July 2008 were affected. The source of the outbreak strain was linked to a sandwich company in Ireland.

In Ghana, Mensah et al., (2002) in their study on street foods in Accra, isolated Salmonella arizonae from light soup.

2.6.2. Pathogenicity of Escherichia coli.

Escherichia coli (E. coli) is a member of the coliform group of bacteria and known as colon bacillus because of its natural habitat being the large intestine and primarily of intestine origin (Frazier, 1967; Smith, 1969). It is a gram negative bacillus growing aerobically and anaerobically at an optimum temperature of 37°C (98°F), readily killed by temperatures above 55°C (131°F). Its incubation period is 12 hours to 3 days and symptoms consist mainly of diarrhea.

E. coli is a major part of normal gut flora of most warm blooded animals. Not all of the many strains of E. coli are harmful. The organism is usually shed in faeces and most strains are harmless. However, a few are pathogenic to humans and are associated to food
borne diseases (Omaye, 2004). According to Hobbs et al., (1987), pathogenic or enterovirulent E. coli are divided into five groups based on their in the body:

1. Eteropathogenic (EPEC) is responsible for severe infantile diarrhea.

2. Enterotoxigenic (ETEC) produces a heat labile (LT) or heat stable (ST) toxin. Both may be produced by the same organism. They are agents of the following conditions:
   a) paediatric diarrhoea,
   b) severe cholera-like illness in adults in cholera areas
   c) travellers’s diarrhea, which may be both food and water-borne.

3. Enteroinvasive (EIEC) with invasive properties for the mucosa. They give rise to a dysentery-like disease, and they are restricted to a limited number of serotypes of largely unknown prevalence.

4. Enterohaemorrhagic (EHEC) is responsible for bloody diarrhea and colitis and somewhat distinct from bacillary dysentery since fever is not prominent and the bloody discharges are copious rather than scanty. One serotype, (O157:H7) has been incriminated.

5. Enteradherent (EAEC) according to the pattern of adherence to cells.

E. coli O157:H7 is the strain that causes the most severe food poisoning which affects three in every 10,000 people with the majority being children under age nine (Paradox and Odle, 2007). Their contamination results from unhygienic cooking practices. Symptoms of the disease are characterized by blood in stools, renal failure due to blood clots in the kidney tubules and internal bleeding due to lack of blood platelets resulting in brain damage, which can occur in severe cases (Garbutt, 1997).
2.6.3 Pathogenicity of Staphylococcus aureus

Staphylococcus aureus is a member of the genus Staphylococcus and consists of gram-positive cocci, with a diameter of 0.5 to 1.5µm. It is anaerobic and usually forms irregular clusters (Prescott et al., 1999). The organism can grow well in high concentration of salt solution and fairly tolerant to dissolved sugars. Toxins are formed by the organism growing in food before it is eaten and not after it has entered the body. Most of these toxins produced by the organisms can withstand heat (Hobbs et al., 1987). Hayes (1985) further asserts that the toxins are destroyed gradually during boiling for at least 30 minutes and may remain active after light cooking.

Brock and Madigan (1991) indicated that Staphylococcus aureus is a major cause of food poisoning and spread primarily by food handlers using poor sanitary practices. The most important source is in the human body with the principal reservoir being the nose. It can also be transferred into food through the hands, expulsion from the respiratory tract and other parts of the body.

Almost any food can be contaminated, but foods such as salad dressings, milk products and food kept at room temperature, rather than hot or cold, can also be contaminated. However, large numbers of the organism must be present in food for them to be hazardous; the precise number is not certain (Hayes, 1985). The author further noted that individuals differ in their susceptibility to Staphylococcus poisoning; some may become ill after ingesting food containing the toxin others may not.
Classical symptoms of Staphylococcal food poisoning appear rapidly, usually two to eight hours after the contaminated food is eaten. Such symptoms will usually last only three to six hours and rarely more than two days (Nester et al., 1995). Predominant symptoms are salivation, nausea, abdominal cramps, and diarrhea. Blood and mucus may be found in stools and vomit substance in severe cases. There may also be headache, muscular cramps, sweating chills, prostration, weak pulse, shock and shallow respiration (Anderson et al., 1969, Hayes, 1985).
CHAPTER THREE

3.0 METHODS

This chapter deals with the type of study design used, how the sampling was done, data collection and analyses.

3.1 Study Design

This is a cross-sectional descriptive study using both qualitative and quantitative methods for data collection. The study was in two parts; a field survey and a laboratory analysis.

The field survey was designed to find out the knowledge, attitude and practices of food handlers in the SFP by using questionnaires. Interview guides was also used for in depth interview with matrons on food safety issues. Observations were also made with a checklist to document the personal and environmental hygiene and also the manner of services of food handlers.

A laboratory analysis was microbiological assays conducted through experiments of culturing selected food samples on various media. Microbial growth on these food media were counted and analysed.

3.2. Study Location

The research targeted settlements in the Ga East Municipal area including Abokobi, Ashongman, Haatso, Dome, Kwabenya, Madina and Taifa. These communities were selected because most beneficiary schools are located in this Municipality and also records have it that an outbreak of food poisoning occurred under the SFP in May, 2007. The Ga East Municipal Assembly, formerly Ga East District, is located at the northern part of Greater Accra Region and covers a land area of 166 km². The capital of the
Municipal Assembly is Abokobi. The Assembly is boarded on the west by the Ga West Municipal Assembly (GWMA), on the east by the Adenta Municipal Assembly (AdMA), the south by Accra Metropolitan Assembly (AMA) and the north by the Akwapim South District Assembly. The estimated population by the Municipal Planning Coordinating Unit (MPCU) is about 650,200 people comprising 51% males and 49% females. The assembly can be described as peri-urban and has about 65 settlements. Madina, Haatso, Dome, Kwabenya, North Legon, Agbogba and Taifa are some of the urban communities while Adenkrabi, Akporman, Ayimensah, Otinibi, and Danfa are some of the rural communities.

Educational infrastructure is distributed quite fairly in the municipality. There are about 13 privately owned and 2 public senior high schools, 56 public and 58 private junior high schools. Also, there are about 64 public and 101 private primary schools with 32 public and 220 private Early Childhood Development Centres. The problems of inadequate and poor quality infrastructure in the public schools can be found throughout the Municipality. Currently, 20 public primary schools in the Municipality are included in the Ghana School feeding programme and 8 caterers have been contracted by the GSFP Secretariat to feed these children.

The Ga East Municipal Assembly wears a cosmopolitan hat and almost all the ethnic groups in the country exist in the Municipality, although Akans seem to have a slight majority over Gas, Ewes, Dangbes and the Gurs. Though the Municipality has a strong Islamic presence especially in and around Madina, Christianity remains the most
dominant form of religion for the people of the district. The major agricultural activities are crop and livestock production (Ga East District Profile, 2008).

Figure 3.1: Ga East Municipal Assembly Road Map (CERSGIS, 2010).
3.3 Study Population

Any food handler from the eight catering services in the municipality working under the school feeding programme was recruited in the study. These were:

- Cooks
- Cleaners
- Kitchen assistants
- Servers
- Drivers
- Matrons / Caterers

3.4 Sampling

3.4.1. Sample technique and sample size

Quantitative study

The study employed a non-probability sampling technique and a sample size of 75 food handlers from the eight catering services participated in the questionnaire surveys.

Food samples

The following two food types were obtained from the caterers based on their frequency on their menu.

1. ‘Waakye’ – rice and beans cooked together with sorghum stalk and eaten with sauce.
2. Rice and stew- stew was either ‘kontomire’ or tomato.

‘Waakye’ samples were collected from four of the caterers in the morning and afternoon shifts. The other four also had samples of their rice and stew collected from the morning.
and afternoon shifts; for each caterer two samples each of food were collected. In all 16 food samples were collected for quality control.

Foods served to pupils in selected schools were sampled at the points of serving. A total of 16 cooked food samples were collected in the morning and afternoon shift from eight caterers. Food samples were collected in sterilized containers, placed in Stomacher bags, sealed and labelled. The samples were then stored with ice chips in an ice chest and brought to the laboratory. Samples were worked on immediately. Those that could not be worked on immediately were stored in the refrigerator at 4ºC.

**Qualitative study**

The eight matrons/caterers from the eight catering services were interviewed on the measures being taken to ensure food safety in the SFP. Non-participant observation was made from the eight kitchens and eight schools.

**3.5. List of Variables**

**3.5.1. Dependent variables:** knowledge, attitude, practices toward food safety, microbial load in food.

**3.5.2 Independent variables:** age, sex, education, length of service, position in the service, food safety training programmes attended, feeding times and source of food.
3.6. Data Collection Tools

A structured questionnaire adapted from similar study (Buccheri et al, 2007), with both open and close-ended questions was used for collecting data from 75 food handlers. Questions asked were based on issues pertaining to food safety and food borne diseases.

An interview guide covering food safety issues was used to guide the discussion to limit deviations from the topics of interest. This was to appreciate measures being taken to ensure food safety.

Observation was made to investigate the hygienic condition under which food was prepared and served. This was done using a checklist from the Public Health Unit under Accra Metropolitan Assembly in observing activities in both kitchens and schools where children were being served. Non-participant Observation technique was used.

3.7. Microbiological Analysis

3.7.1 Preparation of media

The media used are listed below against their respective purposes. They were all prepared by adhering to the manufacturer’s specifications.

<table>
<thead>
<tr>
<th>MEDIA</th>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ringer solution (Oxoid)</td>
<td>As diluents</td>
</tr>
<tr>
<td>Plate count agar (Liofilchem)</td>
<td>Total viable count</td>
</tr>
<tr>
<td>Violet red bile glucose agar (Oxoid CM0485)</td>
<td>Total coliforms</td>
</tr>
</tbody>
</table>
Eosin methylene blue (Liofilchem)  Selective medium for E.coli
Baird-Parker agar (Oxoid CM0961)  Selective medium for staphy

3.7.2. Ringer solution (Oxoid)

One tablet of Ringer’s solution was dissolved in 500ml distilled water. This diluent was sterilized by autoclaving at 121°C for 15mins.

3.7.3 Plate Count Agar (Liofilchem)

Plate count agar (PCA), 23.5g agar; 1L distilled water.

The PCA (11.8g) was suspended in a 500ml conical flask containing 500ml distilled water which was plugged with non-absorbent cotton wool. The agar was allowed to soak and placed on fire until dissolved and autoclaved at 121°C for fifteen minutes. The PCA was cooled in a water bath to about 48-50°C.

3.7.4 Violet red bile glucose agar (Oxoid CM0485)

Violet red bile glucose agar (VRBGA), 38.5g agar; 1L distilled water.

The VRBGA (19.3g) was suspended in a 500ml conical flask containing 500ml distilled water which was plugged with non-absorbent cotton wool. The agar was allowed to soak, simmer until dissolved. This was then allowed to cool in a water bath to about 48-50°C.

3.7.5 Eosin methylene blue (Liofilchem)

Eosin methylene blue (EMB), 38g agar; 1L distilled water.

Nineteen grams EMB was suspended in a 500ml conical flask containing 500ml distilled water which was plugged with non-absorbent cotton wool. This was allowed to soak,
simmer until dissolved. This was then autoclaved at 121°C for 15 minutes and allowed to cool in a water bath to about 48-50°C.

3.7.6 Baird- Parker agar (Oxoid CM0961)

A 63g BPA was suspended in a 500 ml conical flask containing 90mls distilled water and heated to dissolve completely. The mixture was sterilized by autoclaving at 121°C for 15 minutes, cooled to 48°C and 1 vial RPF supplement (SR 122A) was added.

3.7.7. Preparation of samples for PCA, VRBGA, EMB, BPA

Ten grams of each food sample was weighed into a stomacher bag. To the 10g food sample, 90ml of sterilized ringer’s solution was added aseptically. This mixture was blended using the Seward stomacher blender for 60 seconds at normal to obtain a 1:10 dilution. A 1ml of the homogenized food was pipetted into a test tube containing 9ml of sterilized ringer’s solution. This was thoroughly mixed using a vortex and serially diluted to 10^-5.

3.7.8 Culturing of food samples on PCA, VRBGA, EMB, BPA

One millilitre of each dilution was pipetted into sterile petri dishes and ten millilitres of the required molten media was added, mixed well by gently swirling in a figure eight motion and allowed to set. There were duplicates for each medium used. Petri plates of set media were incubated in an inverted position; EMB, BPA PCA, VRBGA plates were incubated at 37°C for 24 hours.
3.7.9 Plate examination and colony counting

Colony counting was done for the food samples using the Stuart colony counter after incubation.

Colonies that were in sizes 5mm and above were counted. Dark coloured, violet colonies on VRBGA plates were counted as coliforms, dark green metallic sheen on EMB plates were indicative of *E. coli*, dark yellow to black colonies on Baird-Parker plates were presumptive of *Staphylococcus aureus*. Colonies on PCA were counted using size.

3.8. Quality Control

All interviewers and field assistants were trained in the content of the questionnaire, interview guide and checklists to ensure quality of data collected. The training was done with health research interview standards which involved, presentations, mock interviews amongst participants. To minimize non-response and language problem, the questionnaire was administered through face-to-face interview. Food samples were aseptically collected and transported to the Food Science laboratory, University of Ghana, on ice immediately after collection and stored at 4ºC until taken through bacteriological examination. The data collection tools were pre-tested in the Ga West Municipality with strict supervision of field assistants by the researcher.

3.9. Data Processing and Analysis

3.9.1 Field survey statistical analysis (Quantitative data)

The analyses were performed using SPSS version 16.0. Descriptive statistics was used to characterize the respondents and ascertain the prevalence to determine proper food safety
practices, knowledge and attitudes. Association between outcome variables and explanatory variables were examined using chi-square test of independence. In the analysis, knowledge, attitude and practices were the outcome variables and socio-demographic characteristics were regarded as explanatory variables.

A chi-square test of independence was conducted to explore if a relationship existed between dependent variables such as knowledge, attitude and practices and the independent variables including age, sex, education, length of service in the establishment and food safety courses attended.

3.9.2 Qualitative data

In-depth interviews were transcribed verbatim and analysed using Nvivo version 10 by organizing data by overall thematic trends and observations made were pre-coded and categorized into themes. The quantitative and qualitative data were triangulated to complement each other.

3.9.3 Microbiological data analyses

Colony forming units (CFU) were recorded for bacteria on PCA, VRBGA, EMB and Baird-Parker.

The colony forming units were determined by using Harley and Prescott (1990) formula:
Number bacteria/gram= average number of colonies x \frac{1}{\text{dilution factor}}
SPSS version 16 was used for the microbiological analysis. The microbial counts were compared with acceptable or standard microbial load of cooked foods. Differences between feeding times, source of food and microbial counts were established using t-test and one-way anova.

3.10. Ethical Concern

Ethical clearance was obtained from the Ghana Health Service Ethical Review Board. Permission was obtained from the Ghana School Feeding Secretariat and the Ga East Municipal Assembly. With this; a rapport was established with each of the Heads of schools involved. A consent form was completed by the caterers. Informed consent was also sought from the respondents who were assured of confidentiality on the day of interview and observation.

3.11. Limitations of the Study

Limitations of this study included:

- A small sample size of food handlers. A larger sample size may reveal more significant predictors on knowledge, attitude and practices.

- Non random selection of food samples because caterers allowed food to be sampled at their convenience. This may have affected the microbial load found in food samples.

- Lack of funds to do a detailed swab analysis of kitchens, personnel and bowls to confirm microorganism load.
➢ Reported behaviour could compound the limitations of the statistical design.

➢ Quality of the research is likely to be affected by very few sources of secondary data on food safety in school feeding programmes in Ghana.
CHAPTER FOUR

4.0 RESULTS

The results are presented in two parts, that is, results from the field survey and laboratory analysis. The field survey presents the socio-demographic characteristics of respondents, their knowledge, attitude, preventive measures toward food safety and sources of information on food safety. In addition, results on in depth interviews with matrons and observations made at the study sites are also documented. The second part of the results deals with the laboratory analyses on the microbial load of foods served at the schools.

4.1. Socio-demographic Characteristics of Respondents

The demographic and work related characteristics which are sex, age, educational level, position held in establishment, length of service, training in food handling and food preparation and also training in food safety and food borne disease of the seventy five respondents in the field survey are presented in table 4.1.

At the time of the survey, 75 food handlers were present for interview with majority (80.0%) of them being females. Majority of respondents (65.3%) were in the age group 35 or less. The most frequently reported level of education is junior high (32.0%) whiles those with no formal education were (12.0%). Majority of the respondents were cooks (33.3%) and kitchen assistant (30.7%).
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>N = 75</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEX</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>60 (80.0)</td>
</tr>
<tr>
<td>Male</td>
<td>15 (20.0)</td>
</tr>
<tr>
<td><strong>AGE</strong></td>
<td></td>
</tr>
<tr>
<td>Less than 18</td>
<td>3 (4.0)</td>
</tr>
<tr>
<td>19-35</td>
<td>46 (61.3)</td>
</tr>
<tr>
<td>36-44</td>
<td>15 (20.0)</td>
</tr>
<tr>
<td>45above</td>
<td>11 (14.7)</td>
</tr>
<tr>
<td><strong>EDUCATIONAL LEVEL</strong></td>
<td></td>
</tr>
<tr>
<td>No form education</td>
<td>9 (12.0)</td>
</tr>
<tr>
<td>Primary education</td>
<td>11 (14.7)</td>
</tr>
<tr>
<td>Junior high school</td>
<td>24 (32.0)</td>
</tr>
<tr>
<td>Senior high school</td>
<td>15 (20.0)</td>
</tr>
<tr>
<td>Others</td>
<td>16 (21.3)</td>
</tr>
<tr>
<td><strong>POSITION HELD IN ESTABLISHMENT</strong></td>
<td></td>
</tr>
<tr>
<td>Cook</td>
<td>25 (33.3)</td>
</tr>
<tr>
<td>Cleaner</td>
<td>7 (9.3)</td>
</tr>
<tr>
<td>Driver</td>
<td>9 (12.0)</td>
</tr>
<tr>
<td>Kitchen assistant</td>
<td>23 (30.7)</td>
</tr>
<tr>
<td>Others</td>
<td>11 (14.7)</td>
</tr>
<tr>
<td><strong>LENGTH OF SERVICE</strong></td>
<td></td>
</tr>
<tr>
<td>Less than 6mths</td>
<td>16 (21.3)</td>
</tr>
<tr>
<td>6mths-12mths</td>
<td>16 (21.3)</td>
</tr>
<tr>
<td>More than 1yr</td>
<td>43 (57.3)</td>
</tr>
<tr>
<td><strong>TRAINING IN FOOD HANDLING &amp; PREPARATION</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>30 (40.0)</td>
</tr>
<tr>
<td>No</td>
<td>45 (60.0)</td>
</tr>
<tr>
<td><strong>TRAINING IN FOOD SAFETY &amp; FOOD BORNE DISEASE</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>36 (48.0)</td>
</tr>
<tr>
<td>No</td>
<td>39 (52.0)</td>
</tr>
</tbody>
</table>
Majority of respondents (57.3%) had worked in the food service industry for more than one year. It is worth reporting that 21.3% had worked for less than 6 months and the same percentage for between 6 months and 12 months. Only 40.0% and 48.0% of the respondents have had training in food handling and food preparations whiles 48.0% had training on food safety and food borne disease.

4.2 Knowledge on Food Safety

To determine food handler’s knowledge on “food safety”, respondents were asked some questions on food preparation and preservation, hygiene standards and transmission of food borne diseases. The findings are presented in figure 1.

Figure 4.1: Respondents’ Knowledge on Food safety (N=75)
Majority (74.7%) of the respondents agreed that food prepared in advance may contribute to food poisoning and supported their answers with reasons like improper cooking, poor holding temperatures, mishandling practices like dipping finger in soup. A matron in an in-depth interview supports this by saying, “some foods are very delicate like groundnut soups and okro stew when cooked in advance can spoil when not stored properly, so I have decided not to serve them at all”.

A large number (98.7%) of the respondents also concurred that washing hands before handling food could reduce the risk of contamination. However, when asked to describe in chronological way all activities undertaken before and after cooking, most of them neglected the act of washing hands with soap before cooking and as and when the need demanded. The percentage of respondents (65.3) agreed that healthy people could cause illness by carrying germs to food whiles 34.7% disagreed.

Responses from few respondents when asked to give examples of food borne disease; malaria was most mentioned, followed by diarrhoea, AIDS, gonorrhoea the least mentioned. Only (24.0%) of the respondents agreed that food which has germs in it can be made safe.

4.3 Attitudes to Food Safety

Possible attitudes toward food hygiene and related issues have responses presented in Table 4.3
Table 4.3 - Attitudinal Responses of the Respondents (N=75)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Freq (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separation of raw food from cooked food</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>56 (74.7)</td>
</tr>
<tr>
<td>No</td>
<td>19 (25.3)</td>
</tr>
<tr>
<td>Defrosted food should not be refrozen</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>37 (49.3)</td>
</tr>
<tr>
<td>No</td>
<td>38 (50.7)</td>
</tr>
<tr>
<td>Protective clothes &amp; food poisoning</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>72 (96.0)</td>
</tr>
<tr>
<td>No</td>
<td>3 (4.0)</td>
</tr>
<tr>
<td>Temperature &amp; food spoilage</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>63 (84.0)</td>
</tr>
<tr>
<td>No</td>
<td>12 (16.0)</td>
</tr>
<tr>
<td>Improper food storage &amp; health hazard</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>75 (100.0)</td>
</tr>
<tr>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>Food services staff with covered cuts</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>55 (73.3)</td>
</tr>
<tr>
<td>No</td>
<td>20 (26.7)</td>
</tr>
<tr>
<td>Food services staff with diarrhoea</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>7 (9.3)</td>
</tr>
<tr>
<td>No</td>
<td>68 (90.7)</td>
</tr>
<tr>
<td>Food services staff without hairnet</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>12 (16.0)</td>
</tr>
<tr>
<td>No</td>
<td>63 (84.0)</td>
</tr>
</tbody>
</table>
Most respondents (74.7%) stated that raw food should be separated from cooked, but 25.3% declined the need of adopting this key measure to prevent cross-contamination. Although there was no vast difference in opinion on whether defrosted food should not be frozen since 49.3% said ‘yes’ and 50.7% disagreed. Virtually all respondents (96.0%) agreed that use of cap, masks, protective gloves; adequate clothing could reduce the risk of food poisoning. A narrative from an in-depth interview with a matron buttresses this point when she said “I educate my workers on good personal hygiene and food hygiene.”

Knowledge of refrigerator and freezer temperatures was agreed by 84.0% respondents could help reduce the risk of food spoilage and this was captured in the following narrative by one respondent when she said “It would help one store food in the right place so it doesn’t go bad”. Others indicated that the condition of the fridge whether it is working or not will also help you to store food well. Unfortunately none of the respondents know the correct temperature of a refrigerator. All respondent agreed that proper storage of foods that is the right temperature, play a significant role in preventing food spoilage and health hazard to consumers.

Disagreement to the statement: “food services staff with gloves can touch unwrapped food” was expressed (26.7%) whiles only 9.3% agreed food services staff with upset stomach or diarrhoea can handle food. However, probing further the majority (90.7%) who disagreed to this confessed practically it wasn’t implemented since they would take a drug to relieve the pain and resumed their work unless when condition was severe. Most of the respondents (84.0%) disagreed with food services without hair net handling food.
4.4 Practices to Food Safety (food borne- disease control measures).

Strategies to prevention and control food borne disease were investigated and the responses are presented in figure 4.2.

Figure 4.2: Food Safety Practices among Respondents’ (N=75)

Figure 4.2 shows that; an overwhelming majority (92.0%) of those who said they always washed their hands before touching cooked food also said they did that with soap (92.0%) whereas only 8.0% stated that they occasionally washed hands whiles touching cooked food. It was noted that 76.0% of the respondents stated that they always used separate kitchen utensils to prepare foods eaten raw and foods cooked whiles 24.0% did that occasionally.
Majority of respondents (73.3%) did always check shelf life of food products while buying them with 26.7% doing that occasionally. On the average, checking shelf life of foods products while buying them is a usual practice by the respondents. This was confirmed by all caterers in in-depth interviews by checking the expiry dates and freshness of food items before purchase. Periodic medical examination is not a regular practice by the respondents as 73.3% occasionally did go for periodic medical examination with 26.7% doing it always.

4.5. Socio-demographic Factors Associated with some Knowledge, Attitude and Practices to Food Safety.

Chi-square test for independence was used to analyze the data to find out whether respondent’s knowledge, attitude and practices on food safety (Dependent variable) were influenced by the independent variables of age, sex, educational level and position held in the establishment, length of service, training in food preparation and food safety issues.
Table 4.5. Socio-demographic Factors Associated with some Knowledge, Attitude and Practices to Food Safety.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>% (N)</th>
<th>Chi-square ($\chi^2$)</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge about food preparation &amp; food poisoning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>83.3(60)</td>
<td>0.845</td>
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</tr>
<tr>
<td>Male</td>
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</tr>
<tr>
<td><strong>Educational level</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>66.7(9)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Primary education</td>
<td>81.8(11)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior high school</td>
<td>83.3(24)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior high school</td>
<td>73.3 (15)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>93.8 (16)</td>
<td>12.309</td>
<td>4</td>
<td>0.015</td>
</tr>
<tr>
<td><strong>Knowledge about carriers of germs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \leq 35 )</td>
<td>73.5 (49)</td>
<td></td>
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</tr>
<tr>
<td>36+</td>
<td>50.0(26)</td>
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<tr>
<td>Cook</td>
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<td>Cleaner</td>
<td>42.9(7)</td>
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<tr>
<td>Driver</td>
<td>100.0(9)</td>
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<tr>
<td>Kitchen assistant</td>
<td>60.9 (23)</td>
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<td></td>
</tr>
<tr>
<td>Others</td>
<td>90.9(11)</td>
<td>11.678</td>
<td>4</td>
<td>0.020</td>
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<tr>
<td><strong>Attitude to refreezing defrosted food</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Educational level</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>No education</td>
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<td></td>
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<tr>
<td>Primary education</td>
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<td>Junior high school</td>
<td>41.7(24)</td>
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<td>Senior high school</td>
<td>53.3(15)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Others</td>
<td>81.2(16)</td>
<td>10.568</td>
<td>4</td>
<td>0.032</td>
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</table>
### Table 4.5. Socio-demographic Factors Associated with some Knowledge, Attitude and Practices to Food Safety.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>% (N)</th>
<th>Chi-square ($\chi^2$)</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attitude to temperature and food spoilage</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Training in food safety and food borne disease</td>
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<td>28.2(39)</td>
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<td>0.003</td>
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<tr>
<td><strong>Attitudes to food service staff touching wrapped food</strong></td>
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<td></td>
</tr>
<tr>
<td>Educational level</td>
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<tr>
<td>No education</td>
<td>100.0(9)</td>
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</tr>
<tr>
<td>Primary education</td>
<td>63.6 (11)</td>
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<tr>
<td>Junior high school</td>
<td>54.2(24)</td>
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<tr>
<td>Senior high school</td>
<td>93.3(15)</td>
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<td>Others</td>
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<td><strong>Practices on separating kitchen utensils</strong></td>
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<td>Female</td>
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<td>Cook</td>
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<tr>
<td>Cleaner</td>
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<td>Driver</td>
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<td></td>
</tr>
<tr>
<td>Kitchen assistant</td>
<td>26.1(23)</td>
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<td></td>
</tr>
<tr>
<td>Others</td>
<td>9.1(11)</td>
<td>20.076</td>
<td>4</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Training in food safety &amp; food borne disease</strong></td>
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<td></td>
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<tr>
<td>No</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11.1(36)</td>
<td>6.305</td>
<td>1</td>
<td>0.012</td>
</tr>
</tbody>
</table>
### Table 4.5. Socio-demographic Factors Associated with some Knowledge, Attitude and Practices to Food Safety.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>% (N)</th>
<th>Chi-square ($\chi^2$)</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Practices on checking shelf life of food products</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>81.7(60)</td>
<td>10.653</td>
<td>1</td>
<td>0.001</td>
</tr>
<tr>
<td>Male</td>
<td>40.0(15)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Position in establishment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cook</td>
<td>84.0(25)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaner</td>
<td>42.9(7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driver</td>
<td>44.4(9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitchen assistant</td>
<td>73.9(23)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>90.9(11)</td>
<td>10.362</td>
<td>4</td>
<td>0.035</td>
</tr>
<tr>
<td><strong>Training in food handling&amp; preparation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>62.2(45)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>90.0(30)</td>
<td>7.102</td>
<td>1</td>
<td>0.008</td>
</tr>
</tbody>
</table>

df= degrees of freedom,  P< 0.05

**4.5.1 Socio- demographic factors associated with knowledge on food safety.**

There was a statistically significant relationship between males and females agreeing to food prepared in advance contributing to food poisoning ($\chi^2 = 0.845, p = 0.003$). Females (83.3 %) were more likely to know this than males 46.7%. Significance level was also attained on educational levels with response to food prepared in advance contributing to food poisoning ($\chi^2 =12.309, p = 0.015$). Persons with other education such as certificate in catering were 93.8 % more likely to also know that food prepared in advance could contribute food poisoning followed by education at junior high school (83.3%), primary school (81.8%), senior high (73.3%) and those with no education (66.7%).
A chi-square of 4.131 and p value of 0.042 indicated that age when regrouped into two categories had a significant relationship on knowing a healthy person can be a carrier of germs. Food handlers aged 35 and less were more likely to agree to this than those of age 36 and above (73.5% and 50.0%) respectively. Position of establishment also had a significant relationship on this assertion where almost drivers also agreed to this ($\chi^2 =11.678$, $p = 0.020$). Drivers had a multi task sometimes serving or assisting in kitchen if need be.

(Table 4.6), sex, education, age and position held in establishment were found to be statistically significant with $p<0.05$.

4.5.2 Socio- demographic factors associated with attitude to food safety.

Educational level was found to influence ones response on refreezing defrosted food ($\chi^2=10.568$, $p=0.032$). Those with other education such as certificate in catering had 81.2% responding ‘yes’ to the statement defrosted food should not be refrozen. This was followed by senior high (53.3%), junior high (41.7%), primary education (36.4%) and those who had no education being (22.2%).

Those who reported to attending food safety training had a less positive attitude toward knowledge in temperature and food spoilage (2.8%) as against those who reported not having training (28.2%). This indicates that food safety training has a statistically significant relationship on attitude to knowledge in temperature and food spoilage ($\chi^2=9.006$, $p=0.003$).
There was a statistically significant relationship between education and attitude to food service staff touching unwrapped food ($\chi^2 = 11.401, p=0.022$).

(Table 4.6), education and reported food safety training attended were found to be statistically significant with p<0.05

**4.5.3 Socio- demographic factors associated with practices on food safety.**

There was a statistically significant relationship between males and females reporting to behave in a safer manner separating kitchen utensils for raw and cooked foods ($\chi^2 = 13.322, p = 0.000$). Position in establishment was also found to influence ones response to this assertion ($\chi^2=20.076, p=0.000$).

Persons reported to be trained in food safety and food borne diseases were found to be less likely to report on safe behaviour in separating kitchen utensils for raw and cooked foods (11.1%) as against those reported not trained in food safety (35.9%). This was statistically significant indicating training in food safety and food borne diseases can influence reported safe behaviour in separating kitchen utensils for raw and cooked foods ($\chi^2=6.305, p=0.012$).

With a ($\chi^2=, p=0.012$), sex had a significant relationship with reported practices on checking shelf life of food products. Position in establishment and reported training in food handling and preparation also had a significant relationship with reported practices on checking shelf life of food products ($\chi^2=10.362, p=0.035$) and ($\chi^2=7.102, p=0.008$) respectively.

(Table 4.6), sex, education, position in establishment and reported training in food handling and preparation were found to be statistically significant with p<0.05.
4.6 Sources of Information

The most cited sources of information on food safety and prevention of food borne diseases were mass media (66.7%), followed by in-service training on food hygiene (24%). Others were learnt from mums (10.7%), matron (4%) and supervisors (3%).

4.7 Observations Made in Institutions

Observations were carried out in eight kitchens of the caterers under the SFP as well as being followed to the schools being served in the Ga East Municipal Area. This was to investigate the personal hygiene, environmental hygiene and manner of services food handlers. A checklist from the Public Health Unit of the Accra Metropolitan Assembly was adopted to suit the study. The checklist was grouped under personal hygiene, environmental hygiene and manner of services

4.7.1. Personal hygiene of the food handlers

It was observed that good personal hygiene was mostly practiced by servers. They wore clean aprons and caps. Cooks, kitchen assistants, cleaners hardly wore neat clothes probably due to the nature of their work and not being exposed to the public. An appreciable number of them had covered their hair either with scarf or cap. However, male food handlers did not practice this. Wearing of gloves was not a common practice by many food handlers especially in the kitchens. Food handlers in the kitchen were seen to dip their hands in a bowl of water to pick some hot foods like yam, kenkey, scooping cooked rice with a bowl without gloves. Hand washing before cooking was also not well
practiced by many nevertheless, those who visited the toilet always made the effort to wash their hands.

4.7.2. Environmental hygiene
Sanitation in the kitchens was poor. Most of the caterers had make shift kitchens in their homes where food is prepared. The building structures were mostly wooden making it difficult to clean. However, it was comforting to see the floors being concreted. Because of water shortage, majority of the caterers stored water in containers and often fetched water with bowls or cups ending up dipping their hands in the water; with a few having polytanks and fetching directly from them. Since most of these kitchens are make shifts, they are actually not big in size, thus affecting ventilation, lighting and storage facilities. It was good to see toilet facilities and changing rooms being provided by many caterers. Refuse was well kept in refuse bins and emptied frequently. It was very worrying to notice that almost all the kitchens where accidents could easily occur did not have first aid boxes.

4.7.3. Manner of services
All but one kitchen were situated off the school compound. This meant having to transport food from kitchens to the schools. Few of the caterers had their private vans for this; with majority hiring commercial vehicles like “trotro” or taxi depending on proximity and quantity of food being delivered. Some of these commercial vehicles were not in their best state. They were rickety, not well maintained and could serve as hiding
places for cockroaches, mice etc. Most of the beneficiary schools practiced the shift system where food was delivered in the morning and afternoon groups. However, caterers who lived far off from schools sometimes resorted to keeping food in food warmers from morning till the afternoon. Food was put in big polythene bags before placing them in these food warmers; usually for the staple foods like yam, rice, kenkey, banku etc. but soups and sauces are kept in big saucepans. The right temperatures of this food could not be guaranteed. It was observed that many pupils were served food in their own bowls. This was a bit disturbing since they were not supervised in washing the bowls before being served. Some schools did not have storage facilities for water and this made washing of hands unsafe. A bowl of water was provided by most caterers for pupils to wash hands and bowls at the same time. Foods were usually served in the open where food could be easily contaminated by dust. There was no permanent eating place for the kids; they either hanged around or ate in their classrooms. Supervision was very poor by both teachers and caterers.

4.8 Microbiological Evaluation of Food Samples

This part of the results presents the total viable counts, coliform counts, presence or absence of E. coli and Staphylococcus aureus. The results from table 4.9 indicate total viable count to be highest in food samples taken from St. Dominic RC School with Kwabenya D/A Primary being the only school with no count. Food sampled from Nwantanang 5&6 Primary, St. Dominic RC, Redco D/ A and Abokobi Presby Primary had total coliform counts. Food samples examined were found to contain staphylococcus aureus with the exception of food from Dome Anglican KG and Kwabenya D/A Primary.
All food samples were devoid of E. coli. with the exception of food sampled from Redco D/ A and Abokobi Presby Primary, Nkwantanang 1&2 Primary. There was no difference between the feeding times and microbial count of food sampled.
## Table 4.8 Microbial Content of food samples

<table>
<thead>
<tr>
<th>Source</th>
<th>Name of food sample</th>
<th>Feeding time</th>
<th>Mean colonies forming unit per gram (cfu/g)</th>
<th>Total viable count</th>
<th>Total coliform</th>
<th>Staph</th>
<th>E. coli</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dome Anglican KG</td>
<td>Rice with tomato stew</td>
<td>M</td>
<td>1.0 x 10^2</td>
<td>ND*</td>
<td>ND*</td>
<td>ND*</td>
<td>ND*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>3.0 x 10^2</td>
<td>ND*</td>
<td>ND*</td>
<td>ND*</td>
<td>ND*</td>
</tr>
<tr>
<td>Kwabenya D/A Primary</td>
<td>Rice with kontomire stew</td>
<td>M</td>
<td>ND*</td>
<td>ND*</td>
<td>ND*</td>
<td>ND*</td>
<td>ND*</td>
</tr>
<tr>
<td></td>
<td>Rice with kontomire stew</td>
<td>A</td>
<td>ND*</td>
<td>ND*</td>
<td>ND*</td>
<td>ND*</td>
<td>ND*</td>
</tr>
<tr>
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<td></td>
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<td>Madina Estate Primary</td>
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<td>A</td>
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<td>1.5 x 10^2</td>
<td>2.4 x 10^2</td>
<td>5.7 x 10^2</td>
<td>1.1 x 10^2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>2.0 x 10^2</td>
<td>2.2 x 10^2</td>
<td>4.0 x 10^2</td>
<td>1.5 x 10^2</td>
<td></td>
</tr>
<tr>
<td>Abokobi Presby Primary</td>
<td>Waakye</td>
<td>M</td>
<td>1.3 x 10^2</td>
<td>ND*</td>
<td>1.2 x 10^2</td>
<td>1.2 x 10^2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>1.2 x 10^2</td>
<td>ND*</td>
<td>1.3 x 10^2</td>
<td>1.8 x 10^2</td>
<td></td>
</tr>
</tbody>
</table>

ND* = Not Detected

However, there was a difference in the microbial count of foods sampled and the source of food. Total coliform count was found to be statistically significant (p<0.001) in establishing differences in the source of food.
CHAPTER FIVE

5.0 DISCUSSION OF RESULTS

The results are discussed in light of the Conceptual framework.

5.1 Background of Respondents

In the study it was found that food handlers in the School Feeding Programme in the Ga East municipality were mostly females. This confirmed DFIP/CPHP report (2005) that majority of cooked food vendors in Africa were women, therefore acted as a livelihood support for the female headed households.

The educational background of respondents was impressive with 88% of the respondents having had some form of education and majority attaining education to the junior high level. This finding corroborates the study of Mensah et al., (2002), who found that most street food vendors in Accra were educated.

Many of these workers did not have training on food preparation and food handling which suggest they were not certified food handlers. Askarian et al., (2004) in his study, found that only one food handler had a certificate in food preparation and food hygiene.

5.2 Comparative Analysis of Responses to ‘Knowledge, Attitudes and Practices to Food Safety ‘Questions’.

Results show that many of the food handlers had sufficient knowledge to ensure proper preparation and preservation of food such as the knowledge about the risk associated with preparing food in advance which is likely to contribute to food poisoning when not stored well, or cooked properly. They also did know that washing of hands before handling food
and sanitizing all cooking utensils could reduce the risk of contamination. Knowledge on healthy people being likely to carry germs to food was well expressed. This agrees with Department of human resources (2007), who stated that healthy people can cause illness by carrying germs to food. However, majority of food handlers did not fare well when asked to give the correct temperature of a refrigerator and examples of food borne disease. This confirms the findings of a survey by Askarian et al., (2004) who determined knowledge, attitudes and practices of food service staff regarding food hygiene in Shiraz and food handlers lacked knowledge on food pathogens and the right temperature for hot and cold foods.

The survey revealed a general positive attitude toward safe storage practices involving temperature control and correct handling of food using adequate clothing and gloves, sharing of utensils for raw and cooked foods. Unlike other studies, which generally reported discrepancy between safe beliefs versus unsafe practices, in the current study, comparatively better results were obtained for responses on practices than knowledge and attitudes (Angelillo and Viggiani, 2001; Askarian et. al., 2004). Washing hands before touching cooked food and using soap in washing hands were general practice reported by food handlers. These results contradict the findings of Buccheri et al., (2007), in their study.

In Italy Buccheri et al., (2007) reported that older staff had significantly better knowledge on food safety but this was not true in the present study where younger staff had a better
knowledge of healthy people being possible carriers of germs. Educational level was found to have influenced knowledge regarding risk associated to preparation of food in advance. This finding agrees with results of Italo et al., (2000), that knowledge was found to be significantly higher among those with higher educational level. Female respondents were more likely than males to checking shelf life of food products. This finding does not agree with other surveys on food handlers’ food safety behaviours that found protective practices more common in the male gender (Askarian et al., 2004).

Generally, results on persons reported trained on food safety and food borne disease had a less positive attitude toward knowledge in temperature and food spoilage and were less likely to self report practising separating raw food from cooked food. Interestingly, this finding corroborates with results of a study by Bas et al., (2006) that although training may bring about an increased knowledge of food safety, it does not always result in a positive change in food handling behaviour.

Overall, statistical significance was associated with some independent and dependent variables; we therefore refuse the null hypothesis that there is no significant association between food handlers’ socio- demographic information and their knowledge, attitude and practices towards food safety.

5.3 Comparative Analysis of Microbiological Safety of Food Served by Caterers

Generally the knowledge of food handlers on food safety was not translated into their activities. Lack of proper personal and environmental hygiene and appropriate
infrastructure did not support hygienic food service. There seemed to be a correlation between the services offered by the catering services under the SFP and the level of contamination of foods at the different schools. Observations made on food handlers’ premises of the kitchens and school environment for serving food suggested their contribution to this. The microbial counts of the food from the school with the worst hygiene practices (food handlers not neatly dressed and poor kitchen environment), were the highest (maximum count of $3.17 \times 10^4$ CFU/g), but were least at the school with the best facility (food handlers seen in neat aprons, wore head gear and gloves as well as a clean kitchen and school environment) (0 CFU/g). This observation suggests that the hygienic conditions under which food is prepared and served contribute to the contamination of food. Several authors have confirmed the need for good personal and environmental hygiene to prevent contamination of food (Brock and Madigan, 1991; Fox and Cameron, 1989).

The microbial counts of all food samples ranged from $1.0 \times 10^2$ CFU/g to $3.17 \times 10^4$ CFU/g. According to Fung et al., (1980) ranges of $10^{3-4}$ CFU/g represents intermediate counts, $10^{5-6}$ CFU/g as high counts and beyond $10^6$ CFU/g represents an index of food spoilage. The data suggest that the foods were not spoilt. However, the presence of total coliforms in 8 food samples is indicative of possible insanitary practices which challenges the microbiological safety of the foods served. According to ICSMF (1976), foods considered wholesome for consumption must not have any coliforms (0 CFU/g).
Staphylococcus aureus was identified in eleven foods sampled from the schools. The count obtained from this microorganism from foods sampled ranged between $1.2 \times 10^2$ CFU/g - $9.7 \times 10^3$ CFU/g. According to Garbutt (1997), the number of cells required to secrete enough toxins to produce a Staphylococcal disease is estimated to be about $5.0 \times 10^6$ CFU/g of the food ingested or higher. Thus the data suggest that the Staphylococcal count of food could not produce a Staphylococcal disease. However, their detection is very important for microbiological safety considerations. *S. aureus* is part of the normal microflora of the skin of human (Hobbs and Roberts, 1987). The authors further state that an estimated 30 – 50% of the human populations are nasal, throat and skin carriers who could transfer this species to food through cross-contamination by avoiding proper hand washing practices. Inferring from the sources of *Staphylococcus aureus*, observations made suggest some food to have been cross-contaminated from not wearing gloves, inappropriate hand washing practices, and improper personal hygiene from observations made.

The presence of E. coli, a faecal coliform in some foods sampled is an indicator of inadequate hygiene practices. Downes and Ito (2001) stated faecal coliforms to be indicator organisms whose main source is the large intestine of mammals and their presence may suggest faecal contamination. The author however, indicated that their presence does not necessarily mean foods were associated with faecal material, since the organism occurs naturally in the soil. Paradox and Ordle (2007), however, suggested that the presence of E. coli in foods has a food borne disease significance. This is because
certain strains such as E. coli O157: H7 is pathogenic which causes a severe food poisoning with children particularly being susceptible to it. Hobbs and Roberts (1987) further asserted that E. coli contamination mostly results from unhygienic food handling practices.
CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The data obtained suggest most food handlers had basic knowledge on food safety issues. However, this was not well translated into their activities and behaviours. Generally, food safety measures amongst most catering services providers in the SFP in the Ga East Municipality are inadequate.

6.2 Recommendations

The recommendations given here are geared towards the need for more research as well as implications for health promotion programmes.

- The study should be extended to beneficiaries of the GSFP in other municipalities using the study design employed in this work to give a better profile of the situation in the country. This would help in developing structures that will promote safe food to school children. Future studies should include comparison of each catering service’s knowledge, attitude and practices to food safety and the load of microorganisms in their food.
- The GSFP secretariat must ensure certified food handlers are involved in the programme.
- The GSFP secretariat should provide an enabling environment that is, providing cooking and serving utensils, regular payments to caterers to ensure smooth running of the programme.
➢ Health inspectors must continuously ensure proper food safety in the programme. This can be possible if a quality control system is incorporated into all operations.

➢ GSFP secretariat and Ministry of Local Government must provide pre-service and in-service training support on food safety which can motivate behavioural change.

➢ GSFP secretariat must strengthen their monitoring and evaluation system.

➢ Ministry of Education must encourage good hygiene practices amongst pupils.
REFERENCES


APPENDIX 1: QUESTIONNAIRE FOR FOOD HANDLERS

FOOD SAFETY IN THE SCHOOL FEEDING PROGRAMME IN THE GA EAST MUNICIPAL AREA.

NAME OF INTERVIEWER________________________________________________

DATE__________________________________________________________________

LOCATION_____________________________________________________________

Good morning/afternoon, Sir/Madam:

We are conducting a survey on food handler’s knowledge, attitude and practices on food safety and would be grateful if you could spare some time to answer a few questions on this subject.

_____________________________________________________________________

Section A (Demographic Characteristics)

1. Age: less than 18 □ 19-35 □ 36-44 □ 45+ □

2. Sex: M □ F □

3. Education level

   No formal education □ Primary education □ Junior high school □

   Senior high school □ others, specify □

4. What position do you hold in this establishment?

   Cook □ Cleaner □ Driver □

   Kitchen assistant □ Others, specify ____________________________
5. How long have you worked in food service industry?

   less than 6mths☐   6mths – 12 mths☐   More than 1yr ☐

   Others, specify___________________________________________.

6. Have you any training in food handling and preparation?

   Yes ☐   No ☐

7. Have you had any training in food safety and food borne diseases?

   Yes ☐   No ☐

8. If yes, describe two things you learnt__________________________________________

   __________________________________________________________

   __________________________________________________________

Section B. Knowledge

The questions below are about knowledge of food preparation and/or preservation, hygiene standards and transmission of food borne diseases. Please answer by checking yes or no where necessary explain further.

9. How can food be contaminated?

   __________________________________________________________

   __________________________________________________________

   __________________________________________________________

10. Is food prepared in advance likely to contribute to food poisoning?

    Yes ☐   No ☐

    Explain your answer__________________________________________

11. Describe in chronological way all activities you undertake

    - During cooking____________________________________________
12. Why is it important to properly wash and sanitise all cooking utensils?

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

13. Can washing hands before handling food reduce the risk of contamination?

Yes □ No □

Explain your answer___________________________________________________

_________________________________________________________________

_________________________________________________________________

14. What can contribute to making food unsafe?

_________________________________________________________________

_________________________________________________________________

15. What measures would you take to prevent food being unsafe as identified in Question 14 above?

_________________________________________________________________

_________________________________________________________________

16. Name one food borne disease?

_________________________________________________________________

17. Can healthy people cause illness by carrying germs to food?

Yes □ No □
18. Do you think food can be made safe if it has germs in it?

Yes ☐ No ☐

Explain your answer_______________________________________________

19. How do you know food has gone bad? _____________________________

________________________________________________________________

C) Attitudes

The following statements describe possible attitudes toward food hygiene and related issues. Please indicate your agreement (yes) or disagreement (no) with each of the

Explain further where applicable.

20. Raw food should be kept separated from cooked food

Yes ☐ No ☐

21. Defrosted food should not be refrozen

Yes ☐ No ☐

Explain your answer________________________________________________

__________________________________________________________________

22. Using cap, masks, protective gloves and adequate clothing reduce the risk of food poisoning.
23. Is it important to know the temperature of the refrigerator/freezer to reduce the risk of food spoilage?

Yes □ No □

Explain your answer______________________________________________________________
______________________________________________________________________________

24. Improper storage of foods may be cause of health hazard to consumers

Yes □ No □

25. Food services staff with gloves can touch unwrapped food.

Yes □ No □

Explain your answer______________________________________________________________
______________________________________________________________________________

26. Food services staff with upset stomach or diarrhoea can handle food.

Yes □ No □

Explain your answer______________________________________________________________
______________________________________________________________________________

27. Food services staff without cap or hair net can handle food.

Yes □ No □
D. Food borne-Diseases Control Measures

The questions below refer to measures for food borne diseases prevention and control. Please answer to each question, by checking *always or occasionally* according to your use and explain further where applicable.

28. Do you wash your hands before touching cooked food?

   Always □   Occasionally □

29. Do you use soap in washing your hands?

   Always □   Occasionally □

   Explain your answer________________________________________________
   ___________________________________________________________________

30. Do you use separate kitchen utensils to prepare foods eaten raw and foods cooked before eaten?

   Always □   Occasionally □

31. How do you thaw frozen food?

   Exposed □   how___________________________
   _________________________________________

Explain your answer________________________________________________
_________________________________________________________________
32. How do you store leftover food?

In the open ☐ Fridge ☐ Freezer ☐
Others specify________________________________________

33. Do you check shelf life of food products while buying them?

Always ☐ Occasionally ☐

34. What do you look out for when buying perishable food?

____________________________________________________________________
____________________________________________________________________

35. Do you have periodic medical examinations?

Always ☐ Occasionally ☐

36. When you have a cut what do you do? ________________________________

____________________________________________________________________

37. What do you do when you have a fever, diarrhoea or running stomach when you are on duty?________________________________________________

____________________________________________________________________

E. Information

38. From where do you get information about food safety and prevention of food borne disease?
i. Education courses on food hygiene

ii. Audio/visual materials

iii. Mass-media

iv. Other (please specify)_________________________________

THANK YOU!!!!!!!!!!!!!!
APPENDIX 2: INTERVIEW GUIDE FOR MATRONS

I am ...................................................... from the school of public health, university of Ghana. I am conducting a research as part of my academic work in trying to assess current food handling practices in school feeding programme. I selected your institution and you happen to be one of my respondents who will help me answer some questions about the issue. Confidentiality of this conversation is assured. But before I start I need to seek your permission and time to go ahead. Do you agree to be part of the study?

Yes, I agree / No, I disagree

1. Where do you get your food items from?

2. How are the food items presented in the market?

3. What are the qualities you look out for when buying food items?

4. Food items brought to your premises how are they
   - stored?
   - handled?
   - cooked?

5. What measures do you take in preventing food borne diseases in your establishment? (In terms of personnel, kitchen environment and manner of services)

6. What suggestions can you give in ensuring that the SFP secretariat helps in promoting food safety in the programme?
APPENDIX 3: OBSERVATIONAL GUIDE (CHECK LIST).

SANITATION REPORT IN CATERING SERVICES

<table>
<thead>
<tr>
<th>Date:</th>
<th>Name of establishment:</th>
<th>Inspector:</th>
</tr>
</thead>
</table>

**Hygiene**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
</tr>
</thead>
</table>

**Personal Hygiene**

1. Do food handlers wear protective clothing?
2. Do they wear caps?
3. Do they wear gloves when touching unwrapped food?
4. Do they wash their hands after using wash room and before cooking?
5. Do they talk a lot while handling food?
6. Is there anyone with an open cut?
7. Do they cough or sneeze directly on food?

**Environmental hygiene**

8. Is the catering service establishment in environment situated away from open drains, sewage and refuse?
9. Is there adequate lighting in the kitchen?
10. Is there adequate ventilation in the kitchen?
<table>
<thead>
<tr>
<th>Hygiene</th>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environmental hygiene</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Are walls painted and clean?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Are floors concreted and clean?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Are there cobwebs at corners/ceilings?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Does the establishment have toilet facilities, its location and cleanliness?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Does the facility have a store room and how clean is it?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Where is their source of water?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. If water is not supplied by pipe how is it stored?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Is the size of kitchen utensils, equipment appropriate, and how clean are they?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. How is refuse kept?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Is there a first aid box?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Manner of services</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. How is food transported to schools?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Is food well covered and in right temperatures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Are bowls, cups and spoons well washed before serving food?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. How is food served? Is the eating environment clean?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 4: CONSENT FORM

A Study on Food Safety in the School Feeding Programme in the Ga East Municipal Assembly.

School Of Public Health

Department of Social and Behavioural Sciences

College of Health Sciences

University of Ghana

Paulina Saah Owusu, Researcher

You are being requested to participate in our study on “Food Safety in the School Feeding Programme in the Ga East Municipal Assembly”. This study seeks to assess food handling practices of the programme. The findings of this study will help make recommendations that will address food safety issues confronting the programme. Participation in this research study is voluntary and you may wish to terminate participation if you so wish. Before agreeing to be part of this study, please read and/or listen so as to understand the following information carefully. You are free to ask questions for better understanding.

1. Description of Procedure. If you accept to participate in this study, you will (may) be asked to meet with investigators for an interview and answering of questionnaires on food safety and you will be observed in your activities when necessary.

2. Risks and Inconveniences. Possibly, the discussions may take longer than the anticipated time. If some of the questions in the interviews make you feel uncomfortable,
you can choose not to answer certain questions, take a break and continue later or choose
to stop the discussion or interview.

3. **Benefits.** Through your participation, you will help us to better understand what your
concerns are in order that improvements on education and training will be made on your
behalf.

4. **Confidentiality.** Information obtained from you during the study will be confidential
and your privacy will be protected at all times. You will not be identified individually in
any way as a result of your participation in this research. However the data to be
collected may be used for academic publications.

5. **Voluntary Participation.** Your participation in this study is entirely voluntary. You
may refuse to participate in this study and this will not have any negative consequences
for you. If you begin to participate in the research, you may at any time discontinue for
any reason without any negative consequences.

6. **Other considerations and questions.** If anything seems unclear to you, feel free to
ask any questions. Please consider this research and consent form carefully before
signing.

_____________________________________________________________________

**Authorization:** I have read or listened to the above information and I have decided that I
will participate in the above study. The researcher has explained to me and answered my
questions with regards to the study. I know what will be asked of me. If I don't
participate, there will be no penalty or loss of rights. I can stop participating at any time, even after I have started.

I agree to participate in the study. My signature/thumbprint below also indicates that I have received a copy of this consent form.

Name of participant (please print): ………………………………………

Participant’s signature/thumb print: …………………

Date: ……………………………………………………

Name of interviewer: ……………………………………………………

Signature of interviewer: …………………………………………………

If you have further questions about this study, please contact:

The principal investigator, Paulina Saah Owusu,
Department of Social and Behavioural Science,
School of Public Health, University of Ghana, Legon.
Telephone number: 0244 266279

Primary supervisor: Dr. Mrs. Matilda Steiner-Asiedu,
Department of Food Science and Nutrition,
University of Ghana, Legon.
Telephone number: 0245447875
APPENDIX 5: Identification of Microorganisms

*From left to right:* Total coliforms and E. coli
From left to right: Staphylococcus aureus and Total viable count respectively
### APPENDIX 6: One-way Anova table

Comparing microbial counts of food and sources of food sampled

<table>
<thead>
<tr>
<th>Microbes</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total viable count</td>
<td>2.175</td>
<td>0.149</td>
</tr>
<tr>
<td>Total coliform</td>
<td>63.026</td>
<td>0.000</td>
</tr>
<tr>
<td>Staph</td>
<td>1.669</td>
<td>0.244</td>
</tr>
<tr>
<td>E. coli</td>
<td>1.822</td>
<td>0.209</td>
</tr>
</tbody>
</table>