

**AKENTEN APPIAH-MENKAH UNIVERSITY OF SKILLS TRAINING AND
ENTREPRENEURIAL DEVELOPMENT
DEPARTMENT OF HOSPITALITY AND TOURISM EDUCATION**

**FOOD SAFETY IN SENIOR HIGH SCHOOLS IN KWAHU EAST DISTRICT,
EASTERN REGION**

DORA DARKO

MARCH, 2023

**AKENTEN APPIAH-MENKAH UNIVERSITY OF SKILLS TRAINING AND
ENTREPRENEURIAL DEVELOPMENT**

DEPARTMENT OF HOSPITALITY AND TOURISM EDUCATION

**FOOD SAFETY IN SENIOR HIGH SCHOOLS IN KWAHU EAST DISTRICT,
EASTERN REGION**

DORA DARKO

7201180040

**A DISSERTATION IN THE DEPARTMENT OF HOSPITALITY AND
TOURISM EDUCATION, FACULTY OF VOCATIONAL EDUCATION,
SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES, AKENTEN
APPIAH-MENKA UNIVERSITY OF SKILLS TRAINING AND
ENTREPRENEURIAL DEVELOPMENT IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF
CATERING AND HOSPITALITY DEGREE**

MARCH, 2023

DECLARATION

STUDENT'S DECLARATION

I, DORA DARKO, declare that this Dissertation, except for quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my original work, and it has not been submitted, either in part or whole, for another degree in the Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development or elsewhere.

SIGNATURE: DATE

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work were supervised under the guidelines for supervision of Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development.

NAME: **DR. GILBERT OWIAH SAMPSON**

SIGNATURE DATE

DEDICATION

I dedicate this work to my husband Mr. Edmund Atta Asante and my sons Papa Kojo

Amoah Acquah and Obrempong Yaw Antwi Asante.

ACKNOWLEDGEMENTS

First, all thanks and praise to almighty God for the guidance and protection.

A document of this nature could not have been completed without the support, encouragement, technical and professional guidance of some individuals whose efforts and contribution have to be acknowledged.

My sincere thanks and gratitude go to Dr. Gilbert Owiah Sampson, whose corrections and suggestions greatly contributed to the success of this work.

I am also grateful to my brother, Mr. Richard Owusu Darko His constant encouragement and an early morning visit to my room to urge on me to begin this remarkable journey, the final part of which is this dissertation cannot go unacknowledged. I am very grateful to you, Bro.

Finally, my gratitude goes to my late parent Mr. S.D. Owusu and Miss Ida Narh, my principal Mr. Sampson Botchey and all my colleagues of Abetifi Kyemase Technical for their support and prayers towards my education and to Esther Tenkoreng and all my family members, I am very grateful to you.

TABLE OF CONTENTS

CONTENTS	PAGE
DECLARATION	ii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
TABLE OF CONTENTS	v
LIST OF TABLES	viii
ABSTRACT	x
CHAPTER ONE	Error! Bookmark not defined.
INTRODUCTION	Error! Bookmark not defined.
1.1 Background of the Study.....	Error! Bookmark not defined.
1.2 Problem Statement	Error! Bookmark not defined.
1.3 Main Objective.....	Error! Bookmark not defined.
1.3.1 Specific Objectives.....	Error! Bookmark not defined.
1.4 Research Questions	Error! Bookmark not defined.
1.5 Significance of the study	Error! Bookmark not defined.
1.6 Organization of the Study	Error! Bookmark not defined.
CHAPTER TWO	Error! Bookmark not defined.
LITERATURE REVIEW	Error! Bookmark not defined.
2.1 The Concept of Food Safety.....	Error! Bookmark not defined.
2.2 Food Safety in Schools.....	Error! Bookmark not defined.
2.3 Quality of Food	Error! Bookmark not defined.
2.4 The flow of food contamination.....	Error! Bookmark not defined.

2.5 Sources of Food Contamination	Error! Bookmark not defined.
2.5.1 Atmosphere	Error! Bookmark not defined.
2.5.2 Water	Error! Bookmark not defined.
2.5.3 Food Products.....	Error! Bookmark not defined.
2.5.4 Humans.....	Error! Bookmark not defined.
2.5.5 Food Equipment	Error! Bookmark not defined.
2.6 Food Safety Knowledge	Error! Bookmark not defined.
2.7 Hazard Analysis and Critical Control point analysis	Error! Bookmark not defined.
defined.	
2.8 Barriers to Food Safety Practices	Error! Bookmark not defined.
2.9 Model guiding the study.....	Error! Bookmark not defined.
2.10 Chapter Summary.....	Error! Bookmark not defined.
CHAPTER THREE	Error! Bookmark not defined.
METHODOLOGY	Error! Bookmark not defined.
3.1 Study Design	Error! Bookmark not defined.
3.2 Population.....	Error! Bookmark not defined.
3.3 Sampling Technique and Sample size.....	Error! Bookmark not defined.
3.4 Data collection instruments	Error! Bookmark not defined.
3.5 Data Analysis	Error! Bookmark not defined.
3.6 Ethical Considerations.....	Error! Bookmark not defined.
CHAPTER FOUR	Error! Bookmark not defined.
RESULTS AND DISCUSSIONS	Error! Bookmark not defined.
4.1 Introduction	Error! Bookmark not defined.

4.2 Socio-Demographic Characteristics of Respondents	Error! Bookmark not defined.
4.3 Employment Profile of Respondents.....	Error! Bookmark not defined.
4.4 Knowledge of Food Safety of Respondents	Error! Bookmark not defined.
4.5 Food Safety Practices and Approaches of Respondents ...	Error! Bookmark not defined.
4.6 Source of contamination in student-served foods	Error! Bookmark not defined.
4.7 Obstacles to Food Safety Practices among Food Handlers.....	Error! Bookmark not defined.
4.8 Chapter Summary.....	Error! Bookmark not defined.
CHAPTER FIVE.....	Error! Bookmark not defined.
SUMMARY, CONCLUSION, AND RECOMMENDATIONS.	Error! Bookmark not defined.
5.1 Introduction	Error! Bookmark not defined.
5.2 Summary	Error! Bookmark not defined.
5.3 Main Findings	Error! Bookmark not defined.
5.4 Conclusion.....	Error! Bookmark not defined.
5.5 Recommendation.....	Error! Bookmark not defined.
REFERENCES.....	Error! Bookmark not defined.
APPENDIX	Error! Bookmark not defined.

LIST OF TABLES

- Table 1: Number of food handlers in selected Senior High Schools**Error! Bookmark not defined.**
- Table 2: Socio-Demographic Characteristics of Respondents **Error! Bookmark not defined.**
- Table 3: Employment Profile of Respondents**Error! Bookmark not defined.**
- Table 4: Food Safety Knowledge Dimensions of Respondents.... **Error! Bookmark not defined.**
- Table 5: Approaches and Practices of Food Safety..**Error! Bookmark not defined.**
- Table 5 (contd): Approaches and Practices of Food Safety**Error! Bookmark not defined.**
- Table 6: Obstacles to Food Safety Practices**Error! Bookmark not defined.**

LIST OF TABLES

Figure 1: Conceptual framework of food safety practices**Error! Bookmark not defined.**

Figure 2: Sources of contamination**Error! Bookmark not defined.**

ABSTRACT

This study aimed to investigate the food safety practices of food handlers in Senior High Schools in the Kwahu East District. A cross-sectional design underpinned by the positivist philosophy was used for the study. Sixty-nine (69) food handlers were surveyed using an Observation Checklist and Questionnaire. The majority (53.6%) of the respondents obtained their knowledge of food preparation through formal education and training. The study revealed a knowledge and practice gap in food safety, particularly in defrosting frozen foods. Respondents in surveyed boarding secondary schools in the Kwahu-East District had an appreciable practice regarding food safety, but their knowledge was below their practice level when comparing the means. Environmental hygiene (5.00(0.00)), food hygiene (4.6(0.00)), and Health and personal Hygiene (3.12 (0.04)) were the three major domains where respondents showed relatively good practices. The study also identified various factors that hinder the implementation of appropriate food safety measures, including defective and

insufficient equipment and supplies, irregular water supply, minimal space, an open kitchen layout, and a busy work schedule. The study further revealed poor personal hygiene of food handlers (46%), inadequate cleaning of cooking materials (25%), dirty kitchens (10%), and poor disposal practices of garbage (19%) as sources of food contamination in student-served foods. The study recommends that the Kwahu-East District Assembly and School Administrators take necessary steps to enhance food safety practices among food handlers in the Senior High Schools in the district to avoid foodborne diseases.

CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

Food is a fundamental need for human growth since it is essential for life support and its acquisition, production, and intake (Daniyan & Nwokwu, 2011). *Food* is defined as any item in a liquid or solid form that may be consumed orally to give energy for the body's growth and development and critical nutrients. Due to the abundant nutrients they contain, microbes also need them for development. Food is undoubtedly directly related to health (Daniyan & Nwokwu, 2011). Thus, preventing contamination from water, the environment, dust, surfaces, equipment, insects, rodents, and people handling food is essential. The commercial and institutional sectors comprise the two main subsectors of the hospitality sector. According to Marzano (2010), institutional catering generally involves serving meals to customers as an adjunct to the primary product or service being offered and to the community. Examples include catering for the police and the military and schools, clinics, care homes, and childcare facilities. This industry's non-profit focus, which often operates within a budget, is one of its defining characteristics (Tan, Rifan, Khalid, Musa & Anuar, 2015). The budget allotted may typically cover a monthly, termly, or academic year period, depending on the institutional operation's policy, like in the case of boarding senior high schools.

In Ghana, the catering industry in schools has been cited as a source of the spread of foodborne diseases, accounting for 77% of all foodborne infections detected in the country (Alale, 2013). The number of outbreaks of foodborne illness covered in the media is evidence of this. For instance, according to medical professionals, forty (40) students from Adonten Senior High School in the Eastern Region were sent to

the hospital with food poisoning after consuming dinner there (City FM online, 2013). Another report also shows that 20 students from Awudome Senior Secondary School (AWUSCO) in Awudome-Tsito in the Ho-West District were sent to the Ho Regional Hospital with possible cases of food poisoning after ingesting food from their dining hall. According to a different account, 15 students from North Ridge Senior High School in Adeiso, Eastern Region, were sent to the Adeiso Health Centre after ingesting food from their dining hall and showing signs of possible food illness (City FM online, 2013).

There is a worldwide concern for maintaining food safety in all operations and institutions that handle food due to the constant outbreak of foodborne illness outbreaks (Sanlier & Konaklioglu, 2012; Lues & Van Tonder, 2007). According to Keener (2005), food safety refers to a food's quality that will allow ingestion without carrying a disproportionate risk of harm, illness, or fatality. As an alternative, the WHO (1984) defined *food safety* as the circumstances and actions required throughout food preparation, manufacturing, processing, storage, and distribution to guarantee that it is secure, sound, healthful, and suitable for human consumption.

The Food and Drugs Authority (FDA), the Public Health Units or Environmental Health Department, Metropolitan Municipal and District Assemblies (MMDAs), and the Ho Municipal Assembly (HMA), with particular emphasis on the Ghanaian context, have established rules and regulations to manage the operations of food handlers in all food operations to ensure the delivery of adequate food to consumers. These rules include receiving a medical report every year, wearing protective gear like hand gloves and hair restraints, maintaining overall hygiene, and providing proper vermin control in areas where food is prepared to prevent contamination, among other things (HMA, 2012; FDA, 2013).

1.1 Problem Statement

Food has a crucial role in a person's overall development, and school lunches play a significant role in pupils' overall mental and physical development. Their poor dietary supplementation makes them more vulnerable to foodborne illnesses, especially babies and children. The provision of meals to pupils in a boarding school environment typically complements the formal teaching provided. This is done to keep an eye on students' eating patterns while they are away from home and to ensure that the food is balanced nutritionally and prepared to avoid infection.

Unfortunately, most foodborne outbreaks are linked to schools, defeating this goal. Despite this, Ghanaian food researchers have paid less attention to the infrequent occurrence of foodborne illnesses in schools and have concentrated on the commercial food industry, emphasizing street foods and sellers. As a result, there is a lack of information in the literature about epidemiological statistics on the safety and quality of school meals, especially those provided in boarding secondary schools.

To determine the sanitary quality of the food served to students in boarding schools, it is also essential to identify the practices employed during the storing, cooking, and serving food. Food handlers at boarding schools tend to use subpar methods for preparing and storing food, maintain low personal hygiene standards, and lack awareness of food safety procedures. This study intended to fill a gap in the literature by investigating the food safety practices used by food handlers at Senior High Schools in Kwahu East District (Abetifi).

1.2 Research Questions

The study will attempt to answer the following questions;

1. How knowledgeable are food handlers about food safety issues?

2. How effectively did those who handled food adhere to food safety?
3. What were the sources of contamination in student-served foods?
4. What obstacles did food handlers face while trying to adopt food safety procedures?

1.3 Main Objective

The primary objective of the study is to investigate the food safety practices of food handlers in Senior High Schools in Kwahu East District (Abetifi).

1.3.1 Specific Objectives

The specific objectives of the study are to:

1. Examine the knowledge of food handlers on food safety,
2. Analyze the food handlers' approaches to food safety,
3. Identify the causes of food contamination in the student meals, and
4. Identify the obstacles to food handlers implementing best practices for food safety.

1.4 Significance of the Study

In addition to adding to the domain of research on food safety, this research will highlight existing concerns about the food safety procedures followed by food handlers while storing, preparing, and serving meals to students in High Schools in Ghana. Moreover, it will provide vital data to health and sanitation inspectors on the behaviours of food handlers in boarding high schools, enabling them to develop and alter strategic plans or guidelines for the efficient regulation and oversight of their actions. The study's findings will also compel decision-makers and administrators to

implement appropriate food safety initiatives to address the study's identified impediments to food safety procedures. The findings will also let school administrators and management know how well their kitchen staff adheres to proper hygiene standards and how to handle food safely. This will therefore guide the need to develop and execute health education programs to enhance their understanding of food safety and hygiene practices to lower health risks associated with school meals.

1.5 Organization of the Study

The research is in five main segments. The study's background, the issue statement, the research questions, the study's aims, and its importance were all covered in the introduction chapter of chapter one. The review of relevant literature on food safety in food service enterprises is covered in the second chapter. The notion of food safety, food safety in schools, the microbiological quality of food, contamination sources, the principles of the flow of food, food safety knowledge, practices, and obstacles to food safety practices are just a few of the different topics covered. The model directing the investigation was further emphasized in the chapter. This served as the foundation for creating the study's conceptual framework. The study's methods were thoroughly described in Chapter 3. The research design, target population, data sources, difficulties encountered during fieldwork, data processing, and presentation were all covered in this. In chapter four, data analysis from the field was given, and the study's conclusions were further examined in light of the literature review and conceptual framework. The key findings were compiled in the concluding chapter. It also included the study's findings and conclusions, followed by pertinent advice.

CHAPTER TWO

LITERATURE REVIEW

2.1 The Concept of Food Safety

According to Moreaux (2014), maintaining food safety is all about managing food properly along the whole food chain to prevent contamination, which might result in foodborne disease. This kind of safe handling necessitates a deliberate effort on behalf of the food handler while keeping the consumer's health in mind. According to the World Health Organisation (2000), providing safe food is an essential human right. Despite this, naturally occurring pathogenic bacteria that cannot be recognized by organoleptic means commonly infect a variety of foods (seen, smelled, or tested). However, they can still result in illnesses of various severity, even death, particularly if exposed to environments encouraging the growth and contamination of such microbes (WHO, 2000). Getachew (2010) asserts that dangerous compounds in food directly affect food safety. They tend to contaminate food by affecting its wholesomeness and ultimately causing disease, injury, or illness to people when consumed when their presence exceeds permitted limits.

Nyamari (2013) and Moreaux (2014) include physical or unpleasant dangers, such as rust, grime, hair, machine parts, nails, bolts, toothpicks, fake or artificial nails, and particles of nail polish, stones, and jewellery. In addition, physical pollutants that can be detected in food include needles, pins, stone or wood fragments, plastic or metal shards from kitchen or tableware, and paper and cigarette butts. Physical food safety risks are, in fact, foreign or alien to food since they were not originally part of its makeup. They enter the food supply due to improper handling at any stage of food preservation, preparation, and delivery. Physical food safety issues are much less likely to result in widespread harm than chemical ones since they are simpler to

identify. However, if consumed, they may be harmful to health. For instance, they may result in wounds to the mouth, throat, teeth, gums, and intestines (Getachew, 2010; Grintzali & Babatsikou, 2010).

Microorganisms, often known as microbes, and their byproducts, such as toxins, are biological dangers that may make people sick if they consume contaminated food (NRAEF, 2006). Bacteria, viruses, protozoa, moulds, parasites, and fungi are a few examples. Foods that are toxic to people on their own are also biological dangers. These are naturally present in several fish and mushroom species. Generally, biological hazard-related diseases are categorized as infections or intoxications (NRAEF, 2006). An infection occurs when hazardous bacteria are present in food, whereas intoxication occurs when the microorganisms' toxins or poisons are consumed.

Food can become chemically contaminated by environmental pollution of the land, water, and atmosphere. For instance, the chemicals in soils caused by untreated sewage or irrigation result in higher levels of absorption by food crops, which can contaminate the food crops (Karanja et al., 2010). Another cause of food crops' pathogen contamination and heavy metal absorption is uncured animal manure (Lagerkvist, Hess, Okello, Hansson & Karanja, 2013).

A food service establishment may get contaminated with food. As a result, the food handler's job is to employ methods that can lower contamination. In order to reduce the number of germs in food to a safe level, one of these techniques is correctly heating it to the internal minimum temperature (Guilford County Department of Public Health, 2011). The significance of hygiene and how it impacts food safety is also emphasized in the FAO/WHO (2008) report. It advises cooking food in dedicated places for that purpose, keeping these areas clean at all times, and

keeping them away from contaminants (including garbage, sewage, dust, and animals).

2.2 Food Safety in Schools

Due to the enormous number of servings delivered to students each day and the possibility that any epidemic may affect many pupils, food safety is crucial to school catering (Osaili et al., 2013). "Schools are the only institutions that can reach almost all adolescents and are in a unique position to enhance teenagers' education and health conditions throughout the nation (CDC, 2005). Schools, among other large institutions, take a significant chunk of government budgets because of their delicate role, especially in industrialized nations (Winson, 2008). However, among various food service businesses, school catering is the most commonly linked to foodborne illness outbreaks (Seaman, 2010; Sanlier & Konaklioglu, 2012).

Similar circumstances were recorded in Portugal, where 31% of outbreaks between 1993 and 2000 were connected to schools and kindergartens. A 2012 annual report from the Malaysian Ministry of Health found that schools were involved in 62% of foodborne outbreak events (WHO, 2003; 2004). Everyone should be worried about food safety problems in schools as a result, particularly when outbreaks of foodborne diseases significantly negatively impact the school environment (Marx, 2008).

Typically, school catering companies make a variety of foods in considerable numbers in the same kitchen. Many hands are needed to prepare meals for many students at once, which might create a risk environment for microbiological contamination and raise the possibility of food contamination due to improper handling (Annor & Baiden, 2011). Hygienic food preparation and instruction of

people engaged in storing, preparing, processing, and serving meals must be employed in schools as they serve as essential first lines to avoid most foodborne diseases (Gibson, Rose, Haas, Gerba & Rusin, 2002).

2.3 Quality of Food

Every meal has an appropriate bacterial count that will not make people sick when consumed. However, germs over what is considered tolerable might seriously endanger public health. According to Oranusi et al. (2013), a high amount of contamination suggests poor food handling and storage practices, which increases the risk of disease transmission. Food storage, preparation, and service processes include handling, moving, and contacting food ingredients. Because of this, the microbiological quality of prepared meals might be affected. Food handling errors at all production phases, preparation, storage, and even serving has often been a factor in most contaminated foods that have caused foodborne illness outbreaks (Alale, 2013).

The existence of the indicator organism, which is directly related to the microbiological quality of food, is determined by the types of food safety and hygiene procedures breached. According to Nik Rosmawati, Wan Manan, Noor Izani, and Nik Nurain (2014), indicators of food safety and hygiene standards include "total plate counts (TPC), total coliforms (TC), *Escherichia coli*, *Bacillus cereus* (*B. cereus*), *Staphylococcus aureus*, and *Salmonella spp*".

The ability of food to encourage microbiological growth has been a significant focus of research conducted worldwide on the microbiological quality of foods as a health risk. A study was done in Ghana to look into the microbiological quality of the street food available in Accra. 69.7% of the 511 dishes chosen from the menu included mesophilic bacteria. Unacceptable amounts of microbiological

contamination were present in "salads, macaroni, fufu, omotuo, and red pepper." Some food samples contained human diseases such as *Shigella sonnei*, *Salmonella arizonae*, *Enteroaggregative*, and *E. coli* (Mensah, Yeboah-Manu, Owusu-Darko & Ablordey, 2002). The authors claimed that vendors needed instruction in hygiene since street food could be a source of enteropathogenic bacteria. Another study conducted in 2012 by Saba and Gonzalez-Zorn to assess microbial food safety in Ghana found alarming levels of food contamination. The authors recommended a coordinated effort to reduce the prevalence of diseases caused by contaminated food.

Although some are caused by physical or chemical contamination, microbiological contamination is unquestionably the leading health risk of school meals (Esen & Owusu, 2013). The type of food and the preparation method affect the microbial infection risk. It is safer to cook the food right before eating it rather than cooking it and storing it at room temperature (WHO, 1984). Additionally, dirty, insufficiently cleaned, or improperly cleaned cooking equipment can introduce microbes into processed foods. It is ideal for processing equipment that comes into touch with food to be constructed in a way that allows for sufficient cleaning, sterilization, and upkeep to stop microbial contamination.

2.4 The Flow of Food Contamination

Food travels through many steps before it reaches the consumer's table, which is one of the sources of food contamination. The path that raw food products at a catering company must take from the point of purchase and receipt through storage, preparation, cooking, holding, chilling, and reheating before being served to the customer is called the food flow (NRAEF, 2006). Any step along the way might lead to contaminated food. A key idea in the flow of food is the regulation of time and

temperature, which significantly impacts the causes of foodborne diseases. As a result, how healthy food handlers comprehend and apply the ideas of the flow of food will determine how successfully food is ensured to move safely through these stages.

The transmission of bacteria from one food or surface to another is known as cross-contamination. It is a significant threat to the food movement and the most critical source of food contamination. Most stomach illnesses are caused by cross-contamination. Cross-contamination was identified as the primary factor contributing to an outbreak of Salmonellosis and Staphylococcal food poisoning (Varghese, George & Nayak, 2013; Chandran, 2012). The most frequent sources of cross-contamination in the kitchen are the hands of food handlers, contaminated cooking and prepping instruments, and the positioning of exposed raw foods to food items in a refrigerator or other holding equipment (Abd Patah, Issa & Nor, 2009). Microorganisms can get into food in the kitchen in two ways: directly or indirectly. Food gets contaminated by tools, utensils, cutting boards, and improper storage methods. This is called "indirect contact." On the other hand, direct contact happens when people who work with food do not wash their hands after touching raw or cooked food. Cross-contamination can happen at any point in the cooking process, so it is easy to stop it by putting up physical or procedural barriers (NRAEF, 2006).

2.5 Sources of Food Contamination

The key environmental factors that might cause microbial contamination in food are air, water, food products, people, and equipment.

2.5.1 Atmosphere

In essence, airborne moisture droplets and dust both contain bacteria. They are temporary and vary depending on the specific habitat they are located in while not growing in the dust. High-temperature, low-humidity, dust- and moisture-free air is known to have a low concentration of microorganisms (Krieg, 1984; Sneath, 1986). However, if the environment contains a source of infections, bacteria and viruses of many sorts can be transmitted through the air (for example, domestic animals and open drainage systems). Food preparation and delivery should occur in an atmosphere that is clean, tidy, devoid of apparent filth, and sanitized, rather than in an unclean one where dirty water, flies, dust, and domestic animals are abundant, according to the WHO (2010). Therefore, limiting microbial contamination of food from the environment is critical to removing all potential sources, managing dust particles, and lowering air humidity.

2.5.2 Water

Water has no odour, colour, or taste in its purest form. On the other hand, human and animal activity continues to threaten the safety of drinkable water. Water is used in manufacturing, processing, and, in some instances, storing foods. It is also an ingredient in a lot of processed meals. As a result, water quality can considerably influence the microbiological quality of foods. Although drinkable water is free of coliforms and bacteria, inadequately treated water may include pathogenic and spoilage microbes that induce undesirable reactions when eaten.

2.5.3 Food Products

Product-induced sources of food contamination include the food's natural composition, which, if it contains enzymes, can lead to its disintegration and destruction (Getachew, 2010). The decaying process does not produce a very pungent smell when carbohydrates make up the bulk of a food's composition. Unlike meals that possess a high concentration of proteins and lipids, spoiling can result in a wide range of disagreeable odours. Furthermore, several internal and external variables influence whether microbial development preserves or spoils food. Temperature, humidity, gases (carbon dioxide and oxygen), and microbes in food are all extrinsic variables. The food's intrinsic features include its pH, moisture content, water activity or availability, oxidation-reduction potential, physical qualities, nutritional availability, and the enhanced probability of natural antibacterial agents (Rath & Patra, 2012). These circumstances are favourable for the development of microbes in food.

2.5.4 Humans

The most frequent causes of contamination along the phases of the flow of food are human-induced; hence preventing foodborne disease requires proper handling of food during its preparation, storage, and serving. Food products pass through several hands between the processes of manufacture and consumption. Food contamination from these hands has been linked to the spread of illness, particularly with packaged foods. It has been observed that people who work with food do not practice good hygiene. They may not wash their hands properly or avoid touching their faces while they work. However, the danger of microbial food contamination is significantly increased when food is prepared or served, when people taste cooked

food with their fingers or the same spoons many times without thoroughly cleaning up after each use, and when food is defrosted or refrozen in at room temperature (Omemu & Aderoju, 2008).

2.5.5 Food Equipment

Many different types of machinery are used in the food manufacturing process. Microorganisms from the air, raw foods, water, and humans can readily infect this equipment, contaminating processed meals. According to Aarnisalo, Tallavaara, Wirtanen, Maijala, and Raaska (2006), food processing equipment is a significant source of food contamination due in part to its unsanitary design. Food safety can be compromised if all places are not thoroughly cleaned and sterilized; this is especially true of hard-to-reach or cramped spaces, which provide ideal conditions for developing and spreading hazardous and decaying organisms. Cross-contamination can also originate from improperly cleaned small equipment and utensils, such as cutting boards, knives, spoons, and similar items. Therefore, they must be colour-coded for a particular use while handling food with tools and utensils (WHO, 2010). For instance, the easiest way to avoid food poisoning or contaminating other foods is to use different cutting boards, knives and bowls for raw and cooked meals (Jevsnik, Hlebec, & Raspor, 2008). To lower bacteria levels in food, it is also crucial to properly clean and sanitize tools and equipment regularly.

2.6 Food Safety Knowledge

Learning can take the shape of formal or informal education, direct experience, or indirect learning through the experiences of others (Glanz & Lewis, 2002). Workers in the food service industry must receive extensive training and

education to guarantee they have the skills and knowledge to meet all of the restaurant's food safety regulations. Training workers in a food service facility has increased their awareness of food safety issues (Pirshaeb, Almasi, & Rezaee, 2010; Afolaranmi et al., 2014). For this reason, the World Health Organization (2000) and others agree that training and education are crucial to the HACCP approach.

Due to its central role in the cognitive processing of information on the attitude-behaviour relationship, it is generally assumed that knowledge is immediately transferred into behaviour (Glanz & Lewis, 2002) and, ultimately, practice (Simelane, 2005). According to research by Chapman et al. (2010), a food safety information sheet led to favourable changes in the habits of food handlers in a food service setting. Education on food safety can be improved by training. However, this does not necessarily lead to better practices while handling food. Most food handlers are overconfident in handling food properly, even though their actions indicate otherwise (Fawzi & Shama, 2009).

Although food handlers were shown to have a generally favourable outlook on food safety, this was found to be at odds with their actual behaviour in a study by Angelillo, Viggiani, Rizzo, and Bianco (2000). However, food poisoning can be caused by a lack of information about food hygiene and failing to put that knowledge into practice (Ehiri & Morris, 1996). When workers in the food service industry have the necessary information and use safe handling procedures correctly, they can significantly reduce the incidence of foodborne illnesses in their establishments.

Studies have established a correlation between food workers' demographics and their level of knowledge about food safety (Osaili et al., 2013). Female respondents were shown to have more outstanding food safety awareness ratings than male respondents when gender was considered (Sanlier & Konaklioglu, 2012). Males

may not have as much experience in the kitchen as females, which may explain why women are more likely to be aware of and adhere to food safety guidelines. Akonor and Akonor's (2013) research found no statistically significant difference in participants' genders' awareness of food safety issues. Therefore, there was no significant difference in response rates across sexes concerning food safety knowledge ($p > 0.05$). One possible explanation for this finding is the rise in male literacy rates in the GSS Population Report (2003).

Similarly, findings from other investigations corroborated their conclusion (Norazmir et al., 2012; Nee & Sani, 2011). Conversely, there is a ripple effect between age and food safety awareness. According to Sanlier and Konaklioglu (2012), people's understanding of food safety improves with age. As a result, those under 30 acknowledged the highest need for improved food safety education. Some researchers have also discovered no correlation between age and food safety awareness (Annor & Baiden, 2011; Martins, Hogg, & Otero, 2012). Sun, Wang, and Huang (2012) found the opposite accurate, reporting that younger respondents had a higher understanding of food safety than their older counterparts.

2.7 Hazard Analysis and Critical Control Point Analysis

A management approach called "Hazard Analysis and Critical Control Points (HACCP)" examines and manages biological, chemical, and physical hazards to ensure food is safe to consume at every step. It begins with the manufacturing, purchasing, and processing raw materials and concludes with the distribution and consumption of the final good (Sohrab, 1999; Sauer, 1998). HACCP practitioners monitor their operations and adjust to eliminate or reduce possible hazards to food quality and consumer health (Sun & Ockerman, 2005). Bas, Yuksel,

and Cavusoglu (2007) claim that it is one of the most crucial methods for protecting against potentially harmful diseases in food. The HACCP system was developed from seven guidelines in the FDA Food Code (cited in McSwane et al., 2003). Those things are:

1. Analyze the Risks
2. Establish critical control limits (CCP) that must be met at each specified CCP in food preparation
3. Create checks and balances for CCPs
4. Make a plan for what to do if monitoring shows a crossed threshold.
5. In order to ensure that the HACCP system is functioning correctly, it is necessary to establish processes.
6. Create a system of reliable record-keeping to document the HACCP approach.

HACCP is as crucial in a school's catering business as in any other restaurant or cafe. Food handlers will be more motivated to ensure student safety if they see that school administration and management are behind the HACCP concept's application across the entire Flow of Food (FoF). Problems that may arise while processing or serving can be avoided with the help of the Hazard Analysis and Critical Control Points system (McSwane et al., 2003). The HACCP system can reduce the prevalence of foodborne illnesses and improve the quality of food preparation and service (Sun & Ockerman, 2005).

The first step of a HACCP plan in school catering is hazard analysis (HA), which involves making a list of all the foods on the menu and pinpointing the locations of any harmful contaminants (biological, chemical, and physical). Next, the food preparation flowchart is updated to include the identified danger areas, and CCPs are determined for the potentially hazardous food items. Procedures in a food processing

system that can be regulated to prevent, remove, or reduce hazards to an acceptable level are known as critical control points (CCPs) (Grintzali & Babastikou, 2010). Time, temperature, moisture, and organoleptic qualities are all quantifiable aspects of the CCPs. The HACCP program will be established, which will aid in the production of safer foods for students to consume by displaying the various foods available, identifying potential CCPs and threshold values, monitoring the CCPs, taking appropriate measures if incidents occur, verifying the HACCP plan, and finally maintaining appropriate records (Sun & Ockerman, 2005).

2.8 Barriers to Food Safety Practices

Barriers to food safety practices greatly limit food service personnel's safe food handling skills. Numerous studies on every continent have identified the primary barriers to implementing safe food handling standards in restaurants and other food service establishments. Green and Selman (2005) conducted a qualitative study with eleven focus groups of food service employees and supervisors to identify what variables influenced the safe use of seven food preparation procedures. This study's findings suggest a lack of management enforcement to guarantee that food workers wear protective clothing and follow food safety requirements, as well as inadequate availability of equipment and resources. Participants also mentioned a lack of food safety education and training contributing to dangerous behaviours.

A study by Ackah, Gyamfi, Anim, Osei, Hansen, and Agyeman (2011) looked at the socioeconomic status, level of hygiene education, and food safety procedures of street food vendors in several areas of Accra. Due to a lack of resources, ignorance, and lax enforcement of food safety measures by authorities, the researchers found that medical examination certifications were challenging.

Aziz and Dahan (2013) surveyed school cafeteria workers in Malaysia to assess their food safety mentality and investigate the factors that may prevent them from following best practices. According to the findings of this research, most food handlers believed that the inconvenient placement of kitchen equipment posed challenges to implementing food safety behaviours. It was indicated that a lack of established food guidelines could be referred to in the event of mishandling. Furthermore, workers reported that unsafe food practices were compromised due to a lack of working space, insufficient dry and wet storage, uninterested supervisors, and poor training.

2.9 Model Guiding the Study

The conceptual Model/Framework that will direct the investigation is illustrated in Figure 1. The study utilized Admasu and Kelbessa's (2018) model for food safety procedures and related elements. It was deemed appropriate based on how the model's goals related to the study's goals. Specific changes were made to make the model appropriate for the research. Four significant factors were considered in the model. They consist of socio-demographic characteristics, food safety practices, food safety, and institutional barriers related to food. Food handlers' health and personal hygiene, knowledge of food safety, food sickness cause, and procedures will be evaluated. The obstacles to the practice of food safety are institutional issues or barriers.

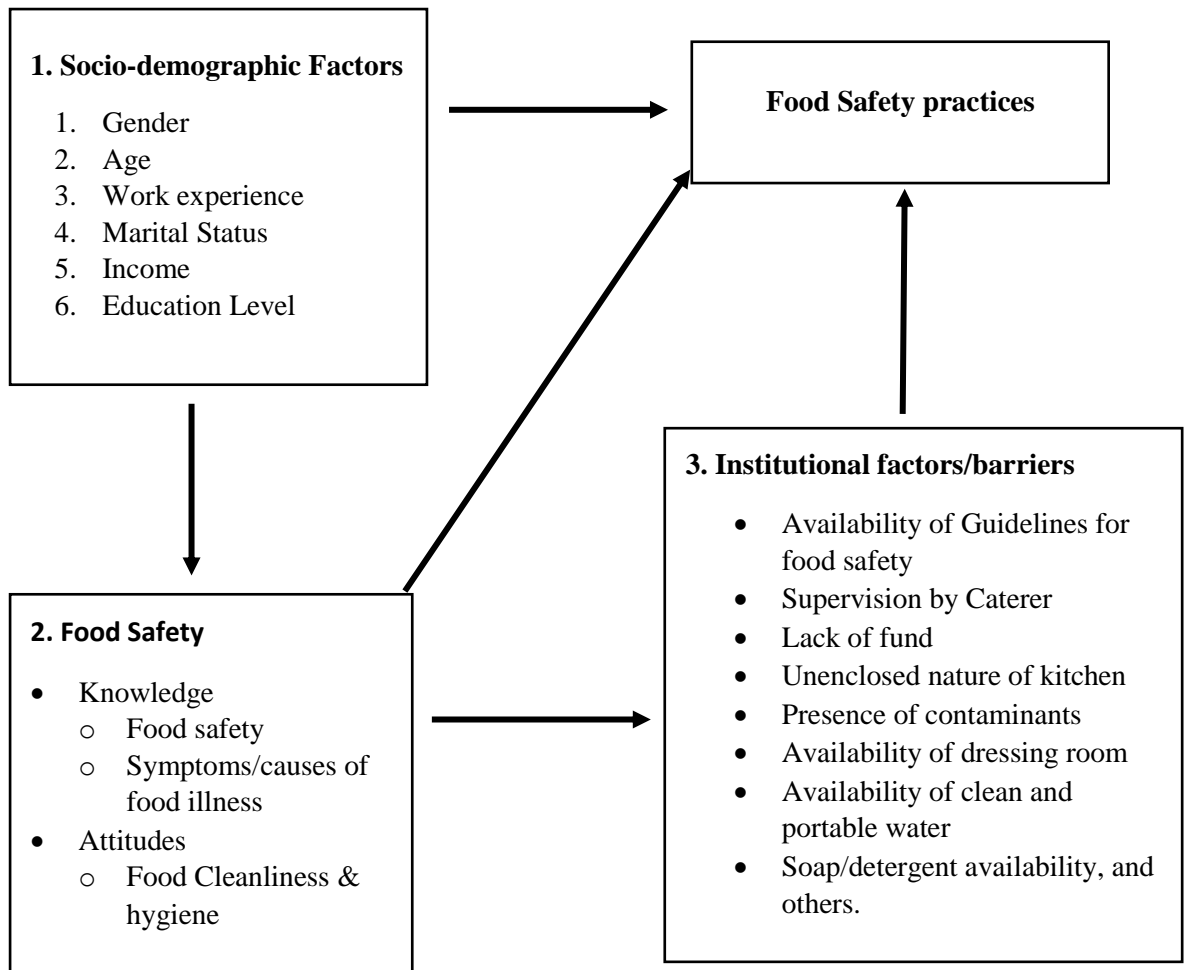


Figure 1: Conceptual framework of food safety practices

Source: Adopted from Admasu and Kelbessa (2018)

The framework explores the connection between factors influencing food handlers' food safety practices, resulting in the creation of meals that are of an acceptable standard for students. As a result, the framework investigated the link between food handlers' behaviours and understanding of food safety. The framework also considers how food safety procedures and obstacles that prevent food handlers from following safe procedures while preparing food relate to one another.

2.10 Chapter Summary

This chapter looked into prior works that were relevant to the topic. First, food safety, school safety, and contamination sources were examined. As a follow-up, it examined the Food Flow concepts, food handlers' food safety knowledge and behaviours, and the impediments that led to food safety violations. A related model was also examined to understand better the processes guiding people's actions. It also discussed how the conceptual model operates.

CHAPTER THREE

METHODOLOGY

3.1 Study Design

The positivist philosophy was used in the study. The positivist philosophy offers a chance to evaluate socioeconomic phenomena objectively and explain how factors relate to one another (Cantah, 2017). The concept is fact-based and provides an unbiased explanation for the research (Levin, 1988). The positivist perspective enables the researcher to stay impartial and apart from the investigation. This suggests that the philosophy forbids involvement by humans in the thing being studied (Crotty, 1998).

Concerning the positivist philosophy, the study used the cross-sectional survey approach. Unlike longitudinal studies, which follow a population over time, the cross-sectional survey design, when used in a study, helps to gather data that already exist during the study duration, making it incredibly fast and cheap because it forgoes the difficulties of loss experienced during follow-ups. The design was used because it provided insight into food handlers' food safety knowledge and procedures, obstacles to implementing these practices, and the quality of meals served when the research was done.

3.2 Population

A target population for a research study can be defined as the entire set of units, thus individuals, groups of persons, or organizations, through whom the research data are collected and used to make interpretations (Cox & Lavrakas, 2008). A target population is a group of individuals or organizations with some characteristics researchers are interested in (Asiamah et al., 2017). A well-defined

target population is significant because it helps others assess the sample's reliability, sampling technique(s), and study findings (Asiamah et al., 2017).

All food handlers at boarding senior high schools in the Kwahu East District registered with the Ghana Educational Service comprised the study's target group. Five (5) SHS with boarding facilities is registered and operational in the district, according to GES statistics. The inclusion criterion for selecting food handlers was built on this. In order to determine the number of food handlers in the chosen schools, a reconnaissance survey was carried out because official GES data on them were unavailable. There were 84 food handlers across the five boarding Senior High schools in the Kwahu East district.

Table 1: Number of food handlers in selected Senior High Schools

School	Population (number of food handlers)	Sample
Abetifi Presby Senior High School	15	12
Kwahu Tafo Senior High School	18	15
Pepease St. Dominic's Senior High School	13	11
Nkwetia St. Presby Senior High School	22	18
Nkwatia Presby Senior High School.	16	13
Total	84	69

3.3 Sampling Technique and Sample size

In determining the sample size of the study, the Yamane (1967) sample size formula was used;

$$n = \frac{N}{(1 + Ne^2)}$$

Where:

n= number of samples

N= Total population = 84

e= confidence level = 0.05

$$n = \frac{84}{1 + 84(0.05)^2}$$

$$n = 69$$

Therefore, the sample size for the study was 69. This included the cook, matron, and all the kitchen staff responsible for preparing and handling food in the boarding schools in the Kwahu-East district.

The convenience sampling technique was used in selecting the sample to be interviewed. Convenient sampling selects available subjects and is considered convenient participants by the researcher involved in a study (Creswell, 2013). This method was used to select food handlers in various schools. This method was used to get the food handlers who were readily available and willing to participate in the study.

3.4 Data Collection Instruments

Information was gathered from participants using a questionnaire and an observation checklist. The survey will consist of three main sections, each with open-ended and closed-ended questions about respondents' socio-demographics, employment histories, and food safety knowledge.

Participants' food safety knowledge was evaluated across three domains (10 questions each): health and personal hygiene, food hygiene, and environmental hygiene (5 questions). Responses were ranked on a "true" or "false" scale to determine how well respondents understood food safety concepts. Ten (10) significant

obstacles were identified to food safety measures from the reviewed literature, and respondents were asked to mark as many as they felt were true for them. Work features comprised employment status, work history, sources of food preparation knowledge, and a medical health certificate, whereas socio-demographic elements included gender, age, marital status, educational attainment, ethnicity, and religion.

According to Altinay and Paraskevas (2008), researchers can get insights on par with an insider by observing the phenomenon of interest. This is based on the work of Sackmann (1991), who made this claim. As a result, the approach has been used to compile data on food safety practices in the food service industry. Health and personal hygiene (with 11 questions), food hygiene (with five questions), and environmental hygiene (with 1 question) were all addressed explicitly in the checklist used to collect the data (four questions). A Likert scale option was given to the respondents. The decision to combine these two research methodologies was chosen since a questionnaire alone would not have been able to uncover the objective methods employed by food handlers. Thus it was necessary to use the observation technique.

3.5 Data Analysis

All the information was input and coded into SPSS 21 for statistical analysis to guarantee accuracy. Therefore, all outliers and extreme values that could have compromised the results' reliability were meticulously deleted from the data (cleaned). The data were analyzed using descriptive statistics such as frequency and percentage distribution plots, bar charts, and cross-tabulations. Descriptive statistics were used to characterize respondents' demographics, employment history, and food safety Knowledge level.

3.6 Ethical Considerations

All ethical concerns, such as the right to participation, informed consent, confidentiality, data privacy, and anonymity, were duly adhered to in conducting the research. Participants' consent was first sought, and they were assured that participation was voluntary. Participants were not obligated to do so and were free to choose not to participate in the study. Permission to participate was also confirmed by the participant's signing or thumb printing in the space provided on the respondent's consent form. Furthermore, the participants were encouraged to ask questions about the study, and the investigator or research assistants provided satisfying answers. Furthermore, to ensure anonymity and confidentiality, participants were identified with serial numbers so that the information provided could not be traced back to them, and any information they provided was inaccessible to any unauthorized person. Lastly, to ensure privacy, participants were assured that the data was protected from unauthorized access, with the researcher storing it in a personal password-protected drive.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Socio-Demographic Characteristics of Respondents

This section discusses the social and demographic information of the respondents in this study. In this study, the age, gender, religion, marital status, and ethnic group of the respondents are taken into account in table 2. The results from table 2 indicate that most of the respondents were females. The findings are not unique to this study, as females have been identified as more involved in food handling in Senior high schools than males (Muinde & Kuria, 2005; Appietu, 2018). This may result from females being mainly responsible for food preparation in the Ghanaian setting (Appietu, 2018).

Moreover, the respondents' ages range from 21 to 50, with an average age of 31.09. Most (55.1%) of the respondents were within the age group of 21 to 30 years. About 27.5% of the respondents were between the ages of 31 to 40 years. Respondents who fall between the ages of 41 to 50 years constituted the minor population, about 17.4%. The findings imply that most of the food handlers are young adults and may have little experience handling food, and there may be a need for a frequent training to ensure that they stay up to date with the latest food safety practices.

Regarding marital status, most (44.9%) of the respondents were married. This was followed by the single respondents (40.6%), widowed (8.7%), and those who were divorced (5.8%). The finding contradicts the results of Appietu (2018), which shows that most food handlers in Senior High Schools are married.

Table 2: Socio-Demographic Characteristics of Respondents

Variable	Frequency (n=69)	Percentage (%)
Gender		
Male	17	24.6
Female	52	75.4
Age		
21 – 30	38	55.1
31 – 40	19	27.5
41 – 50	12	17.4
Education Level		
None	6	8.7
Basic	18	26.1
Secondary/Vocational	32	46.4
Tertiary	13	18.8
Marital Status		
Single	28	40.6
Married	31	44.9
Divorced	4	5.8
Widowed	6	8.7
Ethnic Group		
Ashanti	31	44.9
Akyem	18	26.1
Fante	6	8.7
Ewe	7	10.1
Nzema	7	10.1
Religion		
Christianity	56	81.2
Muslim	13	18.8

Source: Fieldwork (2022)

Furthermore, most respondents had some form of formal education (91.3%), while about 8.7% had no formal education. The results indicate that a high percentage of food handlers in high schools had some form of formal education, which could be

beneficial in understanding food safety principles and applying them in their work. This finding is consistent with a previous study that has shown that education can positively influence food handlers' knowledge and food safety practices (Appietu, 2018). However, 8.7% of the respondents had no formal education highlights a potential issue regarding their ability to understand and follow food safety guidelines.

Also, the respondent's religious affiliation results showed that the majority (81.2%) were Christians. The results were expected as most of the schools studied were established by churches. Regardless, about 18.8% of the respondents were Muslims. Lastly, most (44.9%) of the respondents were Akans (Ashanti), followed by Akyem (26.1%), Ewe (10.1%), Nzema (10.7%), and Fante (8.7%). The religious affiliation and ethnicity of the food handlers in high schools are important factors to consider in food safety practices. The high percentage of Christians among the respondents may suggest a possible influence of religious beliefs and values in their food handling and safety approach. However, it is essential to note that religious affiliation alone should not be relied upon to ensure proper food-handling practices. The diverse ethnic composition of the respondents is also noteworthy. This implies that the food handlers come from various cultural backgrounds, which may affect their food-handling practices. Recognizing that cultural beliefs and practices can impact food handling and safety practices is essential. For instance, certain cultures may have specific food preferences requiring specific food handling methods.

4.3 Employment Profile of Respondents

The response of respondents' job history was also evaluated. They consist of job experience, a source of cooking expertise, having a medical certificate, and regular medical check-ups (Table 3).

Concerning the work status, the cooks constituted most respondents (49.2%), while the Matrons constituted the minuscule population (8.7%). More than half of the respondents have work experience of more than five years (58%). The results further indicate that most respondents gained knowledge of food preparation through formal training and education (53.6%). Also, 37.7% of the respondents gained knowledge through observation, while 8.7% gained knowledge working in family-owned food establishments.

Table 3: Employment Profile of Respondents

Variable	Frequency (n=69)	Percentage (%)
Work Status		
Matron	6	8.7
Cooks	34	49.3
Pantry	29	42.0
Work Experience		
1 – 4 years	29	42.0
Above five years	40	58.0
Knowledge of food preparation		
Observation	26	37.7
Formal training and Education	37	53.6
Family Business	6	8.7
Possession of Medical Certificate		
Yes	63	91.3
No	6	8.7
Routine Medical Check-up		
None	6	8.7
Every Six Month	37	53.6
About a year	26	37.7

Source: Fieldwork (2022)

Furthermore, most (91.3%) respondents indicated they possess a medical certificate. According to the Kwahu-East District Assembly, all food handlers must undergo a routine medical check-up annually, regardless of the sector. In line with this, the results showed that most respondents (53.6%) undergo routine medical

check-ups every six months, 37.7% about once a year, and 8.7% do not undergo a routine medical check-up. The data suggest that many food handlers in Senior High Schools undergo routine medical check-ups. This is in line with the regulations set by the Kwahu-East District Assembly that mandates all food handlers to have a medical certificate which may indicate that regulations are being followed. According to a study by Birke et al. (2019), implementing regular medical check-ups and providing health education to food handlers are crucial in preventing foodborne illness. The findings highlight that food handlers' health status can significantly affect food safety and directly impact the spread of foodborne diseases.

4.4 Knowledge of Food Safety of Respondents

Safe food handling techniques are predicated on educating those who work with food since this helps reduce the occurrence of foodborne illnesses. The areas of respondents' knowledge that were tested regarding food safety are listed in Table 4. Twenty-five questions were used to assess participants' understanding of food safety. They paid particular attention to the hygienic treatment of people's bodies, surroundings, and food.

The respondent has a high knowledge of environmental hygiene since they exhibit the highest average mean score of 4.77 (0.03). This is consistent with previous research showing the importance of environmental hygiene in preventing the spread of foodborne illness (FAO/WHO, 2008; Nik Rosmawati et al., 2014). These studies showed that environmental hygiene is crucial in preventing cross-contamination and the growth of microorganisms in food preparation. Specifically, they exhibit high knowledge of not keeping dustbins in food preparation areas (5.00 (0.00)). This is important as the respondents have high knowledge regarding the harmful effects of flies from dustbins and other organisms and bacteria in food preparation. Moreover, they exhibited high food knowledge in that food

preparation should begin after cleaning the environment and that the presence of flies and dust in food preparation is harmful.

However, the study also found that the respondents had a lower level of knowledge in advocating for the need to carry out food preparation in an enclosed environment, with a mean score of 3.96 (0.11) under environmental hygiene. This is an important finding since previous research has shown that the design of food preparation areas can significantly impact food safety (Ababio & Lovatt, 2015; Appietu, 2017; FDA, 2013). For instance, FDA (2013) found that the design of food preparation areas can influence the occurrence of food contamination.

Finally, under environmental hygiene, the study found that the respondents had a high level of knowledge regarding preventing domestic animals from moving freely in food preparation areas, with a mean score of 4.82 (0.05). This finding is consistent with previous research that has shown the importance of preventing the presence of animals in food preparation areas to reduce the risk of contamination (WHO, 2010).

In summary, under environmental hygiene, the study found that the respondents had a high level of knowledge of environmental hygiene and the harmful effects of flies and dust in food preparation areas. However, there is a need to improve their knowledge regarding the need to carry out food preparation in an enclosed environment. Overall, the findings of the study are consistent with previous research that has shown the importance of environmental hygiene, the design of food preparation areas, and preventing the presence of animals in food preparation areas to reduce the incidence of foodborne illnesses (WHO, 2010; Ababio & Lovatt, 2015; Appietu, 2017; FDA, 2013).

Table 4: Food Safety Knowledge Dimension of Responds

Food Safety Knowledge Dimensions	Mean (SE)
Health and Personal Hygiene	
Wearing short fingernails during food preparation is necessary	3.20 (0.16)
It is necessary to wash hands in between food preparation processes	3.68 (0.13)
A chief cook suffering from a cold or cough cannot be allowed to prepare food	3.94 (0.03)
Safe hands are those washed with water and soap	4.75 (0.06)
A chef should only be permitted to prepare food using hair restraints	3.71 (0.10)
A matron should not be permitted to wear jewellery while preparing food	4.31 (0.16)
A chief cook should not be allowed to taste food using the fingers	4.13 (0.11)
Using a kitchen napkin to dry hands is safer than using a clean serviette	3.37 (0.14)
Wearing hand gloves when serving cooked food is necessary	3.05 (0.15)
A cut on a finger covered with a piece of cloth can be used in handling cooked food	4.91 (0.04)
Average Health and Personal Hygiene	3.91 (0.16)
Environmental Hygiene	
Certain domestic animals should not be allowed to move freely in food preparation areas	4.82 (0.05)
It is not hygienic to keep a dust bin in food preparation to keep waste	5.0 (0.00)
Food preparation can begin after cleaning the environment	5.0 (0.00)
The presence of flies and dust in food preparation areas is harmful	5.0 (0.00)
It is essential to carry out food preparation in an enclosed environment	3.96 (0.11)
Average Environmental Hygiene	4.77(0.03)
Food Hygiene	
Cleaning work surfaces in between uses is necessary	4.09 (0.15)
Using a clean knife to clean fish and cut vegetables is not hygienic	5.00(0.00)
Using separate utensils to handle raw and cooked food is important	4.41(0.06)
Washing green leafy vegetables under cool running water is hygienic	3.64 (0.11)
The freshly prepared soup should be allowed to cool overnight in the kitchen before refrigerating	1.00 (0.00)
Meat bought from the open market is not safe	2.77 (0.15)
Sanitizing work surfaces after cleaning is necessary	3.95 (0.11)
Raw meat wrapped in polythene should not be stored at the top part of a fridge	2.51 (0.14)
Frozen poultry needed for food preparation should not be thawed on the kitchen counter	3.37 (0.14)
The correct temperature for a refrigerator is < 1°C	1.00 (0.00)
Average Food Hygiene	3.17 (0.10)

Source: Fieldwork (2022)

Health and Personal Hygiene (3.91(0.16)) came second in terms of the respondent's knowledge regarding food safety knowledge. The individual item, "a cut on the finger covered with a piece of cloth can be used in handling cooked food," were ranked first. The respondents exhibited high knowledge of the fact that a cut needs to be covered when preparing food. This contradicts Appietu's (2018) findings, which observed that food handlers at Ho Senior High School have less knowledge of handling cuts during cooking. Moreover, the respondents also exhibited enough knowledge of the safety of washing hands with soap and water (4.75). The third highest knowledge was that a matron should not wear jewellery while preparing food (4.31). This aligns with Moreaux's (2014) findings that jewellery can pollute the food. A chief cook should not be allowed to taste food using fingers was ranked the fourth (4.13) highest respondents' health and personal hygiene knowledge. It is essential to taste food using spoons and not with the finger since it can help transmit some bacteria and germs to pollute the food and can wound the fingers (Nyamari, 2013; Getachew, 2010).

In addition, a chief cook suffering from a cold or cough cannot be allowed to prepare food was ranked fifth (3.94) regarding respondents' health and personal hygiene knowledge. A chef should only be permitted to prepare food using hair restraints and receive an average mean score of 3.71(0.10). Next were "it is necessary to wash hands in between food preparation process," "Using a kitchen napkin to dry hands is safer than using a clean serviette" and "Wearing short fingernails during food preparation is necessary" received a mean score of 3.68(0.13), 3.37(0.14) and 3.20(0.16) respectively. The respondents were unaware of the necessity of wearing hand gloves when serving cooked food (3.05(0.15)). The FDA expects that food handlers should wear hand gloves when preparing food as it is part of the rules (FDA, 2013).

Moreover, the respondents had the lowest knowledge of Food Hygiene, with an average mean score of 3.17 (0.10). Individually, the respondents exhibited the highest knowledge that is using a clean knife to clean fish and cut vegetables is not hygienic (5.00). The respondents exhibited the least knowledge of the temperature of a refrigerator (1.00) and that freshly prepared food should not be allowed to cool overnight in the kitchen before

refrigerating (1.00). Table 4 summarizes the mean score and ranking of individual aspects of respondents' knowledge of food hygiene. Regardless the knowledge of food handlers on food hygiene was also observed to be lower in studies conducted by Appietu (2018) and Osaili et al. (2013).

4.5 Food Safety Practices and Approaches of Respondents

The most common sources of foodborne germs found on food workers include their hands, wounds or sores, mouth, skin, and hair, and they are progressively transferred onto the food as it is prepared (Adams & Moss, 2008). Consequently, maintaining high standards of personal cleanliness is essential in avoiding the spread of harmful bacteria in the kitchen. A summary of respondents' food safety approaches is presented in table 5.

Eleven (11) health and personal hygiene-related activities were used in an observation checklist to evaluate the area's food handlers' health and personal hygiene habits. Table 5 demonstrates that respondents are least likely to engage in health and personal hygiene practices, with a mean score of 3.12. (0.004). In particular, whereas 42% of responders wore aprons, nobody used gloves. A prominent source of food contamination and health concerns is unprotected food workers who do not use aprons and gloves while handling food. This includes those who cough or sneeze into their hands, which can inoculate food items with infectious discharge (Kaferstein, 203; Appietu, 2018). So that neither injuries nor contamination occurs, workers in the food service industry must always be instructed to wear gloves (Green & Selman, 2005). Nevertheless, most responders (82.6%) said they cling to hair ties when cooking.

The hand of a food handler is highly essential and involved in food preparation and may create a risky environment for microbial contamination of food and increase the likelihood of food contamination during food handling (Annor &

Baiden, 2011). Moreover, washing the hand is essential in preventing the spread of organisms. From the findings, all the respondents practised washing their hands with water and soap before food preparation.

Table 5: Approaches and Practices of Food Safety

Approach and practice of food safety	Disagree	N	Agree	Mean (SE)
Health and Personal Hygiene	Percentage		Percentage	
	(SD&D)		(A&SA)	
Health and Personal Hygiene				
Food handler avoids wearing jewellery during food preparation	7.2%	18.8%	73.9%	4.04(0.11)
During food preparation, the food handler wears a hair constraint.	1.5%	15.9%	82.6%	4.09(0.09)
During food preparation, the food handler wears a clean uniform.	-	-	100%	4.45(0.06)
Between food preparation steps, the food handler washes his or her hands.	23.3%	24.6%	52.1%	3.36(0.12)
Food handler wears neatly trimmed fingernails during food preparation	1.5%	15.9%	82.6%	4.09(0.08)
Food handler washes hands with water and soap before food preparation	-	-	100%	4.31(0.03)
Food handler wears an apron during food preparation	39.2%	18.8%	42%	3.00(0.15)
The food handler was suffering from a cold and cough at the time of the visit	100%	-	-	1.00(0.00)
The food handler had a cut on the finger at the time of the visit	100%	-	-	1.00(0.00)
Food handler wears hand gloves when handling cooked food	100%	-	-	1.00(0.00)
Food handler cleans their hands with clean serviette instead of kitchen napkin after washing	-	-	100%	4.00(0.00)
The overall mean of Health and Personal Hygiene				3.12(0.04)

Source: Fieldwork (2022)

Moreover, most respondents (82.6%) trim their fingernails during food preparation. According to Moreaux (2014), finger nails are a source of food contamination since bacteria and other pollutants can be found there; trimming them and keeping them short prevent food contamination.

On the positive side, most of the respondents (73.9%) were without jewellery, while all the respondents wore clean uniforms during food preparation. Also, none of the respondents had a cold, cough, or cut during food preparations. This is in line with the findings of Appietu (2018), who observed that fewer food handlers were having cold, cough, and cut during food preparations in Senior High Schools in Ho Municipality.

Concerning food hygiene, five crucial factors were utilized to evaluate how well respondents kept themselves and their cooking areas clean. Food hygiene was ranked second regarding food safety practices and approaches, with an overall mean of 4.6(0.00). As shown in Table 5, all the respondents use separate utensils to handle raw and cooked food. Moreover, all the respondents clean the kitchen countertops in between usage during food preparation. The National Restaurant Association Educational Foundation (2006) states that adhering to this procedure helps lessen the possibility of food poisoning while cooking. Sanitizing surfaces after cleaning are strongly advised for complete prevention since it kills any remaining bacteria or germs that could have been missed during the cleaning process (Appietu, 2018). In line with this, it was observed that 100% of the respondents sanitized the work surfaces after cleaning. In addition, all the respondents (100%) were observed not to use their fingers to taste food. Also, no food handlers were observed eating when food preparation took place.

Maintaining proper sanitation in the food preparation area is a primary step to ensure safe food preparation. According to FAO/WHO (2008), areas, where food is cooked should be clean and kept away from any source of contamination to ensure that the food is healthy for consumption. Karanja et al. (2010) also emphasized that food can be chemically contaminated by environmental pollutants such as land, water, and the atmosphere. Therefore, environmental hygiene is essential to protecting food from contamination and reducing health risks. On average, the respondents highly practice environmental hygiene, ranked first among the dimensions in table 5 with an overall mean score of 5.00(0.00). Specifically, all the food handlers prepare food in a clean setting.

Table 5 (contd): Approaches and Practices of Food Safety

Approaches and Practice of Food Safety	Disagree Percentage (SD &D)	N	Agree Percentage (A&SA)	Mean (SE)
Food Hygiene				
The food handler uses a separate utensil to handle raw and cooked food.	-	-	100%	5.00(0.00)
In between usage, the food handler cleans the kitchen countertops.	-	-	100%	4.00(0.00)
Food handlers using fingers to taste food	100%	-	-	5.00(0.00)
After cleaning, the food handler sanitizes the work surface.	-	-	100%	4.00(0.00)
While meal preparation is taking place, the food handler is eating.	100%	-	-	5.00(0.00)
The overall mean of Food Hygiene				4.6(0.00)
Environmental Hygiene				
The food handler does food preparation in a clean setting.	-	-	100%	5.00(0.00)
The food handler prepares food in an environment free of dust and flies.	-	-	100%	5.00(0.00)
There are no dustbins in the food preparation area.	-	-	100%	5.00(0.00)
Food preparation carried out in a confined space	-	-	100%	5.00(0.00)
The overall mean of Environmental Hygiene				5.00(0.00)

Source: Fieldwork (2022)

In addition, the handlers prepare food in an environment free of dust and flies. It was also observed that there were no dustbins close to the food preparation area. As a result, the area where food was prepared was free from insects and flies (WHO, 2010). Lastly, the food was observed to be prepared in a confined area. Overall, all the respondents were observed to practice environmental hygiene highly. This was mainly a result of the regulations set-up by the school administration for the food handlers to prevent food contamination and protect the students' health.

4.6 Source of contamination in student-served foods

Maintaining food safety is all about managing food properly along the whole food chain to prevent contamination, which might result in foodborne diseases (Moreaux, 2014). Therefore, identifying the sources of contamination is vital to food handlers in ensuring the proper health of consumers. From figure 2, the respondents identified some sources of contamination in student-served foods.

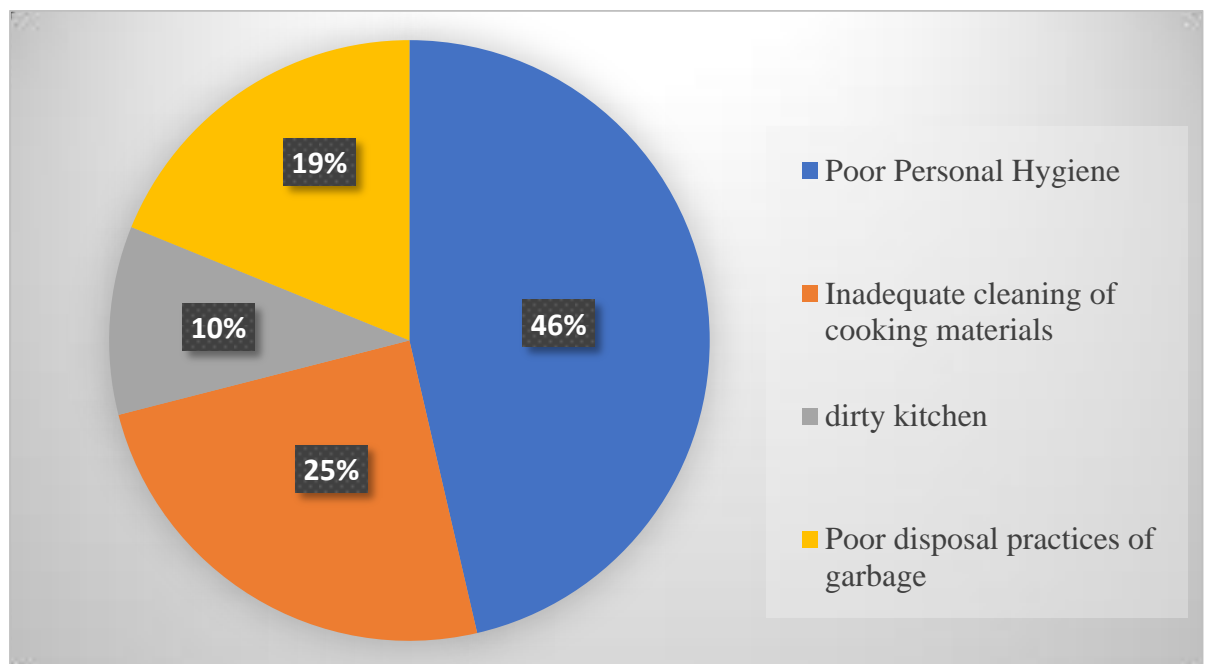


Figure 2: Sources of contamination

Source: Fieldwork (2022)

From figure 2, most respondents (46%) indicated that the source of food contamination could be traced to the poor personal hygiene of food handlers. The results align with the findings of Omemu and Aderoju (2008), which state that poor personal hygiene from food handlers is the primary source of harmful bacteria in food that subsequently causes foodborne diseases. Moreover, about 25% of the respondents believed that inadequate cleaning of cooking materials causes food contamination. Microorganisms in the kitchen can contaminate food through indirect contact (NRAEF, 2006). The indirect contact occurs when poorly cleaned and un-sanitized cooking materials contaminate food. Since contamination can occur at any point in the cooking process, cleaning and sanitizing cooking materials and equipment are essential.

Also, about 19% of the respondents indicated that food handlers' poor disposal of garbage is a source of food contamination. Nevertheless, about 10% of the respondents believed dirty kitchens cause food contamination. Nyamari (2013) explained that metal fragments, pieces of sticks, plastics, and other materials in the kitchen play a role in the physical contamination of food.

4.7 Obstacles to Food Safety Practices among Food Handlers

Barriers to food safety among those who work with food are common. As Appietu (2018) outlined, these variables make it difficult for food handlers to practice their sound knowledge and behaviours about food safety, even though these elements are widely acknowledged as necessary. A multiple-response analysis was conducted where the Respondents selected the listed eight obstacles to maintain safe food handling procedures in table 6.

Table 6 shows that most respondents (16.4%) cannot ensure food is safe due to limited knowledge. All staff must be adequately trained and educated to ensure their knowledge and abilities conform to applicable laws and standards for food safety (Afolaranmi et al., 2014). Therefore, service industry food handlers' poor food safety practices cannot be remedied by providing them with more information and training (Chapman et al., 2010).

Table 6: Obstacles to Food Safety Practices

Obstacles to Food Safety Practices	Responses (N=360)	Percentage of Responses (100%)	Percent of Cases (529.4%)
Irregular Power Supply	30	8.3%	44.1%
Poor enforcement of rules and regulations by Supervision agencies	39	10.8%	57.4%
Lack of training and education	59	16.4%	86.8%
Lack of Funds	43	11.9%	63.2%
Inadequate space and the unenclosed nature of the kitchen	30	8.3%	44.1%
Irregular water supply	39	10.8%	57.4%
Unconcerned attitude toward food safety	36	10.0%	44.1%
Inconvenient location of equipment such as sinks	21	5.8%	30.9%
Busy work schedule	28	7.8%	41.2%
Inadequate provision of equipment and resources	35	9.7%	51.5%

Source: Fieldwork (2022)

In addition, the study showed that a lack of funding (11.9%) seriously hampered food safety procedures. The analyzed institutions were public ones that relied mainly on funding from the government. Food safety procedures are therefore hampered by Ghana's public schools' insufficient access to financial resources (Appietu, 2018). According to Ackah et al. (2011), lack of funding is a significant barrier to food safety.

Additionally, 10.8% of the respondents think inconsistent water supply and lax enforcement of laws are obstacles to food safety. In Ghana, there are regulations and penalties for breaking food safety laws. However, it was found that respondents were apprehensive about practising personal cleanliness and health due to the district authorities' failure to put these rules into practice.

Respondents also mentioned insufficient space and the open layout of the kitchen as significant obstacles to implementing food safety procedures while preparing food. The kitchen's open design was reportedly the primary source of dust, vermin, and insects. Additionally, during the observation sessions, various cleaning-related equipment and service items were left out in the open. This can be the result of the storerooms' limited storage capacity.

Additionally, 8.3% of the respondents cited erratic power supply as a risk to food safety. The unreliable power supply in Ghana has contributed to the failure of numerous industries (Appietu, 2018). However, when the study was conducted, the power supply appeared reliable due to the present execution of intervention programs, particularly in Ghana. As a result, respondents did not consider it a severe threat to their schools' food safety procedures.

Also mentioned by respondents as a barrier to food safety is a busy work schedule. This barrier seems to be a significant problem for the hotel sector. Hertzman and Barrash (2007) also cited a busy work schedule as a significant impediment to food safety measures among respondents who worked in a catering firm's kitchen and dining areas.

However, respondents mentioned an unconcerned attitude toward food safety, inconvenient equipment placement, and defective equipment and resource allocation as barriers to food safety measures. These difficulties prevent food handlers from following the proper procedures for food storage, preparation, and serving claims Appietu (2018).

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

This study aimed to investigate the food safety practices of food handlers in Senior High Schools in the Kwahu-East District. Admasu and Kelbessa's model for food safety procedures was used as the conceptual basis for this investigation (2018). A quantitative strategy was used to gather and analyze the data for this cross-sectional study. Sixty-Nine (69) food handlers from boarding high schools in the Kwahu-East District were sampled for the study. A questionnaire collected information about food handlers' understanding of food safety and their challenges while implementing food safety standards. In order to learn more about the food safety procedures followed by food handlers in the schools under study, an observation checklist was employed. The data obtained were descriptively analyzed per the study's aims.

5.3 Main Findings

On the whole, respondents had an appreciable knowledge of all the food safety knowledge dimensions that were assessed. In particular, the respondents were knowledgeable about the need to ensure environmental hygiene in food preparation, having the highest overall mean score of 4.77. Moreover, the respondents also displayed high health and personal hygiene knowledge, with an overall mean score of 3.91. Regardless, their knowledge of food hygiene was ranked the lowest compared to the rest, with an overall mean score of 3.17.

Furthermore, the majority (53.6%) of the respondents obtained their knowledge of food preparation through formal education and training. A higher proportion of the respondents (91.3%) were noted to have undergone routine medical

check-ups. The results also showed that the majority (91.3%) have some form of formal education.

Respondents in surveyed boarding secondary schools in the Kwahu-East District had an appreciable practice regarding food safety, but their knowledge was below their practice level when comparing the means. Even though the respondents highly practised environmental hygiene (5.00(0.00)). Followed by food hygiene (4.6(0.00) and Health and personal Hygiene with a mean score and standard error of 3.12 (0.04).

Moreover, the sources of food contamination in student-served foods were attributed to poor personal hygiene of food handlers, inadequate cleaning of cooking materials, dirty kitchens, and poor garbage disposal practices.

Lastly, concerning the obstacles to food safety practices among food handlers, the respondents identified irregular power supply (8.3%), poor enforcement of rules and regulations by supervision agencies (10.8%), lack of training and education (16.4%), lack of funds (11.9%), inadequate space and the enclosed nature of the kitchen (8.3%), irregular water supply (10.8%), Unconcerned attitude towards food safety (10.0%) inconvenient location of equipment (5.8%), busy work schedule (7.8%) and inadequate provision of equipment and resources (9.7%).

5.4 Conclusion

The study identified significant gaps in food safety knowledge and practices among respondents in schools in the Kwahu East region. The study has highlighted specific areas where knowledge is lacking, particularly in defrosting frozen foods.

Moreover, multiple factors prevent food handlers from implementing appropriate food safety measures. These obstacles include defective and insufficient

equipment and supplies, irregular water supply, minimal space, an open kitchen layout, and a busy work schedule.

Finally, the sources of food contamination in student-served foods are poor personal hygiene of food handlers, inadequate cleaning of cooking materials, dirty kitchens, and poor garbage disposal practices.

5.5 Recommendation

Based on the results of this research, the following recommendations were made;

- a. The Kwahu-East District Assembly is encouraged to take action to enhance the personal hygiene, food hygiene, and sanitary conditions of food preparation in the district's boarding secondary schools.
- b. Health education programs should be created in cooperation with the district's government, schools, and Health Directorate to solve the problem of poor personal, food, and environmental cleanliness that this research highlighted.
- c. Health and sanitation officers from the environmental health department should develop appropriate strategic plans and policies for the effective regulation and monitoring of the activities of food handlers, especially in boarding secondary schools.
- d. School administrations should not be satisfied with simply having a large student body and a well-designed building; they should also be aware of the level of food safety knowledge and hygiene practices among their kitchen staff and work to improve these areas through the development and implementation of appropriate internal programs.

- e. Politicians and planners should pay close attention to the institutional food service sector, especially boarding schools, by giving the necessary funding, equipment, and resources to improve food safety practices at these institutions.

REFERENCES

- Aarnisalo, K., Tallavaara, K., Wirtanen, G., Maijala, R. & Raaska, L. (2006). The hygienic working practices of maintenance personnel and equipment hygiene in the Finnish food industry. *Journal of Food Control*, 17, 1001-1011.
- Ababio, P. F., & Lovatt, P. (2015). A review on food safety and food hygiene studies in Ghana. *Food Control*, 47, 92-97.
- Abd Patah, M. O. R., Issa, Z. M., & Nor, K. M. (2009). Food safety attitude of culinary arts based students in public and private higher learning institutions (IPT). *International Education Studies*, 2(4), 168-178.
- Ackah, M., Gyamfi, E. T., Anim, A. K., Osei, J., Hansen, J. K., & Agyeman, O. (2011). Economic profile, knowledge of hygiene and food safety practices among street food vendors in some parts of Accra- Ghana. *International Journal of Food Safety*, 13, 191-197.
- Admasu, M., & Kelbessa, W. (2018). Food Safety Knowledge, Handling Practice and Associated Factors among Food Handlers of Hotels / Restaurants in Asosa Town, North Western Ethiopia. *SM J Public Health Epidemiol*, 4(1): 1051.
- Afolaranmi, T. O., Hassan, Z. I., Bello, D. A., Tagurum, Y, O., Miner C. A., Zoakah, A. I., & Ogbonna, C. (2014). A vital tool for improving the knowledge and practice of food safety and hygiene among food handlers in boarding secondary schools in Plateau State. Department of Community Medicine, University of Jos, Jos, Plateau State, Nigeria. *Journal of Medicine in the Tropics*, 16(2), 87-92.
- Akonor, P. T., & Akonor, M. A. (2013). Food Safety Knowledge: The case of domestic food handlers in Accra. *European Journal of Nutrition & Food Safety*, 3(3), 99-111.

- Alale, D. (2013). Food and Drugs Authority School caterers on good hygiene practices. Ghanaian Times.
- Angelillo, I. F., Viggiani, N. M. A., Rizzo, L., & Bianco, A. (2000). Food handlers and foodborne diseases: knowledge, attitudes, and reported behavior in Italy. *Journal of Food Protection*, 63, 381- 385.
- Annor, G. A., & Baiden, E. A. (2011). Evaluation of Food Hygiene Knowledge Attitudes and Practices of Food Handlers in Food Businesses in Accra, Ghana. *Food and Nutrition Sciences*, 2, 830-836.
- Appietu, M. E. (2018). Food Safety Practices in Boarding Senior High Schools in Ghana. *ADRRI Journal of Agriculture and Food Sciences*, 4(1), 1-12.
- Aziz, S. A. A., & Dahan, H. M. (2013). Food handlers' attitude towards safe food handling in school canteens. *Procedia -Social and Behavioral Sciences*, 105, 220-228.
- Birke, W., & Zawide, F. (2019). Transforming research results in food safety to community actions: a call for action to advance food safety in Ethiopia. *Environ Ecol Res*, 7(3), 153-70.
- Centers for Disease Control and Prevention. (2005). Healthy youth! Health topics: Food safety. Retrieved from <http://www.cdc.gov/health-youth/foodsafety/strategies.htm>.
- Chapman, B., Eversley, T., Fillion, K., MacLaurin, T., & Powell, D. (2010). Assessment of food safety practices of food service food handlers (risk assessment data): testing a communication intervention (evaluation of tools). *Journal of Food Protection*, 73(6), 1101- 1107.

- Citi FM. (2013). Over 40 students were hospitalized at Adonten Secondary in the Eastern region of Ghana over food poisoning. Case under investigation. CITIFMONLINE. Viewed 10/08/16.
- Daniyan, S. Y., & Nwokwu, O. E. (2011). Enumeration of microorganisms associated with the different stages of bread production in Futmin bakery. *International Research of Pharmacy*, 2,88-91.
- Ehiri, J. E., & Morris, G. P. (1996). Hygiene training and education of food handlers: Does it work? *Ecology of Food and Nutrition*, 35(4):243–251.
- Esen, R. K., & Owusu, E. (2013). Quality of cooked foods in urban schools in Ghana: Review of foodborne diseases and health implications. *International Journal of Scientific and Technology Research*, 2(10), 267-275.
- FAO/WHO (Food and Agricultural Organization/World Health Organization) (2008). Microbiological Risk Assessment Series. Microbiological hazards in fresh leafy vegetables and herbs.
- Fawzi, M., Gomaa, N. F., & Bakr, W. M. K. (2009). Assessment of hand washing facilities, personal hygiene, and bacteriological quality of hand washing in some grocery and diary shops in Alexandria, Egypt. *Journal of Egypt Public Health Association*, 87(1), 71-93.
- FDA. (2013). Food Code. U.S. Public Health Service, U.S. Dept. of Health and Human Services. Washington, D.C
- Getachew, F. (2010). An Assessment of the hygienic and food handling practices in selected hospitals in Addis Ababa- Ethiopia. Unpublished master's thesis, Addis Ababa University.

- Gibson, L. L., Rose, J. B., Haas, C. N., Gerba, C. P., & Rusin, P. A. (2002). Quantitative assessment of risk reduction from hand washing with antibacterial soaps. *Journal of Applied Microbiology*, 92(1), 136–143.
- Glanz, K., Lewis, F. M., & Rimer, B. K. (2002). *Health Behaviour and Health Education: Theory Research and Practice*. San Francisco: Wiley and Sons.
- Green, L. R., & Selman, C. (2005). Factors impacting food workers' and managers' safe food preparation practices: a qualitative study. *Food Protection Trends*, 25(12), 981-990.
- Grintzali, G. P., & Babatsikou, F. (2010). The significance of application of Hazards Analysis Critical Control Point system in hospitality catering. *Health Science Journal*, 4(2), 84-93.
- Guilford County Department of Public Health at 336-64-3771 (2011). Retrieved from www.co.guilford.nc.us/blog/dph/wp/07/minimum-cook-temps.
- Ho Municipal Assembly (HMA). (2012). Food Safety by-laws for food handlers' in the food service industry.
- Jevsnik, M., Hlebec, V., & Raspor, P. (2008). Consumers' awareness of food safety from shopping to eating. *Food Control*, 19, 737-745.
- Karanja, N. K., Njenga, M., Prain, G., Kangethe, E., Kironchi, G., Githuku, G., Kinyari, P., & Mutua, G. K., (2010). Assessment of environmental and public health hazards in wastewater used for urban agriculture in Nairobi. Kenya. *Tropical and Subtropical Agroecosystems*, 12, 85–97.
- Keener, L. (2005). Maximizing Food Safety Returns on Investment. FI Food Safety and Innovative Seminar
- Krieg, N. R., (1984). Ed., *Bergey's Manual of Systematic Bacteriology*, Vol. 1, Williams & Wilkins Baltimor.

- Lagerkvist, C. J., Hess, S., Okello, J., Hansson, H., & Karanja, N. (2013). Food health risk perceptions among consumers, farmers, and traders of leafy vegetables in Nairobi. *Food Policy*, 38, 92-104.
- Lues, J., & Van Tonder, I. (2007). The occurrence of indicator bacteria on the hands and aprons of food handlers in the delicatessen sections of a retail group. *Food Control*, 18(4), 326-332
- Martins, R. B., Hogg, T., & Otero, J. G. (2012). "Food handlers' knowledge on food hygiene: The Case of a Catering Company in Portugal," *Food Control*, 23(1), 184-190.
- Marx, E. (2008). Eating safely at school: What education policymakers need to know and do to prevent and respond to food-related illness in schools. Alexandria, VA: National School Boards Association.
- Marzano, M. A. (2010). Food safety in conventional and innovative catering systems. Doctoral Programme in Animal Nutrition and Food Safety
- McSwane, D., Rue, N., & Linton, R. (2003). *Essentials of food safety and sanitation* (3rd ed.). New Jersey: Pearson Education, 169–196.
- Mensah, P., Yeboah-Manu, D., Owusu-Darko, K., & Ablordey, A. (2002). Street foods in Accra, Ghana: how safe are they? *Bulletin of World Health Organization*, 80(7), 546-554.
- Moreaux, S., O. (2014). Food safety knowledge and practices among kebab vendors in the Cape Coast Metropolis. Unpublished master's thesis. The University of Cape Coast.
- National Restaurant Association Educational Foundation [NRAEF]. (2008). ServSafe course book. Chicago, IL:

- National Restaurant Association Educational Foundation [NRAEF]. (1999). ServSafe Coursebook. Chicago, IL: National Restaurant Association Educational Foundation.
- National Restaurant Association Educational Foundation. National Restaurant Association Educational Foundation [NRAEF]. (2006). ServSafe Coursebook. Chicago, IL: National Restaurant Association Educational Foundation.
- Nee, O. S., & Sani, N. A. (2011). Assessment of knowledge, attitude, and practices (KAP) among food at residential colleges and canteen regarding food safety. *Sains Malaysiana*, 40, 403–410.
- Nik Rosmawati, N. H., Wan Manan, W. M., Noor Izani, N. J., & Nik Nurain, N. H. (2014). Evaluation of environmental hygiene and microbiological status of selected primary school canteens. *Health and the Environment Journal*, 5(3), 110-127.
- Norazmir, M. N., Hasyimah, M. A. N., Shafurah, A. S., Sabariah, B. S., Ajau, D., Noraziansah, H. (2012). Knowledge and Practice on Food Safety among Secondary School Students in Johor Bahru, Johor, Malaysia. *Pakistan Journal of Nutrition*, 11, 110–115.
- Nyamari, J. (2013). Evaluation of compliance to food safety standards amongst food handlers in selected hospitals in Kenya. Unpublished Doctoral thesis. Kenyatta.
- Omemu, A. M., & Aderoju, S. T. (2008). Food safety knowledge and practices of street food vendors in the city of Abeokuta, Nigeria. *Food Control*, 19(4), 396-402.

- Oranusi, S. U., Oguoma, O. I., & Agusi, E. (2013). Microbiological quality assessment of foods sold in students cafeterias. *Global Research Journal of Microbiology*, 3(1), 1-7.
- Osaili T. M., Abu Jamous D. O., Obeidat B. A., Bawadi H. A., Tayyem R. F., & Subih H. S. (2013). Food safety knowledge among food workers in restaurants in Jordan. *Food Control*, 31, 145-150.
- Pirsaheb, M., Almasi, A., & Rezaee M. (2010). The special education course effects on knowledge, attitude and practice of preparation, distribution and sale centres food staff in Kermanshah. *Iran Journal of Health Environment*, 3, 299-308.
- Rath, C. C., & Patra, S. (2012). Bacteriological quality assessment of selected street foods and antibacterial action of essential oils against foodborne pathogens. *Internet Journal of Food Safety*, 14, 5-10.
- Saba, S. K. C., & Gonzalez-Zorn, B. (2012). Microbial food safety in Ghana Meta-analysis. *Journal of Infection in Developing Countries*, 6(12), 828-835.
- Sanlier, N., & Konaklioglu, E. (2012). Food Safety knowledge, attitude, and Food Handling practices of students. *British Food Journal*, 114, 469-480.
- Sauer, K. L. (1998). Development and evaluation of an internet-based Hazard Analysis Critical Control Point (HACCP) resource for college and university food service operators.
- Seaman, P. (2010). Food hygiene training: Introducing the food hygiene training model. *Food Control*, 21(4), 381-387.
- Sneath, P. H. A. (1986). Ed., *Bergey's Manual of Systematic Bacteriology*, Vol. 2, Williams & Wilkins Baltimore.

- Sohrab, R. T. (1999). Risk Assessment a Prerequisite for Application of HACCP in Food Industries. *Indian Food Packer*, 53(4), 43-50.
- Sun, Y. M., & Ockerman, H. W. (2005). A review of the needs and current applications of hazard analysis and critical control point (HACCP) system in food service areas. *Food Control*, 16, 325–332.
- Sun, Y. M., Wang, S. T., & Huang, K. W. (2012). Hygiene knowledge and practices of night market food vendors in Tainan City, Taiwan. *Food Control*, 23(1), 159-164.
- Tan, Z., Rifan, N. A. M., Khalid, K., Musa, M., & Anuar, J. (2015). Foodborne illness risk factors in institutional food service: utilizing temperature control as a preventive measure. *Journal of Applied Environmental and Biological Sciences*, 5(6), 33-39.
- Varghese, D. M., George, A., & Nayak, M. G. (2013). Effectiveness of an Information booklet on knowledge and practice on food safety among food handlers in restaurants. *International Journal of Advanced Research*, 767-775.
- World Health Organisation [WHO]. (2003). WHO Surveillance Programme for Control of Foodborne Infections and Intoxications in Europe, 7th report.
- WHO. (1984). The role of food safety in Health and Development. Technical report series 705: Geneva. WHO.
- WHO. (1984). The role of food safety in Health and Development. Technical report series 705: Geneva. WHO.
- WHO. (2002). Emerging foodborne diseases. Fact Sheet 124: Available at: www.who.int/inffs/en/fact124.html.
- WHO. (2010). Five Keys to Safer Food. Available at www.who.int/food_safety/consumer/5keys Visited 01.04.2010].

Winson, A. (2008). School food environments and the obesity issue: content, structural determinants, and agency in Canadian high schools. *Agriculture and Human Values*, 25(4), 499-511.

World Health Organization (2004). WHO Surveillance Programme for Control of Foodborne Infections and Intoxications in Europe. 8th Report; Portugal 1999–2000.

World Health Organization (WHO). (2000). Food safety - A worldwide public health issue. World Health Organization.

**APPENDIX
STUDY INSTRUMENTS**

**AKENTEN APPIAH-MENKAH UNIVERSITY OF SKILLS TRAINING AND
ENTREPRENEURIAL DEVELOPMENT**

FOOD SAFETY QUESTIONNAIRE FOR FOOD HANDLERS

**Topic: Food Safety in Senior High Schools in Kwahu East District, Eastern
Region**

Dear Sir/Madam

This study aims to assess food safety in Senior High Schools in the Kwahu East District. It would be greatly appreciated if you could assist in completing this questionnaire. The data would be solely used for academic purposes and kept confidential. You have also been assured anonymity, as your name will not be associated with the responses.

Thank you.

Module I: Socio-demographic Characteristics of respondent

1. Gender:

- Male
- Female

2. Age:

3. Education level:

- None
- Basic
- Secondary/ Vocational
- Tertiary

4. Marital Status

- Single
- Married
- Widowed
- Divorced

5. Ethnic group:

6. Religion

- Christian
- Muslim
- Traditionalist
- Others (please specify)

Employment profile

7. Work Status

- Matron
- Chief cook
- Cook
- Pantry
- Others (Specify).....

8. Work experience (in years)

9. How did you learn how to prepare food?

- Through observation
- Formal education and training
- Family business
- Others (specify)

10. Do you have a medical health certificate or license?

Yes

No

11. When was the last time you had a routine medical examination?

.....

Module II: Barriers to food Safety & Source of Contamination (Please tick any of the boxes below)

I am unable to practice food safety the way I would have preferred because of the;

- a) Irregular power supply { }
- b) Poor enforcement of rules and regulations by food supervision agencies { }
- c) Lack of training and education on appropriate food safety practices { }
- d) Lack of funds { } 5. Inadequate space and the unenclosed nature of the kitchen { }
- e) Irregular water supply { }
- f) My unconcerned attitude towards food safety { }
- g) Inconvenient location of equipment such as sinks { }
- h) Busy work schedules { }
- i) Inadequate provision of equipment and resources { }

Any other, please specify.....

Please can you state what the sources of food contamination in the boarding school are?

.....

Module III: Food handlers' knowledge of food safety and hygiene

Instructions: Please rate (√) your level of agreement with each of the following statements (SA = Strongly Agree, A= Agree, N= Neither agree or disagree, D = Disagree, SD = Strongly Disagree)

Food Safety Aspects	SD	D	N	A	SA
Health and Personal Hygiene					
Wearing short fingernails during food preparation is necessary					
It is necessary to wash hands in between food preparation processes					
A chief cook suffering from a cold or cough cannot be allowed to prepare food					
Safe hands are those washed with water and soap					
A chief should only be permitted to prepare food using hair restraints					
A matron should not be permitted to wear jewellery while preparing food					
A chief cook should not be allowed to taste food using the fingers					
Using a kitchen napkin to dry hands is safer than using a clean serviette					
Wearing hand gloves when serving cooked food is necessary					
A cut on a finger covered with a piece of cloth can be used in handling cooked food					
Environmental Hygiene					
Certain domestic animals should not be allowed to move freely in food preparation areas					
It is not hygienic to keep a dust bin in food preparation to keep waste					
Food preparation can begin after cleaning the environment					
The presence of flies and dust in food preparation areas is harmful					
It is essential to carry out food preparation in an enclosed environment					
Food Hygiene					
Cleaning work surfaces in between uses is necessary					
Using a clean knife to clean fish and cut vegetables is not hygienic					

Using separate utensils to handle raw and cooked food is important					
Washing green leafy vegetables under cool running water are hygienic					
The freshly prepared soup should be allowed to cool overnight in the kitchen before refrigerating					
Meat bought from the open market is not safe					
Sanitizing work surfaces after cleaning is necessary					
Raw meat wrapped in polythene should not be stored at the top part of a fridge					
Frozen poultry needed for food preparation should not be thawed on the kitchen counter					
The correct temperature for a refrigerator is $< 1^{\circ}\text{C}$					

**AKENTEN APPIAH-MENSAH UNIVERSITY OF SKILLS TRAINING AND
ENTREPRENEURIAL DEVELOPMENT**

OBSERVATION CHECKLIST- FOOD HANDLERS SAFETY PRACTICES

Name of Senior High School:Date:

Areas of Concern		
Health and Personal Hygiene	Yes	No
Food handler avoids wearing jewellery during food preparation		
During food preparation, the food handler wears a hair constraint.		
During food preparation, the food handler wears a clean uniform.		
Between food preparation steps, the food handler washes his or her hands.		
Food handler wears neatly trimmed fingernails during food preparation		
Food handler washes hands with water and soap before food preparation		
Food handler wears an apron during food preparation		
The food handler was suffering from a cold and cough at the time of the visit		
The food handler had a cut on the finger at the time of the visit		
Food handler wears hand gloves when handling cooked food		
Food handler cleans their hands with clean serviette instead of kitchen napkin after washing		
Food Hygiene		
The food handler uses a separate utensil to handle raw and cooked food.		
In between usage, the food handler cleans the kitchen countertops.		
Food handlers using fingers to taste food		
After cleaning, the food handler sanitizes the work surface.		
While meal preparation is taking place, the food handler is eating.		
Environmental Hygiene		
The food handler does food preparation in a clean setting.		
The food handler prepares food in an environment free of dust and flies.		
There are no dustbins in the food preparation area.		
Food preparation carried out in a confined space		