

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION

**INVESTIGATION INTO FOOD HYGIENE KNOWLEDGE, ATTITUDES
AND PROCESSES OF MEAT AND POULTRY VENDORS IN THE KUMASI
CENTRAL MARKET**

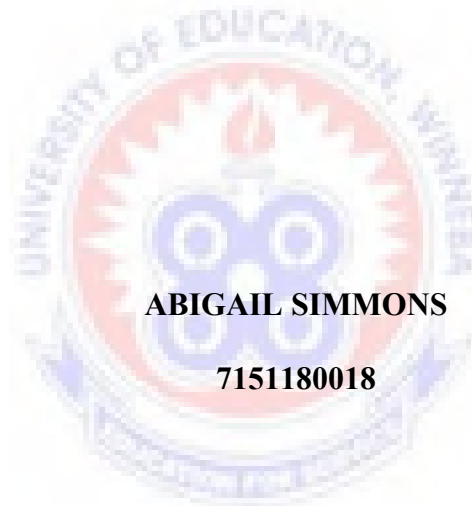


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MARCH, 2017

**UNIVERSITY OF EDUCATION, WINNEBA
COLLEGE OF TECHNOLOGY EDUCATION, KUMASI**

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CENTRAL MARKET**



**A DISSERTATION PRESENTED TO THE UNIVERSITY OF EDUCATION,
WINNEBA, COLLEGE OF TECHNOLOGY EDUCATION, FACULTY OF
VOCATIONAL EDUCATION, IN PARTIAL FULFILLMENT OF THE
REQUIREMENT FOR THE AWARD OF MASTER DEGREE IN
HOSPITALITY AND TOURISM EDUCATION**

JUNE, 2017

DECLARATION

STUDENT'S DECLARATION

I hereby declare that this dissertation with the exception of specified sources which have been identified and acknowledged is my own original work and that no part of it has been presented for another degree in the university or elsewhere.

STUDENT'S SIGNATURE..... DATE.....

ABIGAIL SIMMONS



SUPERVISOR'S DECLARATION

I hereby declare that this work is the result of the student's own effort, and I supervised in accordance with the guidelines and supervision of thesis laid down by the University of Education, Winneba.

SUPERVISOR'S SIGNATURE..... DATE.....

DR. GILBERT OWIAH SAMPSON

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DEDICATION

I dedicate this work to my husband Eric Lord Boateng and children Bismark Boateng, Kwaku Acheampong Boateng and Lord Boateng for their support.



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ABSTRACT

The poor hygiene and sanitary practices along the food production chain in the Kumasi Metropolis contribute to unacceptable level of meat and poultry contamination. This poses a health risk to consumers. To this effect, the aim of the study was to investigate into food hygiene, knowledge, attitudes and practices of meat and poultry vendors in the Kumasi central market. The study used a descriptive survey to investigate into food hygiene knowledge, attitudes and processes of meat and poultry vendors in the Kumasi Central Market. The population consisted of meat and poultry vendors in the Kumasi Central Market. A random sampling technique was used to select two hundred and twenty six (226) respondents. Questionnaire was the main instrument of data collection which was self-administered. The questionnaires were analyzed using the Statistical Package for Social Sciences (SPSS) version 18. The study results revealed that 71% of the respondents said that the hygienic condition of the butcher was poor. Majority, representing 90.3% of the respondents affirmed that they do not wash their hand with soap before touching the meat/poultry. Moreover, 77% of the respondents affirmed that they do not use aprons/white coats and or head covers while selling meat/poultry. The study results hold it that all of the respondents revealed that they do not sterilize their equipment. Unfortunately, the butchers do not use detergent/disinfectant for cleaning their equipment and they do not sterilize their equipment. This is dangerous to consumers' health. Moreover, there is no mandatory protocol in place to make the butchers neither check their health status frequently nor undergo training in areas related to their work. The researcher concluded that that the authorities in Kumasi Central market should monitor the hygienic practices and the health status of the butchers in the Market to avoid contamination and an outbreak of diseases.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

In a study conducted by Ackah *et al.*, (2011), it came to light that street foods play an important socioeconomic role in meeting food and nutritional requirements of city consumers at relatively affordable prices. The number of food poisoning reports rose steadily worldwide since the inception of *E. coli O157:H7* outbreak over the past three decades. This may be partly attributed to improved surveillance, increased global trade and travel, changes in modern food production. According to WHO (2012), food handling personnel play an important role in ensuring food safety throughout the food value chain i.e. food production, processing, storage preparation and consumption. Mishandling and disregard of hygienic practises on the part of the food handlers may enable pathogens to come into contact with food and in some cases to survive and multiply in sufficient numbers to cause illness in the consumer.

Meat is an important component of diet as it is a rich source of proteins (WHO, 2012). It provides the body with some essential which the body will otherwise not be able to synthesis. It is a chief source of Vitamin B12 as well as trace elements such as iron, copper, zinc and manganese (WHO, 2012). Chicken meat, if taken without skin, has extra advantage of being less in fat (5%) which is almost similar to that of lean meat of large animals (Dias,Queiroz, Mendes, Peres,2013).

Raw or uncooked meat has been identified as a major source of food-borne diseases in man. Moreover butchers and meat handlers are at risk of various health hazards due to

inadequate facilities and unhygienic practices. Zoonotic diseases constitute almost 70% of the emerging diseases, which are a major public health problem all over the world (Dias, *et al.*, 2013). Butchers who have regular contact with birds, meat and its products are more prone to contract and transmit zoonotic diseases. Confirmation of bird flu in a Thai poultry butcher in 2004 proves this beyond doubt. Meat consumers are susceptible to meat borne food poisoning (Dias, *et al.*, 2013).

Proper cooking alone may not be sufficient to safeguard them from food poisoning as the exo-toxins produced by some pathogens such as *Clostridium* or *Staphylococcus* can withstand high temperature (Dias, *et al.*, 2013). As such, proper meat inspection that would ensure hygiene in poultry slaughtering and handling of meat is very important. There are numerous reports of food poisoning occurring due to the consumption of contaminated poultry meat (Dias, *et al.*, 2013, McLean, Cheng, Mannetje, Woodward, Pearce, 2003). In 2003, 8271 cases of laboratory confirmed *salmonella* infection were reported in Austria and the cause was stated to be infected chicken meat. The outbreaks of salmonellosis among the Norwegian, Swedish and Finnish travellers returning from Greece during 2001-03, were identified to be associated with consumption of contaminated chicken meat (McLean, Cheng, Mannetje, Woodward, Pearce, 2003).

E. coli, *Salmonella*, *Campylobacter*, *Staphylococcus*, and *Listeria* are likely to contaminate poultry products and are often associated with food (meat) borne illnesses. In the absence of hygiene, these microbiological hazards might lead to serious health consequences such as outbreak of bird flu, cholera, diarrhoea etc. Thus,

it is essential to maintain hygiene to ensure safe meat production. Studies clearly indicate that hygiene is important for wholesome poultry meat production.

It is general knowledge that in Ghana animals are slaughtered openly in shops and private premises and sold to people without observing hygienic practices nor certification from any veterinary doctor which is against public health act stipulations. Slaughtering places are frequently contaminated and meat products from such place can be a potential source of food poisoning and zoonotic diseases. Cross contamination is a dreaded danger at slaughterhouses and utmost care should be taken to prevent this. Likewise, equipment and personnel working at slaughterhouses can be important sources for the contamination of meat. A study in 1985 done at Nsukkain Nigeria revealed the presence of various types of pathogenic bacteria in slaughtering equipment like knife, table, etc and on the hands of the butchers as well as in the meat displayed for sale. A report in 1999 attributes apron clothes worn by the butchers to be the primary source of cross contamination in meat shops. Improper cleaning procedures and lack of disinfectants at slaughterhouses were reported in UK during 2003. Another study from UK, cautions of the lack of proper hand washing among butchers, that can leads to cross contamination. One report points out that incorrect slaughtering procedure might result in contamination of poultry carcasses with their own faeces or feathers. This was resulted in contamination of meat with several bacteria such as *E. coli*, *enterobacter*, *coliforms* and *salmonella*, *campylobacter* (Herman, Heyndrickx, Grijspeerd, Vandekerchove, Rollier, De Zutter, 2003).

Butchers' knowledge and awareness about the hazards of improper butchering is essential to safeguard their health as well as the health of the community. A study

done in Kerala (India), in 1999 revealed that butchers hardly know anything about scientific and hygienic aspects of animal slaughtering. A Ghanaian study highlighted the near total absence of any sort of training given to butchers whose awareness levels are pretty primitive (Miettinen, PalmuL, Bjorkroth, Korkeala, 2001). This study therefore investigates into food hygiene knowledge, attitudes and processes of meat and poultry vendors in the Kumasi central market of Ghana.

1.2 Statement of the Problem

In spite of the increased consumer demand on food safety standards for meat and poultry in the Kumasi central market, there are still poor hygiene and sanitary practices along the food production chain which contribute to unacceptable level of meat and poultry contamination. This poses a health risk to consumers. The number of food poisoning notifications keeps increasing worldwide since the inception of *E. coli* O157: H7.

Secondly, the researcher realised that most people go a long way at home to protect themselves from food related threats. They practice proper refrigeration, wash fruits and vegetables among others. However, no matter how many precautions are put in place, food is vulnerable to contamination. The more food is handled, the more the opportunity for contaminants to be introduced. As many people eat more and more food prepared and sold outside their homes, they increase their risk of exposure to bacteria. It has recently been discovered that the food handlers are greater contributors to the illness problem (Miettinen, *et al.*, 2001).

Finally, the spread of faeco-oral diseases like Typhoid fever, Cholera among others and the amount that the government and individuals spend on the treatment of these diseases is significant. Food and meat/poultry, is the source of most causes of diseases in developing countries like Ghana. Most illnesses are due to preventable errors in food selection. The risks of illness may be reduced by taking measures to minimize contamination which may occur during preparation in the kitchen, transporting or during storage. In order to minimize public health risks, there is a need to investigate into food hygiene, knowledge, attitudes and processes of meat and poultry vendors in the Kumasi central market.

1.3 Purpose of the Study

The main purpose of the study was to investigate into food hygiene, knowledge, attitudes and practices of meat and poultry vendors in the Kumasi central market.

1.4 Objectives of the Study

The specific objectives of the study were to;

1. Investigate food hygiene, knowledge and attitudes of meat and poultry vendors in the Kumasi central market.
2. Evaluate the current hygienic practices among the meat and poultry vendors in the Kumasi central market.
3. Standardise the current processes adopted by meat and poultry vendors in the Kumasi central market.

1.5 Research questions

The following research questions were used for the study;

1. What are the food hygiene, knowledge and attitudes of meat and poultry vendors in the Kumasi central market?
2. What are the current hygienic practices among the meat and poultry butchers in the Kumasi central market?
3. What are the current processes adopted by meat and poultry vendors in the Kumasi central market?

1.6 Significance of the Study

First, meat and poultry vendors in the Kumasi central market will find the information on the analysis of the butchering practices such as food preparation, production and service useful in identifying the critical stages of contamination that require systematic control. Health regulatory authorities and the urban council will have the information to establish policies for implementing good butchering and hygiene practices. Results of the study will also influence policy decision regarding the regulation of meat and poultry processing in the Kumasi central market, help improve upon the quality of meat sold by these vendors in the Kumasi central market and as well help streamline their activities.

1.7 Delimitation/ Scope of the Study

The research was focused on investigating into food hygiene knowledge, attitudes and processes of meat and poultry vendors in the Kumasi central market. Therefore, the study is geographically limited in scope to the Kumasi central market in the Kumasi Metropolis.

1.8 Organization of the rest of the Study

This study consists of five Chapters. Chapter One deals with the background to the study, the statement of the problem, research questions and objectives of the study, significance, delimitation and organization of the study. In Chapter Two the researcher reviewed related literature regarding food safety practices while chapter three deals with the research methodology used in the study. Chapter Three also describes the research design, the population sample and sampling procedures, data gathering instruments and data collection techniques of the study, methods of data analysis. Chapter Four describes the research findings and the discussion of the main findings and Chapter Five presents the summary of the findings, conclusions and recommendations and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The chapter reviewed literature regarding Consumers' Knowledge of Street Food Safety, Consumers' Knowledge of Implications of Food Borne Diseases, Level of Awareness of Food Borne Diseases by Consumers, Knowledge of Potential Dangers of Contaminated Foods, Professional Personal Hygiene practices, Code of Hygienic Practices by Ghana Standards Authority, Specific Guidance to Consumers and Vendors, Hazard Analysis and Critical Control Point and Health hazards associated with meat production and consumption

2.1.1 Consumers' Knowledge of Street Food Safety

The association between knowledge and food safety according to (Simelane, 2005), is often explained through the Knowledge Attitude and Practice (KAP) model. Knowledge accumulates through the learning process of both formal and informal instruction, personal experience and experimental sharing (Glanz and Lewis, 2002). Traditionally, it has been assumed that knowledge is automatically translated into behaviour (Glanz and Lewis, 2002). Notwithstanding, behaviour change authors and experiences in the HIV field, have noted that knowledge alone does not translate into appropriate behaviour modification (Shisana and Simbayi, 2002, Glanz and Lewis, 2002, UNAIDS, 2004). Knowledge however is relevant and it is found to be vital in the cognitive processing of information in the attitude-behaviour relationship (Simelane, 2005).

It is imperative to maintain hygiene at each step from the hatcheries to meat consumption at the dining table. This was illustrated in a study from Belgium in 2003 in which the many routes of *Campylobacter* contamination of poultry-meat from hatcheries to slaughterhouses were demonstrated. In 2001, research showed that 62% (38 of 61) of the raw broiler pieces bought from retail stores were positive for *L. monocytogenes*. In 1999, another Belgium study observed that poultry meat samples were contaminated with *Salmonella*, *C. jejuni* and *C. coli*, and *L. monocytogenes* (Lahariya, Sharma, Pradhan, 2001).

Many studies clearly state the importance of butchers in maintaining meat hygiene (Lahariya, Sharma, Pradhan, 2001). Significant microbial contamination were detected in the surrounding premises and in the meat produced from some of the halal butchering centres in London. Aprons worn by those butchers also were found to be heavily contaminated. The findings of yet another study done in 2003 in London had emphasized the importance of environmental hygiene in butcher's settings in avoiding microbial contamination in large and medium scale facilities. A study done in Hajj, Saudi Arabia, had cautioned that butchers from the Indian Sub-Continent work barefoot and they often hold the knife in their mouth while working, an easy way for cross contamination. This can lead to cross contamination of the meat products and often adversely affect the butchers' health (Lahariya, et al. 2001).

To this end, attitude includes evaluative concepts associated with the manner people think, feel and behave (Keller, 2001). It comprises a cognitive, emotional and a behavioural element indicating what one know, how one feels and what one does (Keller 2001). In the context of this study, attitude is defined to include the

understanding of consumer regarding various aspects of food safety. Rutter and Quine (2002) argue that attitudes may influence one's intention to perform a given behaviour or practice. In furtherance, the authors emphasized that attitudes and behaviour have correlations. For instance if a person has a positive attitude towards appropriate hand washing skill, they are more probable to wash their hands before and after handling food (Simelane, 2005). However, some social scientists have argued that KAP surveys are not necessarily adequate or sufficient to provide information particularly for programmatic planning. It is evident that critical elements relating to a variable may not be captured in the use of questionnaire and that in-depth information gathering using qualitative methods may be additionally beneficial in eliciting information, as surveys fail to explain the logic behind the behaviour (Launiala, 2009).

Another concern is that there is an assumption that there exist a direct relationship between knowledge and behaviour. In health related studies for instance, however, it has been found that knowledge is not the only factor that influences treatment-seeking practice and in order to change behaviour, health programs need to address a number of issues including socio-cultural, environmental, economic and structural factors (Launiala, 2009). Behaviourists further add that a number of factors can influence one or more of the KAP variables such as self-esteem, self-efficacy and misconception (Keller, 2001, Ajzen, 2002, Glanz and Lewis, 2002). A few studies have looked at this aspect of behaviour change, including behavioural models in food handler training, and are discussed later.

Food safety requires proper handling from production through consumption. Although standards in the United States are among the highest in the world and consumer guidance on proper food handling is available through magazines, newspapers, food labels, and other sources, mistakes still occur. As put forward by Bean, Seifert, Chen, Sacks and Scheller (2007), foodborne disease in the United States reported to the Center for Disease Control (CDC) between 1988 and 1992 totaled 2,423 outbreaks causing 77,373 persons to become ill. This obviously indicates lack of knowledge about food safety on the part of the consumers who fell victim of that sad event. One will now wonder that if in the developed country like USA is experiencing an outbreak of disease resulting from unhealthy practice, what can be said about a developing country like Ghana.

Similarly, Raab and Woodburn (2007) showed that, respondents were not good at identifying either the food borne illness or the groups of people particularly at risk for food poisoning. They also found that 40% of the 100 Oregon food preparers believed either that contaminated foods could not be made safe to eat or they did not know how to do so. Worsfold and Griffith (2007), theorize that many consumers are unaware that (at least 60%) food poisoning originates in the home, believing that the responsibility lies instead with food manufacturers or restaurants. On the contrary, surveys conducted in 1986 and 1995/1996 expounded that respondents did know which foods were at high risk from food poisoning, but knowledge about how a food could be made safe to eat was limited (Raab and Woodburn, 2007).

Bryan (2008) notes that, food experts have identified obtaining food from unsafe sources, inadequate cooking or heat processing, improper cooling, unequal time

intervals between food preparations and eating and poor handling of food as the most common food handling problems by consumers. Fein, Lin and Levy (2005), have emphasized that consumers misperceive the nature of foodborne illness and the most likely pathogen source. The author advanced that consumers perceive foodborne disease as a minor illness the reason being that, unlike fever, food borne disease occurs by eating a contaminated food. In sum, foodborne disease according to consumers is a choice implying that one chooses to eat contaminated food. Most consumers according to Williamson, Gravani and Lawless (2002) are of the view that illness is caused by food prepared other than the home. It can therefore be advanced that consumers' knowledge on street food safety is high. Issanchou has affirmed that consumers' are knowledgeable since they are critical as to where they buy what because it invariably affects their choice (Issanchou, 2006).

According to the food safety literature, the process of influencing the consumers to accept certain product is multidimensional. In the view of Sheth, Sisodia, and Sharma (2000), response of the consumer, in case of choice of food is not only based on sensory properties of the product and its physical status, but also associated with other factors such as previous knowledge, previous experience as well as consumers' attitudes and believes. What will make a consumer patronize a particular food item is dependent on several factors. The study's conclusion on the knowledge of consumers regarding food safety is hereby summarized in this segment. Owing to the information reviewed, the study reinforces Deshpande, Farley, and Webster, (2013) submission that consumers worldwide are knowledgeable as to what they patronize. This was also reiterated by (Patterson, DeBaryshe, and Ramsey, 2009, Cronin, Brady, and Hult, 2000).

2.1.2 Consumers' Knowledge of Implications of Food Borne Diseases

This segment of the review, explores consumers' knowledge of what really constitutes foodborne disease. Admittedly, several practices from both consumers and food producers contaminate food regardless of the existing regulatory bodies and institutions mandated to oversee food safety. From the works of Wilcock, Maria, Khanona and Aung (2004), they established that illness that affect man in the society since prehistoric times has been attributed partially to unhealthy food and dirty drinking water. Diseases that are caused by unhealthy foods are still among the dominant ill problems in the recent era (Barrett, Howells, Shanklin, Pilling and Brannon, 2008). In the thoughts of Worsfold and Griffith (2007), the world all over, both the affluent and the pauper are not immune to diseases caused by unhealthy food and dirty drinking water. Notably, the definition of ill health emanating from unhygienic food and dirty drinking water is been rendered unconcerned subject to global, regional and at the local level (WHO, food safety undated).

Highlighting food borne diseases, Flint, Valdar, Shifman, and Mott (2005), note that quite negligible foodborne diseases generally can be linked to unhealthy foods. However, considerable attention is given to food related disease when there is an epidemic. Since diseases emanating from unhealthy foods are not easily identified, the intensity of the issue is often times not prioritized by stakeholders. The discovery that 1.8 million people have lost their lives because of consumption of unhealthy food appears unrecognized (WHO, 2004). The Stomach and Intestinal Inflammation fundamentally has been identified as the disease caused by food and other disease causing organisms easily through unhealthy food. That said, Flint *et al.* (2005) hint that, not all serious stomach and intestinal inflammation diseases emanate from

unhealthy foods. In addition, emphasis was placed on the fact that unhealthy food diseases are not always the major cause of gastroenteritis. Moreover, surveys such as cross sectional explores to capture the occurrence of diagnosed acute stomach and intestinal inflammation that the community for a particular duration. A study conducted in England retrospectively, revealed that annually above five reports a year per a person was identified.

Apparently, an intestinal disease research team in (2000) carried out another study to unravel similar phenomenon. The team strangely identified a whopping three fold over the previous study earlier on. From previous studies carried out in the UK, Australia, Canada, Ireland, and the United States, the results indicated that diseases emanating from the consumption of unhealthy foods were seen to be similar to the previous results States (Feldman and Banatvala, 2014; Palmer, Houston, Lervy, Ribero and Thomas, 2006, Flint et al., 2005). Hinted by the intestinal infections disease study team (2000) and Witte, Koopmans and Kortbeek, (2001), there is a similarity between the report from the study conducted in the UK and the one carried out in the Netherlands.

The study therefore notes that food borne diseases though is a major cause of numerous diseases, efforts geared towards addressing this menace is inadequate since diseases are ignorantly attributed to different events. Significantly, it has been recognized by the World Health Organization (WHO) that, diseases resulting from unhealthy food constitute a wider ratio 60 percent of the public health problems the world all over and contribute immensely towards other illness, co-operated nourishing standing, less fight to diseases and loss of productivity (WHO, undated). The

challenges of modernization relating to food safety presented by the association of all nations to trade among themselves (globalization) in the food supply system has deeply given rise to the international public health problem of diseases emanating from the consumption of unhealthy food.

This menace is increased by the increasing mechanization and trade of foodstuff production, quick expansion associated with improved preparation or consumption of food outside the home and the introduction of fresh resistant to antibiotics, disease causing organisms and vehicle for food (WHO food safety, undated). Food safety Literature advises that the scale of the difficulty needs to be established to be able to commence and withstand the efforts aimed at preventing foodborne diseases at both at the regional level and the international level. The World Health Organization in 2010 embarked on a global initiative to calculate the worldwide difficulty of diseases in conjunction with multiple associates in view of the data gaps relating to the true problem of foodborne diseases and its impact on development and commerce (WHO, 2010).

2.1.3 Level of Awareness of Food Borne Diseases by Consumers

Knowledge is the awareness of familiarity gained by experience of a fact or situation. Knowledge of the consequences of unsafe food hygiene practice can enhance adherence to food safety guidelines. Empirical studies on food hygiene have been done carried out across the globe. In Philippines, a survey on food safety knowledge and practice of street food vendors in a university campus in Quezon City (Azanza, Gatchalian and Ortega, 2000). Similarly, Okojie, Wagbatsoma and Ighoroge (2005), also carried out a study to assess the knowledge and practice of food hygiene by food

handlers in a Nigerian University. A descriptive, cross sectional study was carried out on randomly selected for handlers operating on the campus. 102 respondents were interviewed and inspected using a structured questionnaire administered by researchers. The study showed a majority of 90 (88.2%) of the respondents as females and these had a predominantly poor level of food safety knowledge. The practice of steering and reheating left over was a very low and was practiced by 15 (30.41%) of the respondents, which was a very low frequency of hand washing. Inspection of food handlers showed a low level of personal hygiene. Only 31 (30.41%) had pre-employment medical examination and 49 (48%) had received any form of health education.

The level of consumer awareness of safety of food can be categorized either as high or low. A study conducted by AngelilloViggiani, Greco and Rito (2001) in Italy to assess knowledge concerning foodborne diseases and food safety issues among consumers identified that the majority of food consumers who had attended a training course had high knowledge toward foodborne diseases control and preventive measures. On the contrary, Jay, Cormar, and Govenlock, (2009) indicated that less knowledge in food handling practices account for food borne disease. This is vital as studies by Djuretic et al., (2006) and Evans and Honkapohja (2008) have demonstrated that the primary elements responsible for the outbreaks of food contamination in England and Wales among, individuals were low food safety knowledge.

Numerous consumers are ignorant that inadequate food safety knowledge has accounted for the food contaminations in the home, trusting that the obligation lies

rather with food makers or restaurants to ensure food safety (Worsfold and Griffith, 2007). Sockett (2005), stress that most people do not know the fundamental guidelines of food cleanliness. Conversely, studies carried out showed that respondents did know which foods were contaminated (Ingelfinger, 2008). This implies that consumers' knowledge in food safety concerning the review literature is relatively.

Mukhola (2008), in assessing the factors influencing the safety and quality of street foods in a rural area in Limpopo noted that the knowledge and attitude of both street food vendors and consumers demonstrated little knowledge regarding the proper preparation and storage of food as well as environmental conditions that may be detrimental to health. The author further noted that, 64.4% of the respondents (consumers) confirmed that street food is sold under unacceptable conditions and these needed improvement (Mukhola, 2008). From the preceding literature, it is evident that food safety knowledge among consumers is relatively low so the attempt to explore the phenomena in Kumasi is not out of place. The effort will not only yield consumers' level of awareness, which will facilitate policy modification but will also prompt food vendors to attach importance to their business.

2.1.4 Knowledge of Potential Dangers of Contaminated Foods

According to Ghana Standards Authority (GSA), food contaminants are responsible for more than 200 diseases, ranging from diarrhoea to cancers (Daily Graphic, March 19, 2015). According to the world health organization (WHO), globally unsafe food accounts for the deaths of an estimated two million people annually, including children. Food containing harmful bacteria, viruses, parasites or chemical substances

is responsible for more than 200 diseases, ranging from diarrhoea to cancers. Changes in food production, distribution and consumption as well as changes to the environment; new and emerging disease-causing microorganisms etc. all pose challenges to national food safety systems. Increases in travel and trade enhance the likelihood that contamination of food can spread nationally and internationally.

2.2 Professional Personal Hygiene

This is been perceived as not common to everyone. According to Friedmann (2007), the food service organization in the United States of America advise that food workers must adhere to the highest possible standards of personal hygiene to make certain that pathogenic microorganisms, physical or chemical hazards, do not contaminate food. High standards of personal hygiene also play an important part in creating a good public image, as well as protecting food. Hand washing, fingernails, food worker illness policy (including exclusion of ill workers, cuts, burns, bandages etc.), hair uniforms, gloves use, jewellery, personal cleanliness, or unsanitary habits such as drinking, smoking, or spitting are all parts of defining personal hygiene standards. Poor hand washing is one of the leading causes of foodborne illness. It is noted that active hand hygiene is a concept that really helps (Friedmann, 2007).

2.2.1 Code of Hygienic Practices by Ghana Standards Authority

The Ghana Standards Authority (GSA) has developed a code of hygienic practice for street-vended foods. The code provides guidance in three principal areas, namely: suitable locations under which food should be sold, the caliber of people who should sell food and the processes under which the foods are prepared. The locations should be areas, which are free from open gutters, refuse dumps, smoke, dust or other

contaminants. Also roads to and from areas serving food should have adequate drainage while provision is made to allow for cleaning. Again, living quarters, toilets and areas where animals are kept should be completely separated from food handling areas. In addition, adequate ventilation should be provided to prevent excessive build-up of heat, steam condensation and dust to remove contaminated air.

Concerning personnel handling the food, Ghana Standards Authority (GSA) advises that they (the personnel) must be trained and be made to undergo medical examination every six months. They should also wear suitable protective clothing, including head cover and footwear. When it comes to processing the food, raw materials or ingredients stored on the premises should be maintained under conditions that will prevent spoilage and contamination. Again, water used for washing utensils, food and hands should be safe and not be reused.

2.2.2 Specific Guidance to Consumers and Vendors

The Ghana Standard Authority advice that the following guidelines are adhered to, to help ensure food safety: The practice of keeping clean surroundings, separating raw and cooked foods, keeping food at safe temperatures, and using safe water and raw materials are the few guidelines given to ensure food safety.

2.3 Meat hygiene control

In Ghana, quality control for food products is carried out by various regulatory mechanisms such as the Food and Drugs Authority (FDA).

2.3.1 Codex Alimentarius Commission

The Codex Alimentarius Commission was created in 1963 by FAO and WHO to develop food standards, guidelines and related texts such as codes of practice under the Joint FAO/WHO Food Standards Programme. The major aims of this initiative are, to protect health of the consumers, to ensure fair trade practices in the food trade, and to promote coordination of all other food standards initiatives of international, governmental and non-governmental organizations. In India Ministry of Health and Family Welfare under Government of India is the nodal agency to implement this.

Export Inspection Council of India (EIC) was set up by the Government of India under Section 3 of the Export (Quality Control & Inspection) Act, 1963 as an apex body to ensure sound development of export trade through quality control and pre-shipment inspection. The Act empowers the Central Government to notify various commodities and their minimum standards for exports and to set up suitable machinery for inspection and quality control. Generally international standards or standards of the importing countries are adopted as EIC guidelines. Poultry Meat & Poultry Meat Products were brought under compulsory quality control and pre-shipment inspection under the provisions of the Export (Quality Control and Inspection) Act, 1963.

Meat Food Product Order (MFPO) 1973 - promulgated under the Essential Commodities Act, 1955 stipulates sanitary and other requirements for the preparation of meat and maximum acceptable limits of heavy metals, preservatives, insecticides, other residues in meat and related food products. This order was being implemented by Ministry of Rural Development in the Ministry of Rural Area & Employment. As

per the recent amendment to the Allocation of Business, Ministry of Agriculture (Dept. of Agriculture & Cooperation) would now be the nodal agency to implement this order.

2.3.2 Hazard Analysis and Critical Control Point

(HACCP) is a process control system designed internationally to identify and prevent microbial and other hazards in food production. It includes steps designed to prevent problems before they occur and to correct deviations as soon as they are detected. Pillsbury Company working along with NASA and US army laboratories at Natick had developed a system to ensure the safety of food for astronauts. This was based on the fact that if something has the potential to go wrong at any stage in an operation, it would definitely go wrong at some stage unless one deploys effective control mechanisms. This system was later expanded and became HACCP, a part of Codex guidelines under World Trade Organisation (WTO). In India, HACCP guidelines are implemented through Prevention of Food Adulteration (PFA) act, 1954. HACCP acts as a watchdog for meat hygiene. It is a welcome trend that efforts are being made to implement HACCP in organized sector of the food industry. There is a dare need to implement HACCP in unorganized sector also as 70-80% of meat food is being produced and processed in the unorganized sector in India. HACCP mainly identified following major risk factors.

Improper holding temperatures

Preparing food ahead of planned schedule

Poor personal hygiene

Inadequate cooking

Inadequate cleaning and disinfecting of equipment

Cross contamination

Use of left over

Contaminated raw material

Public health Acts mainly try to ensure the bare minimum facilities that should be followed by the people engaged in poultry slaughtering for selling purposes. University of Minnesota has put forward some guidelines for the hygienic requirements of household level slaughtering.

2.3.3 Health hazards associated with meat production and consumption

Meat has been identified as a major source of food-borne diseases in man. Moreover butchers and meat handlers are at risk of various health hazards due to inadequate facilities and unhygienic practices. Zoonotic diseases constitute almost 70% of the emerging diseases, which are a major public health problem all over the world. Butchers who have regular contact with birds, meat and its products are more prone to contract and transmit zoonotic diseases. Confirmation of bird flu in a Thai poultry butcher in 2004 proves this beyond doubt. Meat consumers are susceptible to meat borne food poisoning. Proper cooking alone may not be sufficient to safeguard them from food poisoning as the exo-toxins produced by some pathogens such as *Clostridium* or *Staphylococcus* can withstand even heating. So, proper meat inspection that would ensure hygiene in poultry slaughtering and handling of meat is very important. There are numerous reports of food poisoning occurring due to the consumption of contaminated poultry meat. In 2003, 8271 cases of laboratory confirmed salmonella infection were reported in Austria and the cause was stated to be infected chicken meat. The outbreaks of salmonellosis among the Norwegian, Swedish and Finnish travellers returning from Greece during 2001-03, were identified

to be associated with consumption of contaminated chicken meat. Slaughtering occupation may also be associated with some occupational diseases such as lung cancer, warts, dermatitis and many zoonotic diseases among butchers. A cohort study among meat workers in New Zealand done in 1988-2000, had shown many cases of cancer. Health hazards due to chicken meat production and consumption can be viewed in the following sub-topics.

2.3.3.1 Bacterial diseases

These might be divided in two parts - primary diseases of poultry that can be transmitted to human being and exogenous infections acquired during processing of meat. Among the first group, common bacterial diseases of poultry having potential health hazards are salmonellosis, staphylococcal infection, clostridial diseases, coliform infections, fowl typhoid, paratyphoid infection, Arizona infection, fowl cholera, tuberculosis, chronic respiratory disease, “air sacs disease”, listeriosis, and campylobacteriosis. Listeriosis manifests in human being in the form of fever, headache, nausea and vomiting. *Salmonella*, *Campylobacter*, *E. coli* and *Staphylococcus* causes diarrhoea in human beings. In the second category, major exogenous organisms, which might lead to infections and intoxications, are *Staphylococcus*, *E. coli*, *Salmonella*, *Clostridium* and others.

2.3.3.2 Viral and chlamydial diseases

Avian influenza (bird flu), Newcastle disease, infectious bronchitis, laryngo-tracheitis, fowl pox, avian leucosis complex, lymphoid leucosis, Marek's disease, eastern equine encephalitis and ornithosis are major viral and chlamydial zoonotic diseases of poultry. Eastern equine encephalitis mostly affects persons under the age of 15 or

over 50 years of age. The dreaded bird flu which is at present considered to be in the third stage of pandemic falls under this category.

2.3.3.3 Protozoan diseases

Histomoniasis, coccidiosis and Cryptosporidium are major protozoan diseases that get transmitted from poultry to human. In immuno-compromised people, Cryptosporidium can cause severe, persistent diarrhoea and weight loss. The risk of infection to humans due to coccidia is extremely low as it is host specific.

2.3.3.4 Fungal diseases

Cryptococcosis, aspergillosis, candidosis, and histoplasmosis are common fungal diseases transmitted from poultry to humans. Histoplasmosis primarily causes pulmonary symptoms in human beings. Cryptococcosis is manifested as meningitis or meningo-encephalitis in human beings.

2.3.3.5 Miscellaneous diseases

Skin bruising, fracture of bones, physical contamination by biological residues, faecal material, paints, the dirty scalding-tank-water, heavy metals, and antibiotic residues in chicken are other concerns that negatively affect the health of poultry meat. Bruising is important as it has been revealed in a study that bruised tissue might carry bacteria such as *Staphylococci*. A study in 2002 in US food supply had revealed that most of the food category including poultry meat had persistent organic pollutants (POPs) residues.

2.4 Relevance of hygiene in meat production

E coli, *Salmonella*, *Campylobacter*, *Staphylococcus*, and *Listeria* are likely to contaminate poultry products and are often associated with food (meat) borne illnesses. In the absence of hygiene, these hazards might lead to serious consequences. This was evident in the recent outbreak of bird flu. Thus, it is essential to maintain hygiene to ensure safe meat production. Studies clearly indicate that hygiene is important for wholesome poultry meat production. It is imperative to maintain hygiene at each step from the hatcheries to meat consumption at the dining table. This was illustrated in a study from Belgium in 2003 in which the many routes of *Campylobacter* contamination of poultry-meat from hatcheries to slaughterhouses were demonstrated. In 2001, research showed that 62% (38 of 61) of the raw broiler pieces bought from retail stores were positive for *L. monocytogenes*. In 1999, another Belgium study observed that poultry meat samples were contaminated with *Salmonella*, *C. jejuni* and *C. coli*, and *L. monocytogenes*.

2.4.1 Personal Hygiene

As a consequence of humans also containing microorganisms naturally or from the surrounding environment it is important to maintain an appropriate personal hygiene.

Important hygienic aspects related to Personal Hygiene includes:

1. Food vendors practicing hand washing before handling food and often during food preparation.
2. Food vendors washing hands after going to the toilet (WHO, 2010).
3. Food vendors' drying hands after hand washing procedure.
4. Food vendors wearing clean protective clothing.
5. Food vendors wearing head covering.

6. Food vendors avoiding wearing of personal effects such as jewellery, watches, pins or other items in food handling areas.
7. Food vendors ensuring that cuts and wounds are covered by suitable waterproof dressings.
8. Food vendors avoiding personal behaviour such as smoking, spitting, chewing or eating, sneezing or coughing over unprotected food

Food vendors not handling food if you know or suspect to be suffering from or to be a carrier of a disease or illness likely to be transmitted through food. (FAO Corporate Document Repository, 2009)

2.5 The current processes adopted by meat and poultry vendors (Slaughtering methods)

2.5.1 Selecting birds for slaughter

Healthy, clean and well-fleshed birds are the prerequisites for getting wholesome poultry meat. Ideally birds should not be fed for 24 hours prior to slaughter, only water can be given. This is to prevent contamination of meat with the feed and ingested material in the digestive tract while slaughtering and evisceration of the bird. Under University of Minnesota guidelines for household level slaughtering of poultry this duration of fasting is only 6-8 hours. .

2.5.2 Stunning

Generally electric method of stunning is preferred wherein the head of birds is either brought in contact with a 500V electrified metal slope or with 150 V electrically charged water bath. Stunning is not permitted in Muslim religion.

2.5.3 Cutting and bleeding

After stunning, the anterior part of bird's throat, just below the lower jaw, is cut open severing both the large jugular veins to allow free flow of blood. This stab/ cut should not open the esophagus or trachea which might result in contamination of meat. Slaughtered bird should be kept upside down at least for 90 seconds, so that at least 50% of the blood is drained out. Putting the birds upside down in bleeding cones or hooking the birds upside down on their legs on clothline would ensure complete drainage of blood. In the halal method of slaughtering adopted by Muslim's, the birds are simply bled without stunning by cutting directly across the exposed throat at the base of the skull.

2.5.4 Scalding

Scalding involves submerging the carcass in hot water to relax the muscles holding the feathers. Ideally it should be done in continuously running warm water. Younger birds can be scalded at 125° - 130° F for 30 to 75 seconds but for older birds it may need higher temperatures of about 140° F for 30 to 75 seconds.

2.5.5 De-feathering

Removal of feathers from the dead birds could be done mechanically or manually. De-feathering machines are used to do it in large scale slaughtering centres. In smaller settings, usually the butcher himself plucks the feathers manually. Hand plucking is the usual pattern in household level slaughtering as well.

2.5.6 Singeing

Young birds may not need singeing. Generally, it is done with a bottle gas torch or an open flame. It is done to remove pin feathers from carcass.

2.5.7 Neck slitting and foot removal

Afterwards neck and head should be removed without breaking of bone by using a twisting motion to cut through the joint. Then skin should be loosened from the neck and crop and trachea. Removal of gullet (what is it? Explain) is the next step. Feet are removed by cutting through the shank joint without breaking the bones.

2.5.8 Evisceration

Safe removal of the viscera and related tissue of the carcass (dead bird) is called evisceration. The body cavity of the bird is cut open with an incision from the hind end with a cut around the vent to form a 'J' shaped incision. Vent (the excretory opening), surrounding oil glands and some adjacent tissue are removed together, taking care not to contaminate the meat with bird's faeces. Likewise with intestine and other viscera are removed carefully. One should not cut open the intestine which can cause contamination of the meat. Other viscera should be removed by stretching the abdominal opening. After separation of the viscera from the carcass, the edible parts of the viscera, the giblets (the gizzard, liver and heart) should be salvaged separately. Gallbladder should be separated from the liver without rupturing it. Gizzard should be split open, discard the contents, thoroughly washed under a stream of water and its inner lining peeled off by inserting the thumbnail under the lining at the edge of the cut surface. It is washed again before putting it back along with the

edible parts. Lungs are removed from the carcass by inserting the hand in the body cavity. The whole process is done mechanically in large-scale slaughter settings.

2.5.9 Cutting meat

After evisceration, the carcass is again washed thoroughly and placed on a cleaned slab and cut into pieces according to the requirements.

2.6 Empirical Framework of the Study

2.6.1 Food hygiene knowledge and practices

Knowledge of the consequences of unsafe food hygiene practice can enhance adherence to food safety guidelines. Studies on food hygiene have been done across the globe. In Philippines, a survey on food safety knowledge and practice of street food vendors in a university campus in Quezon City was carried out by Azanza, Gatchalian, and Ortega (2000). Topics such as health and personal hygiene of vendors, food manufacturing procedures, food contamination and waste management as well as food legislations were assessed. The study found that among the 54 street food vendors surveyed, knowledge on food safety concepts was established particularly on topics that dealt with health and personal hygiene, food contamination and good manufacturing procedures; however, vendors were shown not to be knowledgeable in food legislation and waste management. A significant gap existed between knowledge and practice on these topics and this primarily attributed to the tendencies of street food vendors to compromise food safety for financial issue. The provision of continuous food hygiene education, some financial assistance through social service affiliation and basic water and waste management utilities were

recommended to reduce the gap between knowledge and practices of safe vending on school campuses.

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

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

need for health education of those vendors in order to ensure food safety for the consumers.

Muinde (2005) had a study on Hygiene and sanitary practices of vendors of street foods in Nairobi, Kenya. The accessible population was all street food vendors from Dandora and Kayole estates. Data collection was done by using in depth interview schedule and observational checklist. Data was analyzed using both descriptive and inferential statistics. Results show that 35% of vendors belong to 20-25 years, 60% were males while 40% were females. Slightly over half of vendors (57.5%) were married. In all, 62% of vendors had primary education and below, 36.3% had secondary education while only 1.3% had college education. Most vendors 61% vendors acquired cooking principles by observation, 33.3% were taught by parents while 6.3% gained by trial and error. Based on observation about 85% of vendors prepared their foods in unhygienic conditions given that garbage and dirty waste were consciously close to the stalls, about 92.5% did not have garbage receptacles, hence they dispose their waste just near the stalls. In all, 92% of vendors threw waste water just beside the stalls making the environment surrounding the eaters quite filthy. Hence there is a significant P value > 0.5 indicating that there was no relation between education and state of environment.

Benny –Oliviera (2007) conducted a study on —Hygienic practices by vendors of the street food —doubles and public perception of vending practices in Trinidad. A structured questionnaire was administered to 120 street vendors and 115 public members in Trinidad, West Indies. Most vendors are male (61.7%), had been vending for 5 years (81.7%) and received primary level of education (72.5%). Preparation of

doubles was mainly by family (84.2%) in the morning of vending (81.7%). Vendors were appropriately dressed (99.2%), used forks/spoons (100%) and tongs (81.7%) for serving. At vending sites, containers with faucets supplied water (85.7%) and toilets were not close (97.5%). Most respondents (86.1%) consumed doubles. Some (30.6%) felt ill from eating doubles, but only 2.7% reported to a medical doctor/health authority. Significant associations were found for vending practices and sanitation of vending environment.

Furthermore, a study conducted in Latin America by Arambulo, Almeida, Gueller and Belotto (1994) on street food vending showed that there was a rapid rise of food vending. It was also found out that the generally unregulated and quasi- clandestine street food industry tended to observe poor hygiene practices which pose significant public health problems. Latin America rice cholera epidemics in this context have drawn increasing attention to street food potential for disease transmission and have created growing support for attempts to resolve these problems. To them this could be achieved through legal reorganization directed at structurally developing the street for food vending and permitting application of measures especially provision and use of safe food. Programmes that would provide appropriate training for inspectors as well as health education for both vendors and consumers of street food, the promotion and adaptation of improved methods for preparing and selling such food were advocated for. This they said may not provide immediate panacea for the street food vending problem in Latin America but can immensely improve the situation that existed at the time. Some studies have been done globally on contamination of street food, to assess microbiological contamination of street food.

Begue, Gonzales, Correa-Gracian and Tang (2007) studied the dietary risk factors, associated with the transmission of *Helicobacter Pylori* in Lima, Peru, in trying to establish the facts influencing the risk of acquisition of *Helicobacter pylori* infection. They sampled one hundred and four children within the age range of 0-17 years requiring an endoscopy for the evaluation of gastrointestinal systems. These children had their demographic and dietary data collected and biopsy specimens of the gastric antrum stained for the identification of *Helicobacter pylori*. They discovered that 52 representing 50% infected subjects were significantly older than the uninfected ones with no difference in gender, crowding, source of drinking water, or exposure to domestic animals, increased consumption of fish, chicken, beef, beans, vegetables, rice cheese, milk and unboiled water. They concluded that their findings supported the role of food prepared under unhygienic conditions as a probable mechanism of transmission of *Helicobacter pylori* in developing countries.

Also a study carried out by Volland, Ali, Van Asten, Ismid, Widjaja, Visser et al (2004) to assess the risk factors for transmission of food borne illness in restaurants and street vendors in Jakarta, Indonesia sought to explain a previous study in Jakarta which showed that eating from restaurant was not associated with disease. To explain this 128 street food vendors with the food handlers from restaurant were engaged in a cross sectional study. Poor hand washing hygiene and direct hand contact with food, male sex and educational level were independent characteristics of street vendors in logistic regression analysis.

Faecal contamination of drinking water in 65% of samples, dish water in 91% and ice cubes in (100%) was frequent. Transmittable pathogens including *S. Typhi* and

nontyphoid salmonella were isolated in faecal sample in 13 (7%) vendors. It was established that there is poor food hygiene among food vendors as compared to restaurant vendors. The study recommended that, health intervention to reduce the transmission of food borne illness should include hand washing with soap, adequate food-hygiene and frequent and renewal of dish water in street food truck.

Musa and Akande (2003) carried out a research on food hygiene practices of food vendors in Ilorin Secondary School in Nigeria. The study reveals that among 185 respondents, premedical practice was high 141 (76%) but periodic medical examination was low 30 (16%). More than 61 (33%) and 72 (39%) respondents prepared food in advance and reheated food before sale respectively. The major unhygienic practices observed among the food vendors were poor care of utensils, 100 (57%) use of previously used water for washing and cleaning, lack of covering apron among food vendors 128 (69%) and lack of hand washing basin for immediate cleaning, lack of soap and water to clean their utensils, while the rest 100 (57%) used unhygienic methods to clean their utensils. Some of the food contaminating risk factors including unclamped finger nails, skin lesions and poor protection from flies. According to the study, the need exist for food vendors and other handlers to be trained in basic principle of safe food handling.

In Kenya, Muinde and Kuria (2005) conducted a study to determine the hygienic and sanitary practices of vendors in Nairobi using a descriptive survey design. A sample size of 80 street food vendors selling commonly consumed food was selected. Most of the food vendors neither underwent any form of formal training in food preparation nor did they attempt to seek it. Moreover, water for washing utensils and hygiene was

compromised. Also stalls were poorly constructed. They would not give proper protection of the street food from the dust and smoke from vehicles. Furthermore, vendors observed minimal personal hygiene. It was found out that 81.3% of the vendors did not use apron, 60% handled food with their hair uncovered. All the vendors handled money while serving food and only 10% of them wore jewellery of their hand. Also, utensils were washed using water in buckets which were rinsed only once and the water used repeatedly before it was replaced. The water for washing and rinsing the utensils was observed to be dirty. More so, proper methods of storing leftover food were not used, hence this could have promoted the sale of stale food. Out of the food vendors interviewed, 32.1% reported consuming them and rest saved for the following day's sale. Vendors stored leftover food in open places (21%) refrigerator (21%) and plastic containers (21%) while 16% kept them either in polythene bags or in cupboards for sale the next day. Findings also showed that vendors prepared the food either at home or at the stalls, which were located by the road side. These places were highly unhygienic as food vendors deposited their food and waste water beside stalls which rendered the environment dirty and attracted houseflies. Their presence compromised sanitation.

Similarly, Okojie, Wagbatsoma and Ighoroge (2005), also carried out a study to assess the knowledge and practice of food hygiene by food handlers in a Nigerian University. A descriptive, cross sectional study was carried out on randomly selected for handlers operating on the campus. A total of 102 respondents were interviewed and inspected using a structured questionnaire administered by researchers. The study showed that 90 (88.21%) of the respondents were females and these had a predominantly poor level of food hygiene knowledge. The practice of steering and

reheating left over was a very low and was practiced by 15 (30.41%) of the respondents, which was a very low frequency of hand washing. Inspection of food handlers showed a low level of personal hygiene. Only 31 (30.41%) had pre-employment medical examination and 49 (48%) had received any form of health education.

Moreover, Barro, Ouattara, Nikiema, and Traore (2002), conducted a study on microbial quality assessment of some street food widely consumed in Ouagadougou, Burkina Faso. The first part of their research showed that 75% of food vendors were women. The vendors sat close to water drainage system and solid waste. Sometimes food was not as in areas infested by flies and other insect it was also found that water used to wash food materials was of poor quality. The second part of the study showed some foods which were not preheated such as milk product; fruit juice vegetable and fruit failed the microbial quality assessment.

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

Examinations made from 511 menu items classified as breakfast/snack food, main dishes, soups and cold dishes showed the presence of *Mesophilic bacteria* in 356 foods (69.7%), 28 contained *Enterobacteriaceae* (33.7%). The microbial quality of most of the food was within the acceptable limits but samples of salads, macaroni, fufu, rice balls and red pepper had unacceptable level of contaminating. To them, street foods can be a source of pathogens.

Tjoa *et al*, (1997) were quoted to have confirmed the role played by unwholesome meat in the causation of disease. They recommended that food vendors should receive education on food hygiene and moreover special attention be given to the causes of diarrhoea, transmission of diarrhoea pathogens, the handling equipment's and cooked food, hand washing practices and environmental hygiene.

Also, PaaNii (2005), in collaboration with some institutions in Ghana had the concerns that livelihood of vendors and health of consumers may be at risk if concerns over food safety are not addressed. A survey of 180 vendors in five different markets in Accra was conducted and the result showed that most vendors worked under poor sanitary conditions. They also found out from a micro biological survey (45 samples) that some streets foods were intrinsically safer than others. It was found out that kenkey and waakye were safe products while fufu was contaminated. The study also showed that most food vendors (197) sampled had no concern regarding heavy metal (lead metal).

Finally, in a study by Okai and Dordi (2002), a non-experimental design was used to determine the knowledge, attitude and practices on food hygiene by food vendors of

University of Ghana campus. The study highlighted on two types of vendors. Those who brought already prepared food from home and those who cooked on site. It was showed that food vendors' educational background and the relation of the selling had further established that the food vendors had high knowledge with regard to purchasing, transporting, storing, preparing and handling food as well as personal cleanliness. The study also showed that food vendors practiced poor food hygiene as evidenced by the poor state of cooking and selling environment as well as improper handling and washing of drinking cups, napkins and lack of proper water storage facilities.

Food safety experts have identified the most common food handling mistakes made by consumers as well as food vendors. The mistakes include serving contaminated raw food, cooking or heating food inadequately, obtaining food from unsafe sources and cooling food inadequately. Consumers need to appreciate the seriousness of food borne-disease. They must learn to recognize unsafe food-handling practices, the latency period for some microbes and the symptoms of food-borne diseases. They also need to understand how to protect themselves through kitchen and personal hygiene, including thoroughness and frequency of hand washing, temperature control and safe food choices.

Besides water, other raw materials are also important to the safety of the street vended foods because of the biological, chemical and physical hazards that they might introduce. In order to keep prices down, some vendors purchase cheap or adulterated ingredients containing unpermitted chemical additives from unauthorized suppliers which may further increase the risks associated with the food so prepared.

Raw meat, poultry and vegetables are commonly contaminated with large numbers of bacteria, including potential foodborne pathogens such as *B. cereus*, *C. perfringens*, *C. jejuni*, *E. coli*, *L. monocytogenes*, *Salmonella* and *S. aureus*. Spices are known to harbor a large number of microorganisms which include members of the genus *Bacillus*, anaerobic sporeformers, enterococci, members of Enterobacteriaceae, a variety of yeast and mould and pathogens like coagulase positive staphylococci (International Commission on Microbiological Specifications for Foods (ICMSF, 2006). Contamination of foods by spices which act as spore carriers has been reported to lead to food spoilage and can even lead to food poisoning. Spore formers in spices may lead to food spoilage, when they survive the cooking process and multiply under favorable conditions (Powers, Latt and Brown, 2006).

In a study done in Calcutta, samples that were suspected of adulteration were analysed and in 30 of the 50 samples, unauthorized food additives were detected. Similarly, pathogens like *B. cereus*, *S. aureus*, *C. perfringens*, *V. metschnikovii* and *E. coli* were reported in raw chicken, salad and gravy raw materials (Mosupye and Von Holy 2009). These organisms were probably present in these foods either prior to purchase by vendors or may have been introduced by cross contamination during food handling or during preparation.

The above literature reviewed internationally and locally shows the peril a person's health is exposed to through the consumption of unhygienic street foods. It indicates that poor personal and environmental hygiene, lack of food hygiene knowledge on the part of food vendors can go a long way to affect the health of the patrons of street foods. Reasons for contamination could be the location of the stall (surroundings),

poor personal hygiene, and poor food hygiene practices during cooking, storing and serving, poor source of drinking water, poor storage system, uncovered food container, improper practices of taking out water from the pitcher, long hours of storage of food among others.

2.7 Role of butchers, slaughtering methods and butcher shops in maintaining meat hygiene

Many studies clearly state the importance of butchers in maintaining meat hygiene. Heavy microbial contamination (salmonella and campylobacter bacteria) were detected in the surrounding premises and in the meat produced from some of the halal butchering centres in London. Aprons worn by those butchers also were found to be heavily contaminated. The findings of yet another study done in 2003 in London had emphasized the importance of environmental hygiene in butcher's settings in avoiding microbial contamination in large and medium scale facilities. A study done in Hajj, Saudi Arabia, had cautioned that butchers from the Indian Sub-Continent work barefoot and they often hold the knife in their mouth while working, an easy way for cross contamination. This can lead to cross contamination of the meat products and often adversely affect the butchers' health. There are many newspaper reports that in Punjab (India) animals are slaughtered openly in shops and private premises and sold to people without observing hygienic practices nor certification from a veterinary doctor which is against public health act stipulations. A review paper from Nepal in 2003 warns that slaughtering places are frequently contaminated and meat products from such a place can be a potential source of food poisoning and zoonotic diseases. Cross contamination is a dreaded danger at slaughterhouses and utmost care should be taken to prevent this. Likewise, equipment and personnel working at slaughterhouses can be important sources for the contamination of meat. A study in 1985 done at

Nsukka (Nigeria) revealed the presence of various types of pathogenic bacteria in slaughtering equipment like knife, table, etc and on the hands of the butchers as well as in the meat displayed for sale. A report in 1999 attributes apron clothes worn by the butchers to be the primary source of cross contamination in meat shops. Improper cleaning procedures and lack of disinfectants at slaughterhouses were reported in UK during 2003. Another study from UK, cautions of the lack of proper hand washing among butchers, that can lead to cross contamination. One report points out that incorrect slaughtering procedure might result in contamination of poultry carcasses with their own faeces, GIT content, or feathers. This was resulted in contamination of meat with several bacteria such as *E. coli*, enterobacter, coliforms and salmonella, campylobacter.

2.7.1 Hygienic knowledge and awareness of butchers

Butcher's knowledge and awareness about the hazards of improper butchering is essential to safeguard their health as well as the health of the community. A study done in Kerala (India), in 1999 revealed that butchers hardly know anything about scientific and hygienic aspects of animal slaughtering. A Ghanaian study highlighted the near total absence of any sort of training given to butchers whose awareness levels are pretty primitive.

2.7.2 Importance of clean premises

By-products and wastes from the slaughterhouses should be properly disposed; otherwise this can lead to environmental pollution and ecological imbalance. Indiscriminate disposal of poultry wastes and its by-products can contaminate the environment and lead to the spread and sustenance of infection in the community.

One study from Nangal (Punjab) reports that many birds perished after consuming the 'leftover' of slaughtered animals which were dumped into the river Sutlej from a nearby slaughterhouse. Indiscriminate spillage of abattoir by-products, effluents and solid wastes could lead to recycling of infection in animals, which may get into the human cycle and cause disease in humans.

2.7.3 Common Microbial Present in Meat and Meat Products

Microorganisms of relevance with regard to meat hygiene include helminths, moulds, bacteria and viruses. Within these groups, bacteria play the most important role. Parasites are of insignificant value in meat which has passed meat inspection, or where efficient internal parasite control programmes or measure are in place. The most frequently identified bacterial pathogen associated with consumption of beef products are *Salmonella* spp, *Compylobacterspp*, *Staphylococcus aureus*, *Escherichia coli*, *Listeria monocytogenes*, *Clostridium perfringens*, *Yersinia enterocolitica*, *Bacillus cereus* and *Vibrio parahaemolyticus* (Biswas *et al.*, 2011). *Compylobacterspp*, *Salmonella* spp and *Escherichia coli* are often present in fresh meat and poultry (Zhao *et al.*, 2001). Ali *et al.* (2010) reported the foodborne pathogens isolated from meat samples in retail meat shops.

They included *Escherichia coli* O157:H7, *Listeria*spp, *Salmonella enteritidis* and *Shigella* species while in meat handling equipments in retail shops were *Staphylococcus* and *Shigella*spp. Soyiriet *al.* (2008) isolated *Staphylococcus aureus*, *Bacillus cereus*, *Clostridiumperfringens* and *Escherichia coli* in beef samples from butchers. Moreover, the faecal coliforms such as *Escherichia coli* are generally

considered as indisputable indicators of faecal contamination from warm blooded animals (Yousuf *et al.*, 2008).

2.7.4 The Effects of Bacteria in Meat and Meat Products

Food animals are useful as they supply quality protein and revenues to man, but on the other hand they serve as vehicles of disease pathogens. Raw meat remains an important and probably the major source of human food borne infection with pathogenic bacteria. In spite of decades of effort to control them, it has been difficult to obtain food animals free of pathogenic bacteria (Wilfred and Fairuze, 2011). The effects that microbial contaminants cause on meat include spoilage of the meat, food poisoning and condemnation of carcasses which results into reduction of income to farmers as well as meat sellers. Consumers and meat handlers may acquire bacterial diseases such as Anthrax, Q-fever, Campylobacteriosis, Ornithosis, Botulism, *Staphylococcus* food poisoning, Salmonellosis, Brucellosis, Erysipelas, Streptococcosis, Tetanus, Yersiniosis, Clostridiosis, Listeriosis, Glanders, Leptospirosis and Tuberculosis due to poor handling of food animals and meat (Adeyemo, 2002).

2.7.5 Incidences of Microbial Load in Meat, Handling Equipment and Facilities

The microbiological profile in meat products is the key criteria for determining quality and safety of fresh produce. Ideally, meat should be considered as wholesome when pathogens of concern are absent or if present should be at low number depending on their toxin or metabolites produced (Biswas *et al.*, 2011). Bhandare *et al.* (2009) reported TVC at 5.8 ± 0.17 log CFU/cm² and 6.05 ± 0.25 log CFU/cm² in modern Indian and traditional meat shops respectively. In abattoir,

the highest TVC were observed on floor $7.19 \pm 0.18 \log \text{CFU/cm}^2$ and the lowest values in water $3.90 \pm 0.07 \log \text{CFU/cm}^2$, while in retail meat shops the highest were observed on floor $7.45 \pm 0.46 \log \text{CFU/cm}^2$ and the lowest on the plastic bags $3.08 \pm 0.24 \log \text{CFU/cm}^2$. Barros *et al.* (2007) reported contamination level by mesophilic aerobe count in samples from retail establishments and slaughterhouse equipment at $4.68 \log \text{CFU/cm}^2$, Total Coliforms at $2.55 \log \text{CFU/cm}^2$ and that of *Escherichia coli* at $1.8 \log \text{CFU/cm}^2$ respectively.

In other studies Nouichi *et al.* (2009) reported microbial load as indicated by TVC, TCC and TFC in bovine carcass slaughtered at El-Harrach slaughter house in Algeria at 4.48 ± 0.63 , $2.92 \pm 0.43 \log \text{CFU/cm}^2$ and $2.60 \pm 0.32 \log \text{CFU/cm}^2$ respectively. Kumar *et al.* (2010) found a high total aerobic plate count of 75.91 % in beef produced and marketed in some parts of Tigray region with high percentage of unsatisfactory quality. Ukutet *et al.* (2010) reported microbial load on fresh meat sold in Calabar Metropolis markets at 2.24×10^4 - $5.01 \times 10^4 \text{CFU/g}$ and 1.05×10^3 - $3.72 \times 10^3 \text{CFU/g}$ for TVC and TCC respectively.

2.7.6 Source of Beef Contamination

Unless the animals are infected the meat of freshly slaughtered animals are generally sterile. The presence of microorganisms on post slaughtered carcasses is due to contamination occurring immediately before, during and after slaughter. The microbial contaminations of carcasses occur mainly during processing and manipulation during skinning, evisceration, processing at abattoir and retailers establishments (Gill, 2008). The main sources of meat contamination include; animal/carcasses source, on farm factors, transport factors, abattoir and butchers

facilities, parasites and wild animals, meat van, abattoir and retail meat outlet workers.

2.7.6.1 Animal/carcasses source

Faecal matter is a major source of contamination and can reach carcasses through direct deposition as well as by indirect contact through contaminated carcasses, equipment, workers, installations and air (Borch & Arinder, 2002). Faeces as well as soil adhering to animals are carried into abattoir on hair, hides, hooves and tail of animals. Contact between carcasses and hides allow a mixture of microorganisms to be introduced on the carcasses. These contaminating microorganisms are derived from the animal's pre slaughter environment that may be of faecal, soil, water or feed origin (Bell, 2007). Infected body fluid such as urine, milk, blood, mucus, rumen fluid, intestinal fluid and fluid from excised abscess can be another source of carcasses contamination (Galland, 2007).

2.7.6.2 On farm factors

Body condition may affect the pathogens load. Weak animals lie down more often than healthy ones, thereby increasing the likelihood of contaminating hides. Contacts between animals at auction barns may increase the pathogen load (Galland, 2007). The exterior of the animals harbours large number and different types of microorganisms from soil, water, feed, manure as well as its natural flora (Mtengaet *al.*, 2000).

2.7.6.3 Transportation of slaughter animals

The transport factors such as the type and cleanliness of transport facility, distance travelled and duration of journey, harshness of ride, overpopulation of animals in the conveyance and frequency of stops, may affect and contribute to pathogen load (Galland, 2007).

2.7.6.4 Abattoir and butchers facilities

The abattoir and beef retail outlet environments play important roles in contamination of meat. Site selection and availability of good quality portable water are important factors to consider when selecting site for constructing abattoir or retail meat outlets since it affects the quality of meat. Meat contamination in abattoirs and retail meat outlets result from the use of contaminated water, unhygienic practices like poor handling, use of contaminated tables to display meat intended for sale and the use of contaminated knives and other equipment in cutting operations (Fasanmi *et al.*, 2010).

The length of time animals are held at the abattoir before slaughter can affect the pathogen load by increasing the probability of exposure and infections. Sanitation of walk ways, pen floor, railings, feed and water affect the pathogen load (Galland, 2007). Dirt, soil, body discharges and excreta from animals in holding pens or lairages are primary sources of contamination of carcasses in the later stages of the operation. This happens irrespective of whether or not the animals are fit and have passed ante mortem inspection. Adzitey *et al.* (2011) reported the possible sources of contaminations arising from the cutting knives, intestinal contents, chopping boards, hides, meat handlers, containers, vehicle for transporting carcasses and the

meat selling environment. It has been reported by Ali *et al.* (2010) that knives, wooden boards and weighing scales from retail shops are sources of bacterial contamination particularly *Staphylococcus aureus* and *Shigella* species. Akinroet *al.* (2009) reported that with inadequate slaughtering and disposal facilities, the abattoir becomes a source of infection and pollution, attracting domestic and wild carnivores, rodents and flies, which are vectors of diseases. Refrigerator or freezers are essential storage facilities used to prevent spoilage of meat following prolonged storage at room temperature and hence keep meat safe for long period of time.

2.7.6.5 Parasites and wild animals

With inadequate slaughtering and disposal facilities attracting flies, domestic animals, wild carnivores and rodents, abattoir/slaughter houses become among the important sources of microbial contamination (Adeyemo, 2002).

2.7.6.6 Meat van

The vehicles used to transport meat from abattoir to retail meat outlets may act as sources of contamination since often lack regular cleanliness and are not well covered leading to contamination by dusts, insects and flies. Sulley, (2006) reported contamination of meat resulting from other means of transport such as motor-bikes and bicycles due to insufficient vans and trucks. On the other hand, the few transport available were not properly cleaned and thus contained high microbial loads (Sulley, 2006).

2.7.6.7 Abattoir and retail meat outlet workers

The hygienic condition of the abattoir and retail meat outlet workers has potential to contribute contamination in beef before and after processing. Adetunde *et al.* (2011) reported that unclean slaughter men's hands, butcher arms, clothing and equipment used in carcass dressing process accounted for the microbial contamination and also the study of Jeffery, (2003) revealed that the worker hands and their equipment were among the main sources of meat contamination.

2.8 Consequences of Inadequate Food Safety Knowledge

Authors, McIntosh and Peckarsky (2014), define knowledge as the practices which in turn affects willingness to change current practices if it is learned that current practices are unsafe. Variably, Patil, Cates and Morales, (2005), indicated that food handling practices are known to differ from self-reported practices. This has been established as very fundamental by (Djuretic, Wall, Ryan, Evans, Adak and Cowden, 2006, Evans and Honkapohja, 2008) as the writers have indicated that the main factors responsible for the outbreaks of food poisoning in England and Wales during 1992-1994 and 1995-1996, respectively, were inappropriate storage, inadequate cooking or heating, and cross-contamination.

Food safety experts believe sporadic cases and small outbreaks at home are far more common than those cases constituting recognized outbreaks (institute of Food Technologist's expert panel about food safety and Nutrition, 2005). If consumers misconstrue the origin and severity of foodborne illness, they are less motivated to change. Motivation to practice safe food handling requires a belief that someone is harmed by not doing so, and that new behaviour will prevent illness (Shaffer, Fisher,

Lucas, Dulcan, and Schwab-Stone, 2000). The author claims that the failure to associate at-home food handling practices with borne illness is a serious inhibition to convince people to discontinue potentially hazardous food handling behaviour (Fein et al., 2005).

Food safety as put out by Henson and Traill (2013), is the inverse of food risk- the probability of not suffering some hazard form consuming a specific food (Henson and Traill, 2013). Potential undesirable residues in foods span a broad range, from natural (mycotoxins) and environmental pollutants (dioxins) to agro-chemicals (nitrates and pesticides), veterinary drugs, growth promoters, packaging components, and many more.

2.8.1 Food and Quality

It is important to take caution when selecting raw materials for food preparation. These raw materials, including water and ice may be contaminated with dangerous microorganisms and chemicals. Toxic chemicals may be formed in damaged and mouldy foods.

Important hygienic aspects related to Food and Quality includes:

1. Food vendors should select fresh and wholesome foods to prepare food for sale.
2. Food vendors must choose food processed to reduce the risk associated with cooking raw foods for foods.
3. Food vendors should make ice from safe water (FAO Corporate Document Repository, 2009).

4. Food vendors should use safe water or treat it to make it safe (WHO, 2010).

Microbiological analysis of utensils surface and knives have the presence of *Salmonella* and *Shigella* (Rane, 2011). It is also reported that during the preparation of food, the raw material is cut and chopped using the same knife without in between cleaning and such knives are often invaded by flies (Rane, 2011). A study conducted and published in 2011 on street foods: handling, hygiene and client expectations in Cape Coast, Ghana by Annan-Prah *et. al.* confirms the statement made above. Handling, vending and hygienic quality of street foods available to local residents, internal and foreign tourists to Cape Coast, the most important tourism hub in Ghana, were investigated.

Questionnaires assessed stakeholder commitment to and expectations of food hygiene. Laboratory analysis evaluated microbial contamination levels of the street foods. The study showed that both local residents and tourists, foreign tourists put the hygienic safety as the principal criterion over curiosity and price to patronize street foods. Although licenses had been given to 27 (54%) of the 50 investigated food vendors, only 15 (55.5%) of the licensed vendors had had medical examination (8 only once and 7 annually). Food vending premises visibly needed improvement in sanitation. The foods had the following bacterial contamination levels in colony forming units per gram (cfu/g): meat pie (1.3×10^5), khebab (5×10^4), rice with stew (4.1×10^5), fried fish (8×10^4), pepper sauce (1.4×10^5), *etsewor* banku (3×10^5), beans with *gari* (2×10^4), *fufu* (1.6×10^5) *waakye* (6.6×10^5) and *dakua* (2.3×10^5). The presence of *Escherichia coli* of faecal origin was detected in all investigated food samples.

Khebab, fried fish and beans with *gari* had acceptable bacterial contamination levels of $<5 \log_{10}$ cfu/g.

The following major fungi were identified in the street foods: *Aspergillusflavus*, *Aspergillusniger*, *Aspergilluscandidus*, *Cladosporiumherbarum*, *Necrosporacrassa*, *Penicilliumcitrinum*, *Fusarium*, *Mucor* and yeast species. Yeasts were found in all investigated food items. The street foods were, therefore, found to have threatening unacceptable microbial contamination levels.

Street vended foods are not only appreciated for their unique flavours, convenience and the role which they play in the cultural and social heritage of societies, they have also become important and essential for maintaining the nutritional status of the populations. Besides offering business opportunities for developing entrepreneurs, the sale of street foods can make a sizeable contribution to the economies of developing countries. In India, the National Policy for Urban Street Vendors/Hawkers stated that street vendors constitute approximately 2% of the population of a metropolis (Indian Street Food Policy, 2004). Street foods are perceived to be a major public health risk due to lack of basic infrastructure and services, and difficulty in controlling the large numbers of street food vending operations because of their diversity, mobility and temporary nature (Rane, 2011). A general lack of factual knowledge about the epidemiological significance of many street vended foods, poor knowledge of street vendors in basic food safety measures and inadequate public awareness of hazards posed by certain foods has severely hampered the deployment of a precise scientific approach to this very serious issue of public health and safety (Rane, 2011).

The epidemiological studies such as Mensah *et.al*, (2002) which suggests that street foods contribute to a significant number of food poisonings are inadequate, due to paucity of data deficiencies in knowledge about important parameters in the food chain and host pathogen interactions; however, there have been several documented cases of food poisoning outbreaks due to street foods. Street foods were responsible for 691 food poisoning outbreaks and 49 deaths from 1983 to 1992 in Shangdong Province (China). FAO has implemented and supported several projects which aimed at improving various aspects of the street food sector in countries like Bolivia, Colombia, Ecuador, India, Zaire, etc. Malaysia, Philippines and India are the three countries which have regulations for protecting street vendors. Malaysia is the only country where licensed street vendors are provided facilities for conducting their trade. An initiative has been taken in Durban, Africa, where a coalition between local and national authorities, explored the food laws associated with street vending and developed strategies that could be used to control identified food hazards.

2.9 Global Perspective on Food Safety

The food safety development (FSD) strives to reduce the serious negative impact of food- borne diseases worldwide (Gessner & Beller, 2014). Food and waterborne diarrhoeal diseases are leading causes of illness and death in less developed countries, responsible for affecting 1.8 million people annually. Recent trends in global food production, processing, distribution and preparation are creating an increasing demand for food safety research in order to ensure a safer global food supply. WHO works closely with FAO (2002) to address food safety issues along the entire food production chain by the use of HACCP system. These methods provide efficient,

science-based tools to improve food safety, thereby benefiting both public health and economic development.

To improve food safety and strengthen consumer confidence, concerns over safety and quality for governments, food producers, industrial traders and consumer are increasing. The burden of food-borne diseases is significant in all parts of the world. In the European region, some food safety and quality problems have endangered consumer health. Food can be contaminated by water used as an ingredient (Ilboudo & Traoré, 2005).

2.9.1 Consumer Information and Demand

The implementation of food safety principles should be confined not only to developed countries but also to developing countries because this is a clear indication of factors of development allowing the destructive eventualities of potential health incidents, which can be avoided (WHO, 2005). Consumers who are well-informed will be able to fight for their rights and ensure that they are provided with safe and good quality products and services.

Countries without effective food control systems cannot ensure safe foods, although the range of foods eaten may affect our individual health in the long term, food safety discussions usually focus on the more immediate effects that arise from consuming foods contaminated with some undesirable biological or chemical agents. Food quality control is the science, which deals with the basic standards of food safety maintenance to be accepted by the human race (FAO / WHO, 2002). In Kenya, there is Food, Drugs and Chemical Substances Act CAP 254 of 1992 and Public Health Act

CAP 242 of 1986 of the Laws of Kenya which deals with public protection on food safety and sanitation (Gok, 2005).

The importance of food technologies in the prevention of diseases and health remains unrecognized in public health establishments and they are thought to be causes of foodborne diseases (WHO, 2005). The role of food technologies in the life and health of people is wide and very important in improving the nutritional quality of food ensuring safety and preventing food-borne diseases. They reduce losses due to spoilage and contamination and therefore prevent malnutrition and starvation. There are socioeconomic implications which facilitate and promote trade in food, provide employment, women facilitation in family's food preparation thus fully participating in social life. They also increase the customers' pleasure and provide a greater choice of products.

2.9.2 Public Health Aspects

Food safety is a priority for consumers and customers as they want safe health food, which keep them strong and healthy (Hayer, 2014). Major case for food contamination with pathogens is unsanitary practices during product handling, processing and distribution. Food poisoning agents (infection and intoxication), that are associated with foods include *Escherichia coli*, *Salmonella spp*, *Vibrio cholera*, *Staphylococcus aureus*, *Bacillus cereus*, *Listeria monocytogenes* and *Clostridium perfringens* (Socket, 2011). *Staphylococcus aureus* is a human associated bacterium isolated from the human skin and nasal membrane and its presence in food indicates lapse in the maintenance of personal hygiene (Adesiyun, 2014).

Salmonellosis is one of the major food-borne health hazards and is associated with animal food such as poultry, meat, milk, eggs and fish (Garner & Nunn, 2015). They produce enzymes that degrade carbohydrates, fats and proteins thus resulting in softening and flavour deterioration of foods (Maff, 2015). Under favourable conditions during harvesting, processing and storage of food commodities, moulds produce toxic metabolites called mycotoxins which are a concern to global food safety because of their effects on human health. Most mycotoxins are heat stable and capable of producing diseases of acute or chronic nature when ingested with food. They can affect organs like the liver, the kidney and nervous systems, endocrine and immune systems. Uses of an integrated management system of risks that reflects the HACCP concepts and emphasizes on good manufacturing practices have been recommended (Kapperud, 2015).

New challenges to Kenya food supply have prompted public health authorities to consider adopting a HACCP- based food safety system on a wider basis, because of the increasing number of new food pathogens (WHO, 2005). HACCP focuses on identifying and preventing hazards from contaminating food, is based on sound science, permits more efficient and effective government oversight, places responsibility on the food manufacturer or distributor, helps food establishments compete more effectively in the world market and reduces barriers to international trade (ICMSF, 1980).

2.10 Application of HACCP to Food Service and the Underlying Benefits

HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical and physical hazards from raw material production, procurement and handling, to processing, preparation, distribution and consumption of the finished product. A firm commitment to HACCP by top management provides company employees with a sense of the importance of producing safe food (WHO, 2002).

The system is designed for use in all segments of the food industry from growing harvesting, processing, manufacturing, distributing and merchandising to preparing food for consumption. Prerequisites programmes like good manufacturing practices (GMPs) are essential foundations for the development and implementation of successful HACCP plans. Food safety systems based on the HACCP systems have been successfully applied in food processing plants, retail food stores and food service operations. It should be emphasized that HACCP is a preventive approach, and not reactive (WHO, 2002).

So as to verify that the procedures are being implemented, inspection schedules, review plans, records and sampling should be incorporated into the methods, procedures and tests of the whole preparation process. Todd (2006) estimated that 5% of all food- borne illnesses may be traced to abusive industrial practices. Ninety five percent are associated with abusive practices in food service, restaurants or home preparation of foods. HACCP principles can be applied in food service establishments

as implied by Bernard (2002), and can reduce the number of outbreaks of food-borne illness.

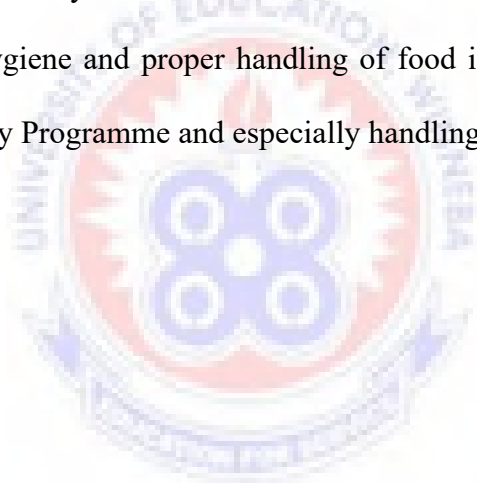
The first CCP of product is at the receiving area where those responsible must examine the condition of each item as it is unloaded, from known and approved suppliers who should have functional temperature indicators which should be checked to monitor abuse (Firestone, 2012). Food fried in badly abused oils may absorb the degraded fat, causing gastrointestinal distress. Complaints of this nature and studies on oil quality led to the development of regulations governing restaurants frying oils in developed countries like Europe (WHO, 2005).

Flyers, (2008) says, the benefit underlying this system for all food sectors and consumers alike to the government include among others improved public health, more efficient and targeted food control, reduced public health costs, trade facilitation and increased confidence of the community in the food industry. To the industry, there will be increased consumer and government confidence, reduced legal and insurance costs, increased market access, reduction in production costs, improved staff-management commitment to the food safety and decreased business risks. To the consumer, there will be reduced risks of food-borne diseases, increased awareness of basic hygiene, increased confidence in the food supply chain and improved quality of life.

Some of the barriers to the implementation of the HACCP systems in food establishment are external conditions which increase the pressure on the strategies for its implementation like regulatory market forces, promotion by public health and food

control authorities (WHO, 2002). Others could be internal factors like the level of knowledge or resources available and lack of government or industry support. Management should be commitment to the system and need to change attitude and organizational culture towards the system approaches.

Adequate training is important for overcoming barriers related to human resources. This should include both employees and enforcement officials and should lead to behavioural changes, enhance competency along with assessment thereafter. The application of HACCP in restaurants should be mandatory (Stuart, 2012). This is to change the traditional role of food safety agencies and food inspectors since the system is making headways in the food industries. Educating food handlers to adhere to good personal hygiene and proper handling of food is an essential component of National Food Safety Programme and especially handling of fish (Owaga, 2004).



CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter contains the methodology. The methodology outlined in detail the research design, profile of the study area, population, sample size and sampling procedure, sources of data, methods of data collection, pilot study, and data processing and analysis.

3.1 Research Design

The study used a descriptive survey to investigate into food hygiene knowledge, attitudes and processes of meat and poultry vendors in the Kumasi Central Market. Moreover, the quantitative research design was used for the study. As a strategy, a survey method would be used to obtain information on selected meat and poultry vendors in the Kumasi Central Market. The study also used both quantitative and qualitative research and a combination of both approaches. These types of research approach were used because they eventually aid the researcher to make judgement about the effectiveness, relevance or desirability of the variables.

3.2 Profile of the Study Area (Kumasi Central Market)

The Kumasi Central Market (*also known as* Kejetia Market) is an open-air market in the city of Kumasi the capital of Ashanti. Kumasi Central Market is in the Rain Forest Bioregion of Ashanti on the Ashantiland Peninsula. Kumasi is approximately 300 miles (480 km) north of the Equator and 100 miles (160 km) north of the Gulf of Guinea. Kumasi is popularly known as "The Garden City" or "heart beat" of Ashanti

and the Ashantiland Peninsula because of its many beautiful species of flowers and plants.

The Kejetia market is the largest single market in Kumasi, Ashanti, on the Ashantiland Peninsula, in West Africa and on Continental Africa with over 45,000 stores and stalls.

Right in the heart of Kumasi capital of Ashanti and the Ashantiland Peninsula; Kumasi Central Market is Kumasi's, Ashanti's, and Ashantiland Peninsula's, West Africa's and Continental Africa's largest open air markets. Kejetia market is bordered to the North by the Kumasi Cultural Centre and to the North West by the Komfo Anokye Teaching Hospital (KATH). The southern part of the Kejetia market forms a border with Adum, a commercial centre of the Kumasi metropolis. Virtually everything that one wants to purchase from a market can be found at Kumasi Central Market. Kejetia market ranges from gold jewelry and diamond jewelry handcrafted by the Ashantis, food including meat and poultry, gorgeous Ashanti kente clothing fabrics and footwear by Printex (in the center of the market), spices, grains, and toiletries. If a person is traveling with someone, it is necessary to stay close since it is very easy to lose one another and pretty easy to lose your way. Kejetia market is a great place to buy fabric such as the Ashanti people's kente clothing, and see a huge Kejetia market, full of everyday hustle and bustle.

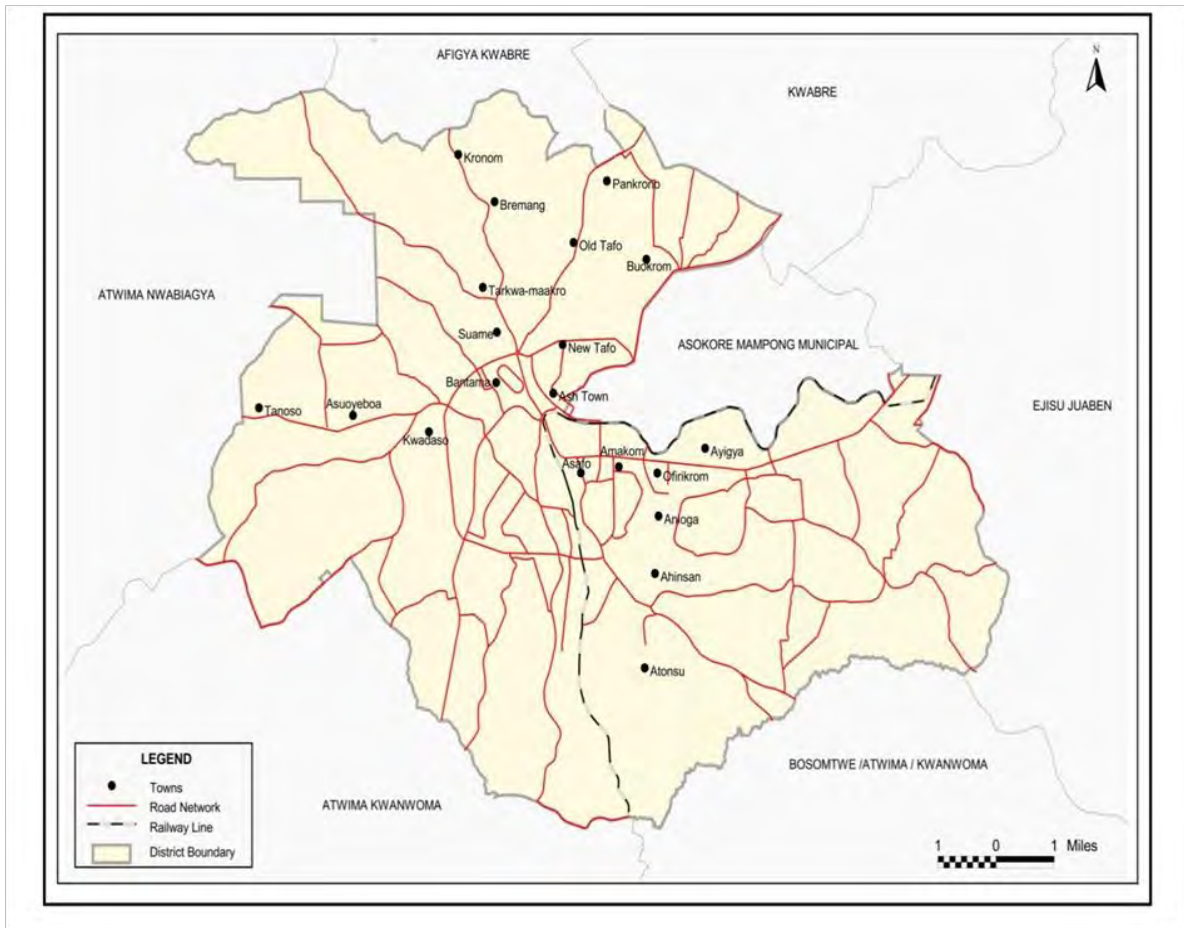


Table 3. 1 Map of Kumasi Metropolis

3.3 Population for the Study

The population consists of meat and poultry vendors in the Kumasi Central Market. The population for the study was 572, comprising meat and poultry vendors in the Kumasi Central Market.

3.4 Sampling Technique and Sampling Size

According to the Krejcie and Morgan (1970), table of determining sample size, a population of 572 requires a sample size of 226. The random sampling method was used to select a sample size of two hundred and twenty six (226) respondents for the study.

3.5 Instrument for Data Collection

Questionnaire is the main instrument of data collection which was self-administered. Face-to-face interview was conducted with the meat and poultry vendors in the Kumasi Central Market with a semi-structured questionnaire with both closed and open-ended questions. Data was collected by face to face interview. The questionnaire consisted of four sections. The first section dealt with general information such as gender, age and educational qualifications. Section two contained questions that investigated food hygiene, knowledge and attitudes of meat and poultry vendors. Section three identified the current processes adopted by meat and poultry vendors and section four evaluated the current hygienic practices among the meat and poultry butchers.

3.6 Validity and Reliability

For a given problem, validity is one of the concepts used to determine how good an answer is provided by research (Then, 1996). It means in essence that a theory, model, concept, or category describes reality with a good fit: a valid measure is one which measures what it is intended to measure. In fact it is not the measure that is valid or invalid but the use to which the measure is put. The validity of a measure then depends on how we have defined the concept it is designed to measure (De Vaus, 1991, cited by Amaratunga et al., 2002). In conducting research the estimation of reliability and validity is a task frequently encountered. Measurement issues differ in the research works in that they are related to the quantification of abstract, intangible and unobservable constructs. In many instances, then, the meaning of quantities is only inferred. If a concept is involved in the testing of hypothesis to support the theory it has to be measured. So the first decision that the research is faced with is

“how the concept was measured?” That is the *type of measure*. The types of measure used were questionnaires. Self-report measures like questionnaires that can be open-ended or close-ended, Likert-type scales, interviews that are structured, semi-structured or unstructured and open-ended or close-ended. Needless to say, each type of measure has specific types of issues that need to be addressed to make the measurement meaningful, accurate, and efficient.

A correlation coefficient is a statistical summary of the relations between the variables. The impact of food hygiene knowledge, attitudes and processes of meat and poultry vendors and the quality standard of the meat and poultry products in the Kumasi Central market was tested using the Cronbach alpha. The findings suggested that there is a positive correlation between the dependent variable (the impact of food hygiene knowledge, attitudes and processes of meat and poultry vendors and the independent variable (the quality of the meat and poultry products in the Kumasi Central Market).

3.7 Pilot Testing

The researcher conducted a pilot study to assess the authenticity of the research instruments. The pilot questionnaires were administered to 15 respondents to answer to correct errors like repetition of questions and typographical mistakes and the avoidance of double questions.

3.8 Ethical Consideration

The researcher followed and maintained relevant ethical issues. These ethical issues included honesty, integrity, acknowledgment, confidentiality, objectivity and

fairness. The researcher acknowledged all previous works that have been used in this research report. In similar ways, the researcher followed and maintained other relevant ethical issues during the collection of primary and secondary data and information from the parties involved in this study.

3.9 Data Analysis

Most of the data obtained from the questionnaires were analyzed using the Statistical Package for Social Sciences (SPSS) version 18. Plausible checks were conducted and inconsistent data was cleared appropriately. Statistical tests were run. Data was represented in tabular and graphical forms for better explanation and understanding.



CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This chapter contains the presentation of the results of the study. The researcher sent out two hundred and twenty six (226) questionnaires for primary data. However, out of the two hundred and twenty six (226) questionnaires sent out for empirical data, 217 questionnaires were retrieved while 9 questionnaires were not retrieved. This means that the analysis of the questionnaires was based on 96% response rate. This was considered adequate for the outcome and purpose of the study.

4.1 Demographic information of the Respondents

This section contains Tables and charts that depict the demographic information of the respondents. Information like age, gender and level of education of respondents were analysed.

Table 4. 1: Demographic information of the Respondents

Age (years)	Frequency	Percent (%)
15-25	62	28.6
26-36	36	16.6
37-47	88	40.6
48-58	31	14.3
Total	217	100.0
Gender		
Male	201	92.6
Female	16	7.4
Total	217	100.0
Level of Education		
No formal education	10	4.6
Primary school	15	6.9
Middle school	74	34.1
Junior high school	76	35.0
Senior High school	42	19.4
Total	217	100.0

Table 4.1 indicates that 40.6% of the respondents were between the ages 37-47 years, 28.6% of the respondents were between the ages 15-25 years, 16.6% of the respondents were between the ages 26-36 years while 14.3% were between the ages 48-58 years. Moreover, the results show that 92.6% of the respondents were males while 7.4% of the respondents were females. The study results affirmed that male respondents were more than females. Furthermore, 35% of the respondents were Junior high school graduates, 34.1% were Middle school leavers, 19.4% were Senior High school graduates, 6.9% were primary school leavers while 4.6% of the respondents had no formal education. In Ghana, Mensah, Yeboah- Manu, Owusu-Darko and Ablordey (2002), observed that out the 177 street vendors, 79 (66.7%) were educated and these vendors exhibited good hygiene behaviour. The surroundings of the vending sites were clean but some sites (3.4%) were classified as very dirty. The cooking of food well in advance of consumption, exposure of food to flies and preparing food on the ground were likely risk factors for contamination.

4.2 The Food Hygiene, Knowledge and attitudes of meat and poultry vendors in the Kumasi central market

In this study, the food hygiene, knowledge as well as attitudes exhibited by meat and poultry vendors in the Kumasi Central Market were investigated. Table 4.2 show results of where the animals are sourced from prior to slaughter.

Table 4. 2 Source of cattle/ poultry slaughtered at abattoir

The Source of cattle/ poultry slaughtered at abattoir	Frequency	Percent (%)
Northern Region	102	47
Imported from abroad	97	44.7
Kumasi	18	8.3
Total	217	100.0

Source: Field Survey, (2017)

Table 4.2 indicates that 47% of the cattle/poultry were from the Northern Region, 44.7% of the cattle/poultry were imported from countries like Brazil, United States of America, Europe, Argentina and Mali while 8.3% were from Kumasi. The study suggested that most of the livestock are from the Northern Region of Ghana. This means that the livestock are transported from a far distance to Kumasi in the Ashanti Region where they are slaughtered. Thus, meat from animals, which have suffered from stress or injuries during handling, transport and slaughter, is likely to have shorter shelf life due to spoilage. This is perhaps the biggest cause for meat wastage during the production processes. Table 4.3 displays the means of transporting meat/poultry from the abattoir to the point of sale.

Table 4. 3 Means of Transporting meat from abattoir to the point of sale

The means of transporting meat from abattoir to the butcher	Frequency	Percent (%)
Cargo Truck	117	53.9
Taxi	100	46.1
Total	217	100.0

Source: Field Survey, (2017)

Table 4.3 depicts that 53.9% of the respondents affirmed that they use cargo trucks in transporting meat from abattoir to the butcher while 46.1% use taxi cabs to transport meat from abattoir to the butcher. Moreover, 100% of the respondents affirmed that the hygienic condition of vehicles used for transporting meat from abattoir to the point of sale is not good. According to their limited knowledge in hygiene the study observed that the vehicles used to transport meat from abattoir to retail meat outlets act as sources of contamination since often lack regular cleanliness and are not well covered leading to contamination by dusts, insects and flies. However, normally the meat is not refrigerated and this is unhygienic. This is in agreement with Sulley, (2006), who reported that contamination of meat resulting from other means of transport such as motor-bikes and bicycles due to insufficient vans and trucks. On the other hand, the few transport available were not properly cleaned and thus contained high microbial loads (Sulley, 2006).

The transport factors such as the type and cleanliness of transport facility, distance travelled and duration of journey, harshness of ride, overpopulation of animals in

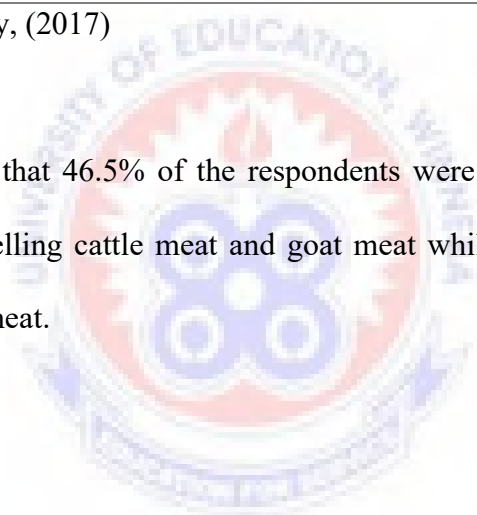
the conveyance and frequency of stops, may affect and contribute to pathogen load (Galland, 2007).

Table 4. 4 Types of meat sold in butcher's shops

The types of meat sold in your butcher	Frequency	Percent
Cattle meat	40	18.4
Cattle meat and goat meat	76	35.0
Poultry	101	46.5
Total	217	100.0

Source: Field Survey, (2017)

Table 4.4 indicates that 46.5% of the respondents were selling poultry, 35% of the respondents were selling cattle meat and goat meat while 18.4% of the respondents were selling cattle meat.



The Table 4.5 shows the hygienic state of the individual butchers. The availability of sink/bowls, handwashing soap, the use of apron/white coat and or head cover, wood chopping board and detergent/disinfectant for cleaning the butcher were analysed.

Table 4. 5 Hygienic State of the Butchers

Statement/question	Frequency	Percent
The Hygienic Condition of Butchers		
Good	63	29
Poor	154	71
Total	217	100.0
Do you have sink for washing hand?		
Yes	-	-
No	217	100
Total	217	100
Do you wash your hand with soap before touching the meat/poultry?		
Yes	21	9.7
No	196	90.3
Total	217	100
Do you wear (PPEs) apron/white coat and or head cover while selling meat/poultry		
Yes	50	23
No	167	77
Total	217	100.0
The condition of apron/white coat and or head cover?		
Somehow good	217	100.0
The use Wood chopping board for cutting meat/poultry?		
Yes	217	100.0
The hygienic condition of Wood chopping board for cutting meat/poultry		
Good	205	94.5
Poor	12	5.5
Total	217	100.0
How many times do you clean your butchers?		
Everyday	217	100.0
Do you use detergent/disinfectant for cleaning the butcher?		
Yes	217	100
Total	217	100.0

Source: Field Survey, (2017)

The study results held that 71% of the respondents affirmed that the hygienic condition of the butchers was poor while 29% of the respondents said that the hygienic condition of the butchers was good. The study indicates that 100% of the respondents affirmed that they do not have sinks or bowls for washing hands and cutlasses. The study shows that majority (90.3%) of the respondents affirmed that they do not wash their hands with soap before touching the meat/poultry while 9.7% of the respondents said that they wash their hands with clean water and soap before touching the meat/poultry. This means that clean and hygienic practices as well as a clean environment can improve the cleanliness of the meat and poultry. This agrees with the study conducted by Fasanmi *et al*, (2010), who asserted that the abattoir and beef retail outlet environments play important roles in contamination of meat. Site selection and availability of good quality portable water are important factors to consider when selecting site for constructing abattoir or retail meat outlets since it affects the quality of meat. Meat contamination in abattoirs and retail meat outlets result from the use of contaminated water, unhygienic practices like poor handling, use of contaminated tables to display meat intended for sale and the use of contaminated knives and other equipment in cutting operations.

The study showed that 77% of the respondents affirmed that they do not use aprons/white coats and or head covers while selling meat/poultry while 23% of the respondents said that they do not use apron/white coat and or head cover while selling meat/poultry. The study also showed that 100% of the respondents affirmed that the condition of aprons/white coat and or head cover is somehow good. The study revealed that 100% of the respondents affirmed that they used Wood

chopping board for cutting meat/poultry. The study results held it that 94.5% of the respondents affirmed that the hygienic condition of Wood chopping board for cutting meat/poultry is good while 5.5% of the respondents said that the hygienic condition of Wood chopping board for cutting meat/poultry is poor. The study results affirmed that 100% of the respondents said that they clean their butchers every day. The study revealed that 71.9% of the respondents affirmed that they do not use detergent/disinfectant for cleaning their equipment while 28.1% of the respondents said that they use detergent/disinfectant for cleaning the butcher. This finding agrees with the finding of Adetunde et al, (2011), who found that the hygienic condition of the abattoir and retail meat outlet workers has potential to contribute contamination in beef before and after processing. Furthermore, they reported that unclean slaughter men's hands, butcher arms, clothing and equipment used in carcass dressing process accounted for the microbial contamination and also the study of Jeffery, (2003) revealed that the worker hands and their equipment were among the main sources of meat contamination and needs to be disinfected. Table 4.6 highlights the hygienic practices of the butchers. The butcher's ability to control the flies, the storage of the beef and the health status of the butchers were assessed.

Table 4. 6 Hygienic Practices of the butchers

Statement /Response	Frequency	Percent (%)
Items used to control flies in the abattoir		
glass window	5	2.3
Fan, oil and net	212	97.7
Total	217	100.0
Does the meat in the abattoir finish the same day?		
Yes	7	16.1
No	210	83.9
Total	217	100.0
The average selling time of meat in the abattoir		
1-4 hours	85	39.2
5-8 hours	132	60.8
Total	217	100.0
The practices of storages of beef after the end of the day		
Transfer of beef/poultry from one butcher to another where there is refrigerator	150	69.1
Use of your own refrigerator in the abattoir	67	30.9
Total	217	100.0
Frequent health status check up		
Yes	217	100.0
If “Yes” at what interval do you go to hospital for checking your health status?		
once per year	100	46.1
every three month	82	37.8
every six month	35	16.1
Total	217	100.0
Have you attended any course related to your work?		
No	217	100.0
If “No” do you want to attend any course related to your work so as to increase awareness and improve hygiene status in the butcher?		
Yes	210	96.8
No	7	3.2
Total	217	100.0

Source: Field Survey, (2017)

The study results held that 100% of the respondents affirmed that they do not sterilize their equipment. This disagrees with Gill (2008), who affirmed that unless the animals are infected the meat of freshly slaughtered animals are generally sterile. The presence of microorganisms on post slaughtered carcasses is due to contamination occurring immediately before, during and after slaughter. The microbial contaminations of carcasses occur mainly during processing and manipulation during

skinning, evisceration, processing at abattoir and retailers establishments. The main sources of meat contamination include; animal/carcasses source, on farm factors, transport factors, abattoir and butchers facilities, parasites and wild animals, meat van, abattoir and retail meat outlet workers.

The study revealed that 97.7% of the respondents said that they use fan and oil to chase flies to prevent the meat from contamination while 2.3% of the respondents use glass window to control flies in their butcher. The study depicts that 83.9% of the respondents said that their meat does not finish the same day while 16.1% said that their meat do finish the same day. The study indicates that 60.8% of the respondents said that the average selling time of meat in their butcher is 5-8 hours while 39.2% of the respondents said that the average selling time of meat in their butcher is 1-4 hours. The study results indicate that 69.1% of the respondents said that after the end of the day they transfer beef/poultry from one butcher to another where there is refrigerator while 30.9% of the respondents said that they use their own refrigerator in the butcher to store meat. Refrigerator or freezers are essential storage facilities used to prevent spoilage of meat following prolonged storage at room temperature and hence keep meat safe for long period of time.

The study demonstrated that 100% of the respondents said that they do check their health status frequently. The study results indicate that 46.1% of the respondents said that they do go to hospital for checking their health status once per year, 37.8% of the respondents said that they do go to hospital for checking their health status every three months while 16.1% do check their health status every six months. Concerning personnel handling the food, Ghana Standards Authority (GSA) advises that they (the

personnel) must be trained and be made to undergo medical examination every six months. They should also wear suitable protective clothing, including head cover and footwear. When it comes to processing the food, raw materials or ingredients stored on the premises should be maintained under conditions that will prevent spoilage and contamination.

The study results showed that 100% of the respondents said that they have not attended any course related to their work. The study shows that 96.8% of the respondents said that they want to attend any course related to their work so as to increase awareness and improve hygiene status in the butcher while 3.2% of the respondents said that they do not want to attend any course related to their work so as to increase awareness and improve hygiene status in the butcher because of time factor. This conforms to the study conducted by Stuart (2012), who asserted that, adequate training is important for overcoming barriers related to human resources. This should include both employees and enforcement officials and should lead to behavioural changes, enhance competency along with assessment thereafter. The application of HACCP in restaurants should be mandatory. This is to change the traditional role of food safety agencies and food inspectors since the system is making headways in the food industries. Educating food handlers to adhere to good personal hygiene and proper handling of food is an essential component of National Food Safety Programme and especially handling of fish (Owaga, 2004).

Moreover, McIntosh and Peckarsky (2014), defined knowledge as the practices which in turn affect willingness to change current practices if it is learned that current practices are unsafe. Variably, Patil, Cates and Morales, (2005), indicated that food

handling practices are known to differ from self-reported practices. This has been established as very fundamental by (Djuretic, Wall, Ryan, Evans, Adak and Cowden, 2006, Evans and Honkapohja, 2008) as the writers have indicated that the main factors responsible for the outbreaks of food poisoning in England and Wales during 1992-1994 and 1995-1996, respectively, were inappropriate storage, inadequate cooking or heating, and cross-contamination. Butcher's knowledge and awareness about the hazards of improper butchering is essential to safeguard their health as well as the health of the community. A study done in Kerala (India), in 1999 revealed that butchers hardly know anything about scientific and hygienic aspects of animal slaughtering. A Ghanaian study highlighted the near total absence of any sort of training given to butchers whose awareness levels are pretty primitive.



4.3 The Current Processes adopted by meat vendors in the Kumasi Central Market (Slaughtering methods)

Figure 4.1 indicates the flowchart for slaughter procedures.

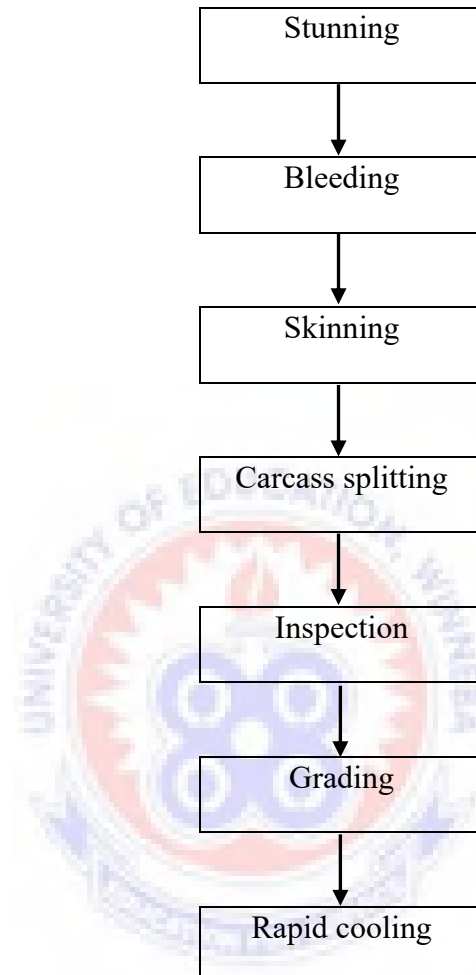


Figure 4. 1 Flowchart for slaughter procedure

Generally electric method of stunning is preferred wherein the head of cattle or goat is either brought in contact with a 500V electrified metal slope or with 150 V electrically charged water bath. Moreover, stunning is not permitted in Muslim religion. After stunning, the anterior part of cattle's throat, just below the lower jaw, is cut open severing both the large jugular veins to allow free flow of blood. This stab/cut should not open the esophagus or trachea which might result in contamination of meat. Slaughtered cattle or goat should be kept upside down at least for 15 minutes,

so that at least 50% of the blood is drained out. Putting the cattle/goat upside down in bleeding cones or hooking the cattle/cow upside down on their legs on clothline would ensure complete drainage of blood. In the halal method of slaughtering adopted by Muslim's, the cattle/goats are simply bled without stunning by cutting directly across the exposed throat at the base of the skull. After this process the cattle/goat is skinned before the carcass is splitted. An inspection officer then inspects the hygienic condition of the processed meat before transporting to the abattoir for rapid cooling and commercial sale. The researcher suggested that the equipment for the slaughter house must be frequently disinfected to avoid contamination.

4.4 The Current Processes adopted by poultry vendors in the Kumasi Central Market (Slaughtering methods)

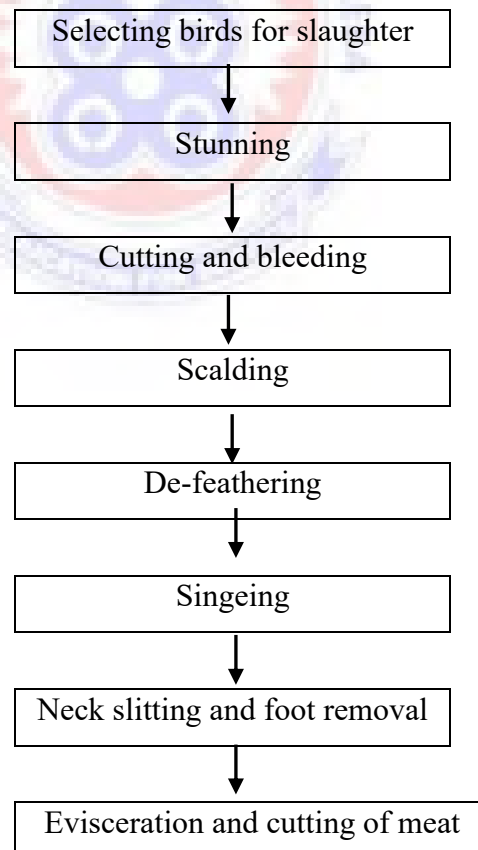


Figure 4. 2 Flow chart for the Current Processes adopted by poultry vendors in the Kumasi Central Market (Slaughtering methods).

The study results holds that 100% of the respondents agreed that that the current processes adopted by meat and poultry vendors in the Kumasi central market i.e. slaughtering methods are selecting birds for slaughter, stunning, cutting and bleeding, scalding, de-feathering, singeing, neck slitting and foot removal, evisceration and cutting of meat.

4.4.1 Selecting birds for slaughter

Healthy, clean and well-fleshed birds are the prerequisites for getting wholesome poultry meat. Ideally birds should not be fed for 24 hours prior to slaughter, only water can be given. This is to prevent contamination of meat with the feed and ingested material in the digestive tract while slaughtering and evisceration of the bird. Under University of Minnesota guidelines for household level slaughtering of poultry this duration of fasting is only 6-8 hours.

4.4.2 Stunning

Generally, electric method of stunning is preferred wherein the head of birds is either brought in contact with a 500V electrified metal slope or with 150 V electrically charged water bath. Stunning is not permitted in Muslim religion.

4.4.3 Cutting and bleeding

After stunning, the anterior part of bird's throat, just below the lower jaw, is cut open severing both the large jugular veins to allow free flow of blood. This stab/ cut should not open the esophagus or trachea which might result in contamination of meat. Slaughtered bird should be kept upside down at least for 90 seconds, so that at least 50% of the blood is drained out. Putting the birds upside down in bleeding cones

or hooking the birds upside down on their legs on clothline would ensure complete drainage of blood. In the halal method of slaughtering adopted by Muslim's, the birds are simply bled without stunting by cutting directly across the exposed throat at the base of the skull.

4.4.4 Scalding

Scalding involves submerging the carcass in hot water to relax the muscles holding the feathers. Ideally it should be done in continuously running warm water. Younger birds can be scalded at 125° - 130° F for 30 to 75 seconds but for older birds it may need higher temperatures of about 140° F for 30 to 75 seconds.

4.4.5 De-feathering

Removal of feathers from the dead birds could be done mechanically or manually. De-feathering machines are used to do it in large scale slaughtering centres. In smaller settings, usually the butcher himself plucks the feathers manually. Hand plucking is the usual pattern in household level slaughtering as well.

4.4.6 Singeing

Young birds may not need singeing. Generally, it is done with a bottle gas torch or an open flame. It is done to remove pin feathers from carcass.

4.4.7 Neck slitting and foot removal

Afterwards neck and head should be removed without breaking of bone by using a twisting motion to cut through the joint. Then skin should be loosened from the neck

and crop and trachea. Removal of gullet (what is it? Explain) is the next step. Feet are removed by cutting through the shank joint without breaking the bones.

4.4.8 Evisceration

Safe removal of the viscera and related tissue of the carcass (dead bird) is called evisceration. The body cavity of the bird is cut open with an incision from the hind end with a cut around the vent to form a 'J' shaped incision. Vent (the excretory opening), surrounding oil glands and some adjacent tissue are removed together, taking care not to contaminate the meat with bird's faeces. Likewise with intestine and other viscera are removed carefully. One should not cut open the intestine which can cause contamination of the meat. Other viscera should be removed by stretching the abdominal opening. After separation of the viscera from the carcass, the edible parts of the viscera, the giblets (the gizzard, liver and heart) should be salvaged separately. Gallbladder should be separated from the liver without rupturing it. Gizzard should be split open, discard the contents, thoroughly washed under a stream of water and its inner lining peeled off by inserting the thumbnail under the lining at the edge of the cut surface. It is washed again before putting it back along with the edible parts. Lungs are removed from the carcass by inserting the hand in the body cavity. The whole process is done mechanically in large-scale slaughter settings.

4.4.9 Cutting meat

After evisceration, the carcass is again washed thoroughly and placed on cleaned slab and cut into pieces according to the requirements.

4.5 The Current Hygienic Practices among the meat and poultry butchers in the Kumasi Central Market.

Table 4.7 indicated the Current Hygienic Practices among the meat and poultry butchers in the Kumasi central market.

Table 4. 7 The Current Hygienic Practices among the meat and poultry butchers

The Current Hygienic Practices among the meat and poultry butchers in the Kumasi central market.	1	2	3	4	5	Total
	Freq.	Freq.	Freq.	Freq.	Freq.	req.
	(%)	(%)	(%)	(%)	(%)	(%)
Hands are washed properly and frequently	6 (2.8)	10 (4.6)	10 (4.6)	115 (53)	76 (35)	217 (100)
Butchers wear clean and proper uniforms	30 (13.8)	55 (25.3)	9 (4.1)	5 (2.3)	118 (54.4)	217 (100)
Butchers use disposable tissues			27 (12.4)	141 (65)	49 (22.6)	217 (100)
Butchers appear in good health	96 (44.2)	105 (48.4)	11 (5.1)	5 (2.3)	-	217 (100)
Handwashing reminder signs are posted	-	-	22 (10.1)	121 (55.8)	74 (34.1)	217 (100)
Employees toilet are operational and clean			12 (5.5)	79 (36.4)	126 (58)	217 (100)
Personal hygiene practices are properly adhered to	50 (23)	2 (1)	32 (14.7)	130 (60)	3 (1.4)	217 (100)

Source: Field Survey, (2017)

1-Strongly agree, 2-Agree, 3-Undecided, 4-Disagree, 5-Strongly disagree

The study indicated that 88% of the respondents agreed that they do not wash their hands properly and frequently before touching the meat, 7.4% of the respondents agreed and 4.6% of the respondents were neutral. The study results suggested that majority of the respondents washed their hands properly and frequently. The study results indicates that 93.6% of the respondents agreed that butchers wear clean and proper uniforms, 4.1% of the respondents were uncertain while 2.3% of the respondents disagreed. The study findings concluded that butchers wear clean and

proper uniforms. The study results showed that majority 87.6% of the respondents affirmed that butchers do not use disposable tissues, while 12.4% of the respondents were uncertain. The study shows that majority 94.4% of the respondents agreed that butchers do not appear in good health, while 5.5% of the respondents were neutral. The study results affirmed that 61.4% of the respondents said that handwashing reminder signs were not posted, 24% of the respondents agreed while 14.7% of the respondents were uncertain. This finding agrees with the WHO (2010), who asserted that as a consequence of humans also containing microorganisms naturally or from the surrounding environment it is important to maintain an appropriate personal hygiene. Important hygienic aspects related to Personal Hygiene includes, food vendors practicing hand washing before handling food and often during food preparation, food vendors washing hands after going to the toilet (WHO, 2010), food vendors' drying hands after hand washing procedure, food vendors wearing clean protective clothing, food vendors wearing headcovering, food vendors avoiding wearing of personal effects such as jewellery, watches, pins or other items in food handling areas, food vendors ensuring that cuts and wounds are covered by suitable water proof dressings, food vendors avoiding personal behavior such as smoking, spitting, chewing or eating, sneezing or coughing over unprotected food.

Food vendors not handling food if you know or suspect to be suffering from or to be a carrier of a disease or illness likely to be transmitted through food. (FAO Corporate Document Repository, 2009). The study results held that 66.4% of the respondents disagreed that employees toilet are operational and clean, 28.1% of the respondents agreed, while 5.5% of the respondents were uncertain. The study finding concluded that employee's toilet are not operational and clean. This agrees with Stuart (2012),

who found that by-products and wastes from the slaughterhouses should be properly disposed; otherwise this can lead to environmental pollution and ecological imbalance. Indiscriminate disposal of poultry wastes and its by-products can contaminate the environment and lead to the spread and sustenance of infection in the community. One study from Nangal (Punjab) reports that many birds perished after consuming the 'leftover' of slaughtered animals which were dumped into the river Sutlej from a nearby slaughterhouse. Indiscriminate spillage of abattoir by-products, effluents and solid wastes could lead to recycling of infection in animals, which may get into the human cycle and cause disease in humans.

The study results showed that 74.7% of the respondents agreed that personal hygiene practices are properly adhered to, 10.6% of the respondents disagreed while 14.7% of the respondents were uncertain. This agrees with Owaga, (2004) who established clearly stated that heavy microbial contamination (salmonella and campylobacter bacteria) were detected in the surrounding premises and in the meat produced from some of the halal butchering centres in London. Aprons worn by those butchers also were found to be heavily contaminated. The findings of yet another study done in 2003 in London had emphasized the importance of environmental hygiene in butcher's settings in avoiding microbial contamination in large and medium scale facilities. A study done in Hajj, Saudi Arabia, had cautioned that butchers from the Indian Sub-Continent work barefoot and they often hold the knife in their mouth while working, an easy way for cross contamination. This can lead to cross contamination of the meat products and often adversely affect the butchers' health. There are many newspaper reports that in Punjab (India) animals are slaughtered openly in shops and private premises and sold to people without observing hygienic

practices nor certification from a veterinary doctor which is against public health act stipulations. A review paper from Nepal in 2003 warns that slaughtering places are frequently contaminated and meat products from such a place can be a potential source of food poisoning and zoonotic diseases.



CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter contains the major findings of the study, conclusions, recommendations and suggestions for further research.

5.1 Major findings of the study

5.1.1 The Food Hygiene, Knowledge and attitudes of meat and poultry vendors in the Kumasi central market

The study results indicated that 47% of the cattle/poultry were from the Northern Region, 44.7% of the cattle/poultry were imported from countries like Brazil, United States of America, Europe, Argentina and Mali. Moreover, 53.9% of the respondents affirmed that they use cargo trucks in transporting meat from abattoir to the butcher while 46.1% use taxi cab to transport meat from abattoir to the butcher. Moreover, 100% of the respondents affirmed that the hygienic condition of vehicles used for transporting meat from abattoir to butchers was good. The study indicated that 46.5% of the respondents were selling poultry, 35% of the respondents sold cattle and goat meat while 18.4% of the respondents were selling cattle meat. The study results held it that 71% of the respondents affirmed that the hygienic condition of the butcher is poor. The study indicated that 100% of the respondents affirmed that they do not have sinks or bowls for washing hands and cutlasses. The study showed that majority 90.3% of the respondents affirmed that they do not wash their hand with soap before touching the meat/poultry. The study showed that 77% of the respondents affirmed that they do not use aprons/white coat and or head cover while selling meat/poultry.

The study shows that 100% of the respondents affirmed that the condition of apron/white coat and or head cover is somehow good. The study revealed that 100% of the respondents affirmed that they used Wood chopping board for cutting meat/poultry. The study results hold it that 94.5% of the respondents affirmed that the hygienic condition of Wood chopping board for cutting meat/poultry is good. The study results affirmed that 100% of the respondents said that they clean their butchers every day. The study revealed that 71.9% of the respondents affirmed that they do not use detergent/disinfectant for cleaning their equipment.

The study results held it that 100% of the respondents affirmed that they do not sterilize their equipment. The study showed that 97.7% of the respondents said that they use fan and oil to chase flies to prevent the meat from contamination. The study showed that 83.9% of the respondents said that their meat does not finish the same day. The study results revealed that 68.2% of the respondents affirmed that they do not sterilize their equipment. The study showed that 89.9% of the respondents said that they use fan to chase flies to prevent the meat from contamination. The study showed that 83.9% of the respondents said that their meat does not finish the same day. The study indicated that 60.8% of the respondents said that the average selling time of meat in their butchershop is 5-8 hours. The study results indicated that 69.1% of the respondents said that after the end of the day they transfer beef/poultry from one butcher to another where there is refrigerator. The study showed that 100% of the respondents said that they do check their health status frequently. The study results indicated that 46.1% of the respondents said that they do go to hospital for checking their health status once per year. 37.8% of the respondents said that they do go to hospital for checking their health status every three month while 16.1% do check their

health status every six months. The study results showed that 100% of the respondents said that they have not attended any course related to their work. The study shows that 96.8% of the respondents said that they want to attend any course related to their work so as to increase awareness and improve hygiene status in the butcher.

5.1.2 The Current Hygienic Practices among the meat and poultry butchers in the Kumasi central market.

The study indicated that 88% of the respondents agreed that they do not wash their hands properly and frequently before touching the meat. The study results suggested that majority of the respondents washed their hands properly and frequently. The study results indicated that 93.6% of the respondents agreed that butchers do not wear clean and proper uniforms. The study result showed that majority 87.6% of the respondents affirmed that butchers do not use disposable tissues. The study showed that majority (94.4%) of the respondents agreed that butchers do not appear in good health. The study results affirmed that 61.4% of the respondents said that handwashing reminder signs were not posted. The study results held that 66.4% of the respondents disagreed that employee's toilet were operational and clean. The study results shows that 74.7% of the respondents agreed that personal hygiene practices are properly adhered to.

5.1.3 The Current Processes adopted by meat and poultry vendors in the Kumasi Central Market (Slaughtering methods)

The study results held that 100% of the respondents agreed that the current processes adopted by meat and poultry vendors in the Kumasi central market such as slaughtering methods are selecting birds for slaughter, stunning, cutting and bleeding,

scalding, de-feathering, singeing, neck slitting and foot removal, evisceration and cutting of meat. Moreover, the slaughtering processes for cattle or goat processing are Stunning, bleeding, skinning, carcass splitting, inspection, grading and rapid cooling.

5.2 Conclusions

The first objective of the study was to investigate food hygiene, knowledge and attitudes of meat and poultry vendors in the Kumasi central market. After successful completion of the study the researcher concluded that the hygienic condition of the vehicles used to transport meat from abattoir to the butchers was somehow good. Moreover, the hygienic condition of the butcher was good. The researcher observed that most of the butchers do not have sinks or bowls for washing hands and cutlasses. Furthermore, most of the butchers do not wash their hands with soap before touching the meat/poultry. Additionally, the butchers used aprons/white coat and or head cover while selling meat/poultry. Unfortunately, the researcher observed that the butchers do not use detergents/disinfectants for cleaning their equipment and they do not sterilize their equipment. This is dangerous to consumers' health. The butchers used fans to chase flies to prevent the meat from contamination. The butchers stored the remaining meat/poultry in a refrigerator for the subsequent days. Another unfortunate conclusion is that most of the butchers do not check their health status frequently. Moreover, they have not attended any course related to their work. However, the butchers indicated that they were willing to attend any course related to their work so as to increase awareness and improve hygiene status in the abattoir.

Moreover, the second objective of the study was to evaluate the current hygienic practices among the meat and poultry vendors in the Kumasi central market. The study results concluded that the butchers do not wash their hands properly and frequently to avoid transmitting germs and bacteria to the food. Moreover, the butchers do not wear clean and proper uniforms. Furthermore, they do not use disposable tissues. The butchers appeared in good health. The study results further concluded handwashing reminder signs were not posted and butchers toilet facilities were not clean. This also contributes to meat/poultry contamination. The researcher suggested that the authorities in Kumasi Central market should monitor the hygienic practices of the butchers in the Market to avoid contamination and an outbreak of diseases.

The third objective was to standardise the current processes adopted by meat and poultry vendors in the Kumasi central market. The researcher concluded that the current processes adopted by meat and poultry vendors in the Kumasi central market such as slaughtering methods were selecting birds for slaughter, stunning, cutting and bleeding, scalding, de-feathering, singeing, neck slitting and foot removal, evisceration and cutting of meat. Furthermore, the slaughtering processes for cattle or goat processing are stunning, bleeding, skinning, carcass splitting, inspection, grading and rapid cooling. The researcher concluded that standardising the current processes calls for the use of internationally accepted slaughtering equipment to ensure that meat/poultry sold in the Kumasi Central market is healthy and meets the international standards.

5.3 Recommendations

According to the key findings and conclusions of the study, the following recommendations were made;

1. The Foods and Drugs Authority should periodically organise seminars, conferences and food handling programmes for the meat/poultry vendors to educate them on the modern methods of handling, storage and preserving foods to enhance consumers' health and increase awareness and improve hygiene status in the butcher.
2. The butchers should be advised to use detergents/disinfectants for cleaning their equipment and also sterilize their equipment to avoid contamination.
3. Moreover, butchers at the Kumasi Central Market should be advised to do regular medical check-ups to know their health status frequently. This intervention would prevent the spread of communicable diseases and improve consumers' health.

5.4 Suggestions for Further Research

Based on the recommendations of the study, the researcher suggested that a similar research should be conducted to investigate the impact of organising training programmes for butchers and the quality of meat/poultry at the Kumasi Central Market.

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APPENDIX

Appendix A

Questionnaire for the Butchers, Meat and Poultry Vendors

The researcher is a product of UEW, Kumasi Campus conducting a piece of research to **INVESTIGATE INTO FOOD HYGIENE KNOWLEDGE, ATTITUDES AND PROCESSES OF MEAT AND POULTRY VENDORS IN THE KUMASI CENTRAL MARKET.** I respectfully request that you form part of this research by completing the attached questionnaire. It is my fervent hope that you participate in the study. May I thank you for your valuable cooperation.

SECTION A: DEMOGRAPHIC INFORMATION

1. Age

15-25 years []

26 -36 years []

37- 47 years []

48-58 years []

Above 59 years []

2. Sex

Male []

Female []

3. Level of education of respondents

None []

Primary school []

Middle school []

JHS []

SHS []

4. Religion

Christian []

Islam []

Traditional []

Others _____

5. Marital status

Single []

Married []

Separated []

Divorced []



SECTION B:

The food hygiene, knowledge and attitudes of meat and poultry vendors in the Kumasi central market

General information on food hygiene, knowledge and attitudes of meat and poultry vendors

6. Where is the source of cattle/ poultry slaughtered at abattoir?.....

7. What are the means of transporting meat from abattoir to the butcher?

8. What is the hygienic condition of vehicle used to transporting meat from abattoir to the butcher?

Good [] Poor []

9. What are types of meat sold in your butcher?

- a. Cattle meat []
- b. Cattle and goat meat []
- c. Cattle meat and fish []
- d. Poultry []
- e. Any other specify.....

10. Do you have sink for washing hand? Yes [] No []

11. Do you wash your hand with soap before touching the meat/poultry?

Yes [] No []

12. Do you use apron/white coat and or head cover while selling meat/poultry?

Yes [] No []

13. What is the condition of apron/white coat and or head cover? Good [] Poor []

14. Do you use Wood chopping block for cutting meat/poultry? Yes [] No []

15. What is the hygienic condition of Wood chopping block for cutting meat/poultry?

Good [] Poor []

16. How many times do you clean your butchers?
17. Do you use detergent/disinfectant for cleaning the butcher? Yes [] No []
18. Do you sterilize your equipment? Yes [] No []
19. Do you have routine control of flies in your butcher? Yes [] No []
20. If “Yes” what are the method used to control flies?
- a. Glass window []
 - b. Insecticides []
 - c. Glass window and Insecticides []
 - d. others specify.....
21. If “No” how do you do in order to control flies in retail meat outlet?.....
22. What is the hygienic condition of butcher? Good [] Poor []
23. Does the meat in the butcher finished the same day? Yes [] No []
24. What is average selling time of meat in your butcher?
- a. 1 - 4 hours []
 - b. 5 - 8 hours []
 - c. 9 -12 hours []
 - d. More than 12 hours []
25. What are the practices of storages of beef after the end of the day?
- a. Transfer of beef/poultry from one butcher to another where there is refrigerator []
 - b. Use of your own refrigerator in the butcher []
 - c. Any other specify.....
26. Do you check your health status Yes [] No []
27. If “Yes” at what interval do you go to hospital for checking your health status?
- a. Once per year []
 - b. Every three month []

c. Every six month []

28. If “No” what is last date when your attended the medical check-up?

a. Last month []

b. Three month ago []

c. Six month ago []

d. A year ago []

29. Have attended any course related to your work? Yes [] No []

30. If “Yes” what type of courses attended?.....

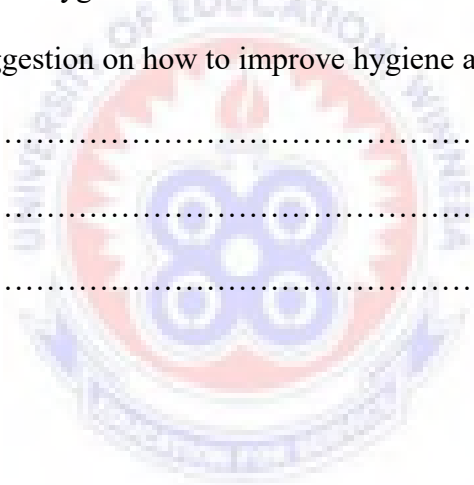
31. If “No” do you want to attend any course related to your work so as to increase awareness and improve hygiene status in the butcher? Yes [] No []

32. What is your suggestion on how to improve hygiene and meat/poultry quality?

.....

.....

.....



SECTION C:**The current processes adopted by meat and poultry vendors in the Kumasi****Central Market (Slaughtering methods)**

Please use the following Likert scale to assess the current processes adopted by meat and poultry vendors in the Kumasi Central Market.

1-Strongly agree, 2-Agree, 3-Undecided, 4-Disagree, 5-Strongly disagree

The current processes adopted by meat and poultry vendors	1	2	3	4	5	Total
Selecting birds for slaughter						
Stunning						
Cutting and bleeding						
Scalding						
De-feathering						
Singeing						
Neck slitting and foot removal						
Evisceration						
Cutting meat						

SECTION D

**The current hygienic practices among the meat and poultry butchers in the
Kumasi central market**

Please use the following Likert scale to evaluate the hygienic practices among meat and poultry butchers in the Kumasi Central Market.

1-Strongly agree, 2-Agree, 3-Undecided, 4-Disagree, 5-Strongly disagree

The current hygienic practices among the meat and poultry butchers	1	2	3	4	5
Hands are washed properly and frequently					
Butchers wear clean and proper uniforms					
Butchers use disposable tissues					
Butchers appear in good health					
Hand washing reminder signs are posted					
Employees toilet are operational and clean					
Personal hygiene practices are properly adhered to					

APPENDIX B

Interview guide for the respondents

1. What are the food hygiene, knowledge and attitudes of meat and poultry vendors in the Kumasi central market?

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2. What are the current hygienic practices among the meat and poultry butchers in the Kumasi central market?

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3. What are the current processes adopted by meat and poultry vendors in the Kumasi central market?

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