

UNIVERSITY FOR DEVELOPMENT STUDIES

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF COMMUNITY HEALTH AND FAMILY MEDICINE

**MEAT HANDLING KNOWLEDGE, ATTITUDES AND PRACTICES
AMONG SLAUGHTERHOUSE WORKERS IN TAMALE METROPOLIS**



A DISSERTATION SUBMITTED TO DEPARTMENT OF COMMUNITY HEALTH AND FAMILY MEDICINE, UNIVERSITY FOR DEVELOPMENT STUDIES, IN PARTIAL FULFILMENT OF THE RAEQUIREMENT FOR THE AWARD OF MASTER OF PUBLIC HEALTH DEGREE.

BY

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SEPTEMBER, 2020



DECLARATION

Student's Declaration:

I hereby declare that, this thesis is the result of my original work except for references which have been dully acknowledged. It contains no materials previously presented by another person which has been accepted for the award of any Diploma or Degree elsewhere.

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Supervisor's Declaration

I declare that the preparation and presentation of the dissertation was supervised in accordance with the guidelines on supervision of dissertation laid down by the University for Development Studies.

NAME OF SUPERVISOR: SHAMSU-DEEN ZIBLIM (PhD)

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DEDICATION

I dedicate this piece of work to my Family who encouraged me throughout my education. God bless you all.



ACKNOWLEDGEMENTS

This research work would not have been possible without the life, good health and the abundant grace bestowed on me by God Almighty to carry through the entire study. It would also not have been possible without the vigilant eyes and critical pieces of advice and guidance of my supervisor, Shamsu-DeenZiblim (PhD).

I am further grateful to my former principal, Mr Alfred Asibi of School of Hygiene, Tamale. Through this great man I had a scholarship from NUFFIC. I thanked NUFFIC for their support as well. I also acknowledged my wife Mrs. Selina Ossom Asare and my children for their support and prayers

It is not likely to capture in print all who have contributed to the success of this study. I am therefore most grateful to all who diversely supported during this research work. I say God bless you all.



ABSTRACT

The slaughtering of animals for human consumption is a critical industry with huge potential of public health risk or safety. Slaughtering of animals takes place in very dilapidated structures under unsanitary environmental conditions and there is hardly any monitoring of equipment that is used at the slaughtering processes. This study was therefore to assess the meat handling hygiene knowledge, attitudes and practices of slaughterhouse workers in Tamale and to identify the determinants of the knowledge, attitudes and practices of the butchers. A mixed method cross-sectional study was employed in the study. A validated 65-item questionnaire was used to collect data on meat handling hygiene knowledge, attitudes and practices from 135 slaughterhouse workers selected with a two-stage clusters sampling. Male (95%) and female (4.5%) respondents had no formal education. The level of high hygiene knowledge and cross-contamination knowledge of the slaughterhouse workers were found to be 23% and 30% respectively. Only 28% and 25% of the butchers also respectively had high desirable meat handling attitude and high recommended meat handling practices. After controlling for other explanatory variables, absence of functional waste bins for solid waste management [(AOR: 2.844, 95%, CI: 0.918 - 8.810, $p=0.070$)] and non-availability of separate areas demarcated for slaughtering and skinning processes [(AOR: 14.126, 95%, CI: 2.994 - 66.645, $p<0.01$)] as operational challenges were both found to be strong predictors of meat handling hygiene knowledge of the slaughterhouse workers. Meanwhile, the level of recommended hygienic practices of the slaughterhouse operators were found to be independently related to non-availability of drains for liquid waste management in the slaughterhouse as an operational challenge [(AOR: 42.845, 95%, CI: 4.757 - 385.915, $p<0.01$)]. The knowledge, attitudes and practices of the slaughterhouse workers were low and largely predicted by operational challenges.



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LIST OF ACRONYMS

DFD	Dark Film Dry
FAO	Food and Agriculture Organization
FDA	Food and Drug Authority
FGD	Focus Group Discursion
GHP	Good Hygiene Practices
GSS	Ghana Statistical Services
GMP	Good Manufacturing Practices
HACCP	Hazard Analysis Critical Control Point
HTA	High Throughout Abattoir
HIV/AIDS	Human Immuno Virus/ Acquired Immune Deficiency
KAP	Knowledge Attitude Practices
LTA	Low throughout Abattoir
PSD	Pale Soft Exudative
RVF	Rift Valley Fever
W.H.O	World Health Organization
SPSS	Statistical Package for Social Sciences



CHAPTER ONE

Introduction

1.1 Background to the Study

A slaughterhouse, which is also well-known as an abattoir, is a designated area animals are slaughtered to provide food. It could also be well-defined as any place that is used for the slaughter of animals whose meat is meant for human consumption. Killing of animals for human consumption is essential globally and dates back to earliest times (Bello & Oyedemi, 2009). The practice of slaughtering livestock (cattle, goat or sheep) to provide meat also offers very beneficial by-products such as skin and leather. By the year 2007, world meat consumption had risen from as low as 70 metric tonnes in 1961, to a whopping 268 metric tonnes. During that same period, the amount of meat consumed worldwide per each individual increased from 22 kg to a staggering 40 kg annually (Chepkemoi, 2015).

The growth of the slaughtering industry depends on countries due to cultural transformations, the kinds of animals killed and wealth of the nation (Long, 1990). Countries which are developed such as the USA and the United Kingdom, traditional slaughter amenities were very small and local to town centres (Broadway & Ward, 1990). During the 20th century, they became centralised, large-scale, and computerized. Primarily they are now meat-packing plants where animals are killed and the meat are packed for supply (Broadway, 2002; Broadway & Ward, 1990). The aim of contributing to this modification was shopping malls taking over butchers as the prime distributors and the improvement in restaurants and fast food establishments requiring huge amounts of uniform products (Broadway, 2002). Huge slaughter amenities had the required capital to respond to these market demands and also augment government regulations proposed at



improving public wellbeing both of which required advanced equipment (Broadway, 2002; Fitzgerald, 2010).

The procedures in slaughtering are vastly labour-intensive which comprises personnel handling carcasses at diverse phases. Proper hygiene practices during slaughtering such as washing of hands with soap, the use of disposable towels, personal protective clothing, and hand gloves when not in place have to be introduced during processing to reduce chances of microbiological contamination of the carcasses (Wambui, Karuri&Lamuka, 2017). Foodborne illnesses occur generally in developing countries as a result of improper hygiene and safety practices, poor food hygiene laws, inadequate regulatory mechanisms, lack of capitals to procure safer equipment and insufficient education of meat handlers (Abdullahi, Hassan, &Kadarman, 2016). Majority of foodborne illnesses occurred from animal as food (Abdullahi et al., 2016).

According to Assefas, (2015), improper food handling and improper personal hygiene of slaughterhouse workers contribute to almost 97% of foodborne-illness outbreaks amongst patrons and has led to endanger peoples life in some cases. Contamination of meat during processing includes the equipment, water, contact surfaces and personnel (Nel et al., 2004; Govender et al., 2013; Nyamakwere et al., 2016).

Slaughter amenities differ from big industrial meat processing facilities in cities to minor unregulated facilities in rural areas specifically in developing countries (Food and Agricultural Organization, 2010). This disparity in the meat industry is mainly due to lack of private sector investment and insufficient regulation of the trade particularly in rural areas (Cook et al., 2017).

Also, there is often a shortfall of appropriate and inexpensive equipment for the processing and transportation of meat (Broadway & Ward, 1990). Regulations of the slaughter industry improve



hygiene, decrease contamination of meat, the spread of diseases, and safeguard workers from occupational health hazards (Cook et al., 2017).

Practices in Slaughterhouse in West Africa are not different from other developing countries. Humane slaughter is a requirement in all categories of slaughterhouses. Slaughtering processes are in stages which include, ante mortem inspection of live animals, stunning, bleeding, flaying, evisceration, post-mortem inspection, washing and grading of the carcasses. In local slaughterhouses carcasses are sold to patrons at the marketing hall close to the slaughterhouse, but in the export slaughterhouses, carcasses are frozen for 12 hours before processing begin thus adding value by making specific cuts and products (Mwai, 2011). Contamination can take effects in all stages of slaughter. The main aim of slaughter is to efficiently remove the skin/hide and viscera in a manner that will prevent contamination of the carcass with the hide or gastrointestinal contents. The hygiene of the operatives and implements used are essential to the accomplishment of process hygiene (Mwai, 2011).

Appropriate slaughterhouse procedures involve inspection of a live animal before slaughter (ante-mortem examination); evisceration, carcass's inspection (post-mortem inspection) and waste disposal. All these are critical to the delivery of wholesome meat and surveillance of animal diseases, specifically those of public health importance (Nwanta et al., 2008).

In slaughterhouse operations an environmental conditions of good sanitary and hygiene practices are needed for the production of wholesome meat (Declan et al., 2004). Failure to observe Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) in slaughterhouse processing procedures in developing countries has resulted in unwholesome meat and improper disposal of waste, with consequent effects on the environment and human health (Akinro et al., 2009).



The Ghana Food and Drugs Authority (FDA) require any facility being used as an abattoir to acquire equipment for slaughtering, holding, processing, preserving and distribution of the carcass. These guidelines indicate several concerns to guarantee that meat is wholesome for human consumption; slaughtering of livestock should take place in a facility that has been duly registered by the Authority that is mandated to do so.

Also, slaughtering of livestock should be done under hygienic conditions as inspected and approved by the controlling authority, and that the facility should contain all the appropriate equipment for the various stages of livestock processing (Ofosu-Koranten, 2013). In most slaughterhouses in Africa, unavailability of slaughtering and processing facilities, poor sewage or waste disposal systems, inadequate clean water supplies and refrigeration has effects on quality of meat (Adeyemo, 2002; Lawan et al., 2013).

Additionally, the scarcity of records on slaughterhouse procedures, coupled with inadequate butchers' hygiene knowledge, attitude towards hygiene and compliance with hygienic meat processing and handling practices leaves much to be desired about the wholesomeness of meat processed from slaughterhouses. Hence the study intends to investigate the Meat Handling Knowledge, Attitudes and Practices among Slaughterhouse Workers in Tamale Metropolis.



1.2 Problem Statement

Many factors such as poor hygiene and sanitation in food establishments like the slaughterhouses contribute greatly to an increased incidence of food-borne illnesses. Meat handlers like butchers working at the abattoirs may not only represent the main carriers of meat contamination but may also be asymptomatic reservoir of foodborne bacteria. No matter how rigorous the codes of good manufacturing practices can be, if proper hygiene is not adequately practiced, the menace of contamination of carcass remains very high at the abattoir.

Food-borne illnesses have caused a significant morbidity and mortality around the world. The World Health Organization (WHO 2008) reported that 18% of children aged below 5 years old in developing countries die due to diarrhea globally as a result of meat contamination.

Again, the Centers for Disease Control and Prevention revealed that there is outbreak of food-borne illness that comes from foods of animal origin, causing 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths annually.

In Ghana meat is produced under insanitary conditions. (Abuska, 2006; Abukari, 2007). The insanitary practices include dressing carcasses on the floor of the slaughterhouses and slabs, using unwholesome water to wash carcasses and inadequate pre and post-slaughter inspection.

These expose meat to several pathogens, some of which may be non-pathogenic and harmful for human consumption. Anecdotal evidence further suggests that slaughtering of animals takes place in very dilapidated structures under unsanitary environmental conditions and there is barely any monitoring of the equipment that is used in the slaughtering processes.



In Tamale Metropolis many slaughterhouses and meat processing units are unacceptable and operated without adequate quality control systems. Meats are habitually transported from the abattoir to the markets either in meat vans, taxis, motorcycle and bicycles (Adzitey et al., 2010). These made meat to be contaminated from start of production to end of production.

For these reasons there is the need to investigate Meat Handling Knowledge, Attitudes and Practices (KAP) among slaughterhouse Workers in Tamale Metropolis in the Northern Region of Ghana.

1.3 Research Questions

1. What is the level of Knowledge on meat handling of slaughterhouse workers in the Tamale metropolis?
2. What is the meat handling attitudes and practices of slaughterhouse workers in the Tamale metropolis?
3. What are the operational challenges of the slaughterhouse butchers in the Tamale metropolis?
4. What are the factors related to the knowledge, attitude and practices of slaughterhouse butchers in the Tamale Metropolis.?

1.4 Main Research Objective

The main objective of the study is to investigate meat handling knowledge, attitude and practices of slaughterhouse workers in Tamale Metropolis.



1.4.1 Specific Objectives

1. To find the level of meat Handling Knowledge of slaughterhouse workers in the Tamale Metropolis
2. To describe the Attitudes and Practices of slaughterhouse workers in the Tamale Metropolis.
3. To identify the operational challenges of the slaughterhouse workers
4. To determine the factors related to the meat handling knowledge attitude and practices of slaughterhouse butchers in the Tamale Metropolis.

1.5 Conceptual framework of the study

The conceptual framework of the study was developed by the researcher himself. It was developed based on the understanding that the quality and safety of meat produced by slaughterhouse butchers depends on their knowledge, attitude and practices which are also influenced by the background characteristics of the butchers, the operational challenges they faced in their work and the kind of regulations and enforcement mechanisms authorities put in place to regulate the work of the slaughterhouse butchers.

The background characteristics of operators such as their age, working experience, marital status and level of education may have a direct bearing on their level of knowledge on the job. Their background information is most likely to affect the way they approach their job attitudinally as well as practices wise. Much so, slaughterhouse operator with higher educational attainments may well be in a position to have a high level of knowledge in the butchery industry and stand a good chance of demonstrating much desirable hygiene attitude towards work and consequently practice hygienic meat handling and processing compared to those with low or no educational standing.



Also, operators with a wealth of experience in the industry may have learned and unlearned the trade in a more refined way to be in better placed to have the requisite knowledge to demonstrate a desirable hygienic meat handling attitude toward work. This may go a long way in influencing their cleanliness as well. Married slaughterhouse men, particularly from the study area are more likely to be more responsible at both home and work side. This is often attributed to maturity as well. Therefore, married slaughterhouse worker may exhibit maturity in hygienic knowledge acquisition and demonstration of desirable hygienic attitude towards work and then in the practice of the trade.

A slaughterhouse man's background directly affects the way he works and hence his practices. The dos and don'ts at the work site may greatly be engineered by what he believes in and has been associated with overtime. The work routines that are often affected by the personnel's background shows a significant role in determining how the slaughter-man practices his trade at the slaughterhouse.

Challenges related to work at the slaughterhouse facility in terms of non-availability of equipment or resources to aid the course of work has a good chance of draining the positive attitude of the works and in turn, hamper the use of recommended hygienic meat handling procedures that ordinarily would have been practised.

The regulatory authority's role of enforcement of legislative instruments meant to protect public safety and to ensure compliance by slaughterhouse workers may influence the level of hygienic practices observed by the workers. In a situation where punitive measures are employed to ensure compliance to recommended practices, operators may well likely to adhere to all the safety



and hygienic practices in their routine operations compared to an environment where the laws are a bit lax or not at all monitored and enforced.

Adequate knowledge about hygienic procedures in meat handling processes at the abattoir among workers is very crucial in ensuring the quality and wholesomeness of the carcasses produced as well as public safety. Good knowledge of the recommended hygienic procedures in meat handling and processing will most likely to be put into practice and consequently achieve both meat quality and safety standards.

Figure 1.1 below represents the conceptual framework of the study and shows how the various factors interact to influence quality and safety of meat produced by the slaughterhouse butchers.



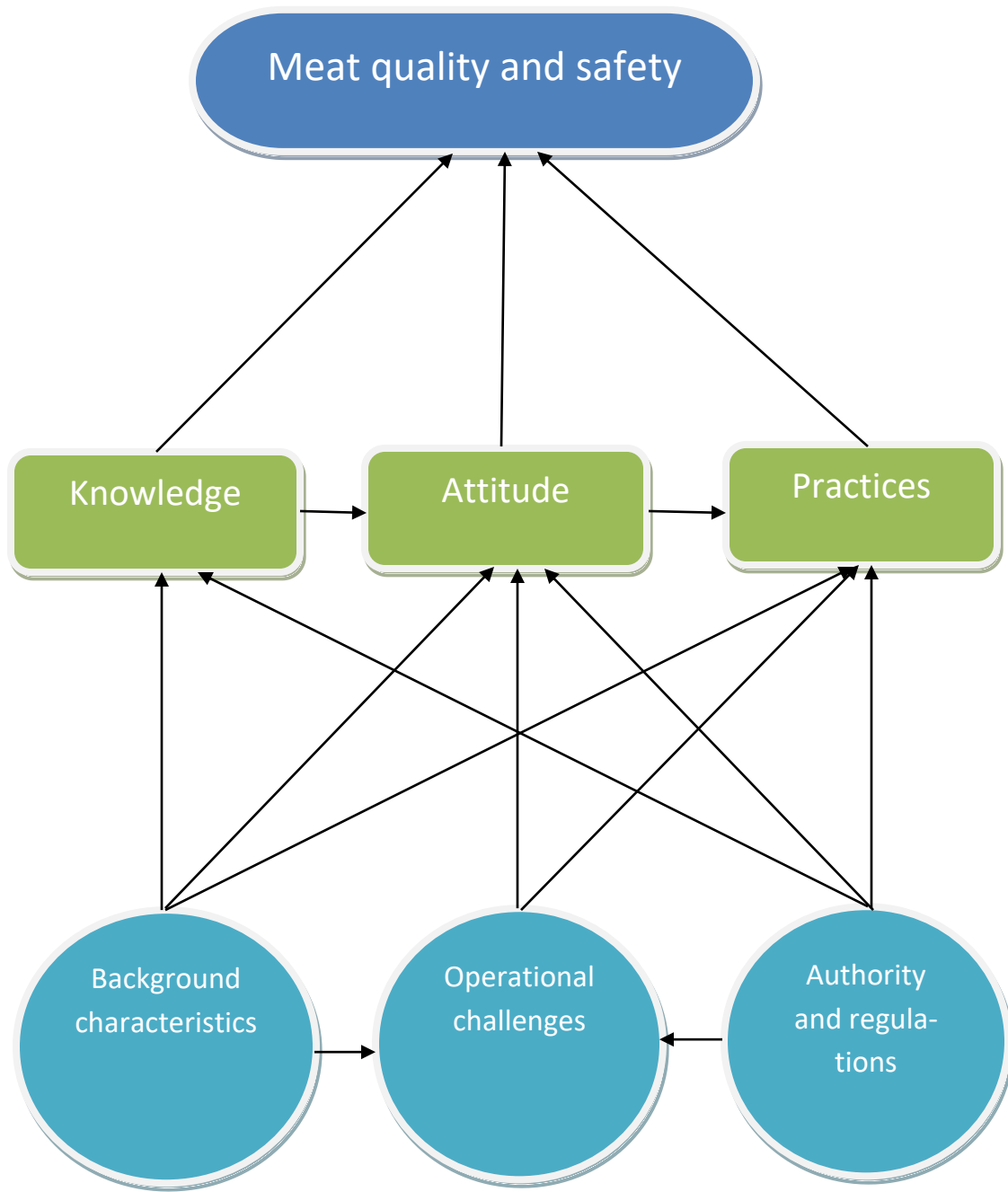


Figure 1.1: Conceptual framework

Source: Researcher's construct, 2019

1.6 Significance of the Study

The study will contribute to knowledge especially in the dimension of Public Health. It will also provide foundation for proper and strict implementation of Ghana's occupational health and safety laws and guidelines at the Tamale Metro slaughterhouse.

The findings of this research will provide a source for informed decision for government organizations and departments responsible for formulating health and sanitary policies on Ghana's abattoirs and meat handling regulations. The research will also serve as a base for further research and study into the general sanitary conditions in Ghana's abattoirs.

Finally it will bring to bear the awareness that is required to ensure the much-needed corrective actions and commitment towards ensuring appropriate operations of abattoirs.

1.7 Scope of the Study

Geographically, the study was conducted in the Tamale Metropolis in the Northern Region of Ghana. The study investigated meat handling hygienic knowledge, attitude, and practices among slaughterhouse workers in the Tamale Metropolis.

1.8 Organization of the Study

The study is structured into six chapters, chapter one covers the background of the study, problem statement, research questions, research objectives, the significance of the study, and scope of the study. Chapter two covers the literature review which reviews empirical evidence from other authors whose studies are related to the current study. Chapter three details the study area and research methodology. Chapter four covers results, chapter five presents' discussions, while chapter six covers a summary of key findings, conclusions and recommendation to the findings.



CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter looked at various definitions and concepts related to the study. It reviews various empirical evidences of other authors that relate to the subject matter of the study. It further analysed various authors' findings and relates it to others and their position in terms of slaughterhouse workers hygienic knowledge and practices in the preparation of meat for public consumption.

2.2. Overview of Slaughterhouse

Public slaughterhouses can be traced to the Roman advancement and in France by the 15th and 16th centuries. In 1890 a law was postulated in Italy, that public abattoirs should be provided in all communities comprising of more than six thousand inhabitants. Similar things were reported in Norway, Sweden, Denmark, Netherlands and Romania (Jode et al., 1996). The most commonly slaughtered animals for food are cattle, sheep, pigs, goats, and fowl, for poultry meat

Undoubtedly, meat has over the years become a major component of the daily food consumed by the average individual as reflected in the increases in the annual per capita meat consumption worldwide. More than at any time in our history, people are consuming more meat. This call for global and national effort towards ensuring that the meat processing medium is adequate to ensure that meat which leaves the slaughtering houses is wholesome. It is critical, without compromise, that the meat that leaves slaughtering houses, to be consumed, has the lowest possible level of micro-organisms, be it bacteria, yeast and moulds (fungi) protozoa or viruses.

Adequate sanitary conditions, good maintenance culture and appropriate hygiene practices are stages that can be taken to control the chances of meat contamination (Desenclos et al., 1996).



Slaughterhouses exist primarily to provide the appropriate environment for slaughtering livestock and controlling the waste spill.

2.3.1 Meat

Meat is mostly the muscle tissue of an animal which is the main edible part of domestic mammals. Gracey et al. (1999), well-defined meat as the animal tissue used as food, mostly skeletal muscles and its associated fats but it may also refer to organs including lungs, livers, skin, brains, bone marrow, kidney and a variety of other internal organs as well as blood. Generally uncooked meat refers to the muscle tissue of an animal used for food. In the meat production industry, the term 'meat' refers particularly to mammalian flesh, while the word 'poultry' and 'seafood' are used to differentiate between the tissue of birds and aquatic creatures respectively (Smil, 2002).

2.3.2 Consumption of raw meat

In most societies, argument and debate have arisen over the ethics of consuming animals as food. Two of the main ethical objectives have to do with the unnecessary killing of sentient (i.e. feelings) living beings, and the inhumane agricultural practices underlying the production of meat. Among the reasons for objecting to the breeding and killing of animals for human consumption are concerns about animal welfare, animal rights, environmental ethics and religious scruples (Abukari, 2007).

Globally, meat industry provides food and income for billions of people; it also has a significant environmental and adverse health effects on the earth. Professionals predicted that the worldwide consumption of pork, beef and poultry and other livestock products will double by 2020, although this prediction may be reduced by the recent economic downturn (FAO, 2001).



It has also been projected by FAO (2001), that globally the intake of meat may double from 2000 to 2050, predominantly as a result of increasing world population, but also partly because of increased per capita meat consumption (with much of the per capita consumption increase occurring in the developing world. Global production and consumption of poultry meat had been growing at more than 5% annually (FAO, 2001). Trends vary among livestock sectors. For instance, global per capita consumption of pork had increased (almost entirely due to changes in consumption within China), but global per capita consumption of ruminant meats had been declining according to FAO's (2001) report.

According to Lund and O'Brien (2011), the hazards from ingesting pathogens found in raw meat are ominously higher than cooked meat, although both can be contaminated. Meat to be consumed can be insufficiently cooked, allowing disease-carrying pathogens to be ingested. Also, meat can be contaminated during the production process at any time, from the slicing of prepared meat to cross-contamination of food in a refrigerator. All of these situations may lead to a greater risk of disease (Lund & O'Brien, 2011).

2.3.3 Quality of meat

The quality of raw meat can be defined as the suitability of meat for use in a specified product (Bastin, 2007; Hozza et al., 2014). Also, when meat is well suitable for the product it is anticipated for, then the 'consumer' meat quality is defined as good. However, if the meat is less suitable for the product, then the 'consumer' meat quality is defined as poor.

According to Adzitey, et al., (2011), live weights before slaughter influence the quality of meat. Adegoke and Falade (2005) reported that nutritive quality attributes of meat, include the nutrient content, nutrient availability and caloric value. The quality and quantity of protein in meat are



reported to be high. However, there are substantial differences between the preferences of individuals including the preference for different cuts of meat, lean or fatty, muscle or organ meats, methods of cooking.

2.3.4 Indicators of meat quality

Proper sanitation helps maintain meat colour, which leads to more sales and reduced colour costs. The colour of freshly cut meat is purplish-red. After it is cut, meat “blooms” by absorbing oxygen from the air, turning bright red. When meat is exposed to air it may cause the meat to turn brownish-red or greyish red. The length of time between the initial ‘blooming’ and discoloration depends on several factors. Two of these factors, the presence of oxygen from the air and dehydration or loss of water from the surface, are controlled by proper packaging materials (Adegoken & Falade, 2005). Fresh meat packaging films, when properly used, permit oxygen to enter the package and act as a barrier to moisture loss. Two other factors, temperature and microbes, must be controlled by practices and operations in the retail market.

Several factors affect the quality of the meat. However, the main factors are nutrition, social environment, cooking, ageing time, post-slaughter handling, slaughter procedure, pre-slaughter handling, lairage conditions, animal handling, disease, transport, slaughter weight, climate and genetics (Guerreso et al., 2013).

Dark Film and Dry (DFD) meat can be found in carcasses of cattle or sheep and sometimes pigs and turkeys soon after slaughter. The carcass meat is darker and drier than normal and has a much firmer texture. The muscle glycogen has been used up during the period of handling, transport and pre-slaughter and as a result, after slaughter, there is little lactic acid production, which results in DFD meat. This meat is of substandard quality as the less pronounced taste and the dark colour is less satisfactory to the consumer and has a shorter shelf life due to the abnor-



mally low pH value of the meat (6.4 – 6.8). Dark Firm and Dry meat means that the animal was stressed, injured or diseased before being slaughtered.

Pale Soft Exudative (PSE), meat found in pigs is caused by severe, short-term stress just before slaughter. The trauma could take place during off-loading, handling, holding in pens and stunning. Here the animals are subjected to nervousness and fear caused by man-handling, fighting in the pens and bad stunning techniques. All this may result in biochemical processes in the muscle, in particular, the rapid breakdown of muscle glycogen. This will make the meat to become very pale with noticeable acidity pH value of 5.4-5.6 immediately after slaughter and with bad odour. It will be difficult to use this type of meat or cannot be used at all by butchers or meat processors and will be wasted in extreme cases. Allowing animals to rest for one hour before slaughter will considerably reduce the risk of PSE (Adzitey et al., 2011).

2.3.5 Spoilage of Meat

Meat can spoil if not handled well within an hours or days and results in the meat becoming unpalatable, poisonous and unwholesome. Spoilage is caused by the practically avoidable as well as inevitable infection and subsequent decomposition of meat by bacteria and fungi, which are borne by the animal itself, by the people handling the meat and by their implements. Meat can be kept appetizing for a much longer time if proper hygiene is practiced during production and processing and proper food safety, food preservation and food storage procedures are applied (CFSAN, 2013).

It is very essential for animals to be stress and injury-free during operations before slaughter, so as not to unnecessarily deplete muscle glycogen reserves. It is also vital for animals to be well-rested during the 24-hours so that the glycogen levels in the muscles of the slaughtered carcass are as high as possible to develop the maximum level of lactic acid in the meat. The lactic acid in



the muscle has the effect of reducing bacteria growth that has contaminated the carcass during slaughtering and dressing (Akinro et al., 2009). These bacteria cause decomposition of the meat in the process of preservation, particularly in warmer environments.

This decreases the lifespan of meat, which can cause wastage of food. If the contaminating bacteria are those of food poisoning type, the consumers of the meat may be fall ill, resulting in expensive treatment and loss of manpower hours to the national economies (Guerreso et al., 2013). Thus, meat from animals, which have suffered from stress or injuries during handling, transport and slaughter, is likely to have a shorter shelf life due to decomposition. This is perhaps the biggest cause of meat wastage during the production processes (FAO, 1985).

2.4 Meat handling knowledge of slaughterhouse workers

The high incidence of foodborne diseases has led to an increase in global concern about food safety. Several foodborne disease outbreaks have been reported to have been associated with the improper personal hygiene of people handling foodstuffs (Bryan, 1988; Shapiro et al., 1999). Personal hygiene is critical in preventing contamination of food and foodborne illness, people handling foodstuffs must wash their hands properly to prevent contaminating other foods, and surfaces they touch (Medeiros et al., 2001). The hands, as well as contaminated gloves, serve as vectors for transmission of transient microorganisms (Fendler et al., 1998).

In many years there have been desires regarding the clothing and personal hygiene of workers, if properly enforced, these should control contamination from workers' bodies (Restino & Wind, 1990; Kasprowiak & Hechelmann, 1992). All employees working in the slaughterhouses must wear hairnets, should wash their hands before and after breaks, visits to the toilets and as necessary during production, clean and sanitize gloves, knives, aprons to minimize contamination (Brendan et al., 2009). Without knowledge of meat safety practices and proper meat handling



procedures, foodborne illnesses cannot be reduced (Redmond & Griffith, 2005). Gould (1994) reported that all meat handlers must have participated in a training programme in personal hygiene, good manufacturing practice, cleaning and disinfection procedures before starting to work in an abattoir. Training helps to improve overall employee knowledge of meat safety (Finch & Daniel, 2005; Roberts et al., 2008).

2.5.1 Disinfection on entering the premises

Anytime a staff is entering the slaughterhouse, he or she should go through a procedure of disinfection by sinking his or her boots in a footbath, which is a basin situated at each entrance of the slaughter line, to avoid passing on infectious agents that might fix to the boots through soil particles (Adler, 1999).

2.5.2 Pre-slaughter handling process

The handling or treatment of stock (animals for slaughter) before they are slaughtered is crucial into both the quality and safety of the processed meat for consumption. Animals exposed to stressful conditions of any kind such as food deprivation, manhandling excessive exhaustion as a result of transportation or fights due to overcrowding are considered as bad pre-slaughter practices. It is imperative to avoid mixing of differently reared animals during transportation and in the lairage. This often results in fights, bruising and sometimes even death. Transporting trucks should be over or under loaded during transportation. Such practices may be having deleterious consequences such as pale, soft and exudative (PSE) on the quality of the meat that would eventually be produced (FAO). The stock should not be held in the lairage for more than 24 hours. Holding stock for long hours in the lairage may lead to a poor condition of meat quality known as dark, firm and dry (DFD).



Additionally, only animals that are healthy for consumption are the kind that should be held in the lairage with the availability of plenty of clean water (FAO,).

Stock meant to be slaughtered should be deprived of food and water (made to fast) for about 24 hours before slaughter. This ensures that there is a reduction of the level of gut contents and bacteria which results in a reduced likelihood of risk of contamination of the carcass at some stage in dressing (FAO,).

Animals for slaughter must be as clean as possible at the point of slaughter. Slaughterhouses workers must ensure that animals must be washed clean before slaughter.

2.5.3 Bleeding and exsanguinations

The purpose of bleeding is to kill the animal and remove as much blood as quickly as possible with very little damage to the carcass (FAO). Bleeding can take the form of bleeding with or without stunning. This form of stunning may either be on the rail bleeding or horizontal bleeding.

Bleeding on a rail– This is regarded as the most hygienic form of bleeding. It is undertaken by shackling the animal immediately stunning it to unconsciousness, then hoisted on a moving rail. The animal is stuck with the bleeding knife while still hoisted. It is left to bleed out up until there is negligible blood flow.

Horizontal bleeding– This process is done on a clean stainless-steel table. The method ensures a faster bleeding rate due to how certain organs and blood vessel are constrained and pressured when the animals are hoisted.

Bleeding on the floor is regarded as very unhygienic (FAO,).



Bleeding without stunning – This type of bleeding is common among the Jewish and Muslim religions because they forbid the consumption of meat killed by non-bleeding methods. Even though ritual slaughter may seem inhumane than bleeding after stunning, highly skilled slaughter operators can successfully carry out the sticking in a way that will result in a gash cut that will sever all the veins and arteries quickly at a very first attempt. This ensures that the animal feels less pain in the slaughtering process (FAO,). The knife used to kill each animal should be frequently washed and rinsed in hot water. It is recognised that an infected knife can pass on microbes into the animal tissues during the early phases of bleeding when the heart is still beating (Reij et al., 2003).

2.5.4 Skinning

Skinning of cattle and small ruminants should be conducted such that under no circumstance should the outer side of the hide touch the inner skinned surface. The hands of the operators that have come into contact with the skin should not equally touch the skinned surface (FAO,).

Reij et al. (2003) argue that knife skinning and the use of bare hands can similarly host pathogens on the surface of the carcass.

2.5.6 Evisceration

In order not to puncture the intestines proper cautions should be taken. Every viscera must remain undamaged with the carcass until the veterinary inspection has been conducted and accepted. Slaughtermen should adhere to the procedure of tying the end part of the intestine and the severed end of the oesophagus by removing the intestine and stomach first, followed by the pluck (heart, liver, and lungs of an animal used as meat (FAO, 1985). The pluck should be hanged on a hook while the paunch (stomach) should be dropped in a paunch container. In order to maintain proper hygiene practices, the stomach and intestines should not be processed while



carcass dressing is in operation as any slight splash from same can easily cause contamination of the meat (Medeiros et al., 2001).

2.5.7 Carcass splitting

Hygienic carcass splitting especially with simple equipment in the case of cattle and small ruminants can be carried out facing the back of the carcass. The splitting should be done along the backbone (chine) using a saw or cleaver from the pelvis to the neck area. In case of splitting with the aid of a saw, a better result is assured. However, bone dust must be removed afterwards. When using a cleaver, it is imperative to saw through the rump and lion in particularly in older animals. The equipment (saw and cleaver) should be sterilized in hot water at about 82°C intermittently between carcasses (FAO,).

2.5.8 Washing

Generally, the main goal of carcass washing is to do away with any visible stains of soil and blood and to give an appealing outlook after chilling. Washing carcasses are in no way considered the most hygienic practice in the meat production process since it tends to spread bacteria rather than reducing their total numbers. During the washing process, observed stains of gut content must be entirely cut off. The use of wiping cloth must not be employed in any stage of the carcass washing process as this may rather introduce more contaminants to the carcass.

In a situation of carcass spraying as a mean of removing dirt and blood stains the use of clean water should not be compromised. Soiled carcasses should be sprayed soon after dressing to prevent the soiled materials from drying up and by so doing reduce the time for bacteria growth. Whiles doing away with stains on skinned surfaces much attention should also be paid to the internal surfaces, the sticking wound and the pelvic area. However, critical care must also be taken to ensure that the minimum amount of water is used in the washing or spraying process because



wet surfaces generally favour bacterial growth. Chilling of the carcass should commence immediately after washing (FAO,).

If water is contaminated then a dry slaughter process by trained slaughter men should be used as a substitute as it is more suitable as a safety measure for carcasses to be dry clean than to contaminate them with unhygienic water (Odeyemi, 1991).

2.5.9 Carcass dressing

Carcass dressing is done to remove all unwholesome or contaminated parts of and to ensure a standardized presentation of the carcass before weighing and selling. However, removing of noticed diseased parts of the carcass should not happen before post-mortem inspection of the carcass by the veterinary officer (FAO,).

2.5.10 By-products

The nonmeat material parts during the slaughtering process are commonly referred to as offal. The offal is the organ from the carcasses which contain the utmost load of infectious organisms and as precautions must be moved to a separated chamber made for them. Initially, they should be emptied of their contents, dried, and then cleansed with water (Guerreso et al., 2013). A variety of meat including offal, bones; brain tongue is the by-products of the meat slaughtering process. By-products such as bone and rendered meat are often used for the production of animal feeds and fertilizers. High-collagen products such as gelatin obtained from such as pork snouts, pork skin and dried rendered bone is used in sweets, jellies and pharmaceuticals. The intestine is most used as casing for sausages. The hides and pelts ruminants are also used for the manufacturing of leather.



2.5.11 Meat inspection

Meat inspection is one of the most important standard procedures in the meat slaughtering and processing industry. It is a mandatory process and aimed at assuring wholesomeness and safety of the meat supply to consumers. Although there is variation in the inspection procedure from country to country, it is primarily centred on the same basic principles. They often take forms antemortem inspection, post-mortem inspection and re-inspection during meat processing, sanitation, facility and equipment, and compliance.

Antemortem inspections are meant to identify animals that are not fit for human consumption before slaughter. During these process animals that are down, disabled, diseased or dead (known as the 4Ds) are identified and removed from the food chain.

Post-mortem inspections, on the other hand, start with the head, viscera, and carcasses aimed at identifying the whole carcass, part of it, or organs that may be unwholesome or safe for human consumption.

Reinspection processes are initiated and undertaken in a situation where a previously inspected meat or carcass is inspected again. Instances, where carcasses are further processed into meat products, require reinspection to assure consumers of the wholesomeness and safe of the ingredients and the manufacturing process of the products such as sausage and ham.

2.5.12 Sanitation

The need to maintain good sanitary practices in slaughterhouses is a key to reducing contamination of carcasses processed. Hence there should be a mandatory inspection of the level of sanitation before and after the production process. The floors, walls, ceilings, drains, equipment and



items used in the production process must be cleaned. Also, all water in the production process must be clean or potable (FAO,).

There should be provisions of sterilizers or disinfectants at vantage points. However, there must be sanitary facilities such as latrines, wash room and cloak room. These amenities must be kept clean and well serviced.

The slaughterhouse area must be fenced to avoid access of unauthorized persons and animals not meant for slaughtering. Proper disposals of waste can prevent rodent infestation within the slaughterhouse which can improve environmental cleanliness.

2.5.13 Personnel

Personal hygiene of the workers is a primitive aspect in slaughtering procedures. Transmission of microbes by personnel mostly from hands is of importance (Bloomfield, 2003). Low doses of infectious organisms such as *Shigella* and pathogenic *Escherichia coli* have been associated to hands as a starting place of contamination (Snyder, 1998).

In addition, people with unhygienic behaviour like spitting, coughing and nose-blowing should be strictly monitored to ensure that they do not contaminate the food they work with. It is important to limit access to the premises during the time of slaughter. All personnel that are allowed entry should also be dressed in the appropriate personal protective clothing, for instance sparkling trousers and wearing of suitable waterproof aprons. Boots should be worn with the trousers neatly folded inside. The aim is that workers must sternly bear with the hygiene code of dressing (Reij et al., 2003).

The idea is not to guard the worker against contamination but to shield the meat/food against contamination. Working clothes must be used solely in the working environment and not in any



place. However, it is worthwhile to avoid entry from unclean area to clean area without changing clothes. Measures should be designed in a way that the staffs should work either in a clean area or in an unclean area.

The staff may eventually be allowed to go from clean to unclean work but never in the opposite direction, except when they have changed working clothes and washed hands. Working clothes should be comfortable and simple to wash. Working clothes should be free of loose adornments (buttons, sequins etc.). The wearing of jewellery, wrist-watches, rings etc. are prohibited as these objects may serve as sources of contaminants and make hand-washing difficult.

Covering of hair during operations is another encouraging hygienic practice at the slaughterhouse. Human hair and beards are sources of heavy contamination with bacteria. Therefore, to reduce the level of bacteria contaminations of the meat been processed, hair or beard must be covered during operations.

The use of hand gloves for operations is mandated. They must be kept in a good sanitary condition else it is better off not to be used for any operation. Gloves are made of rubber or plastic materials and they come in handy in term of protections against meat contamination. As far as protection goes, the use of gloves may protect the hands of workers against knife cuts. Considerable efforts must be taken to ensure gloves are kept following a certain taken hygienic standard.

The state of health of workers at the meat industry especially the slaughterhouses must be good. This is very essential because persons with disease conditions normally have a higher likelihood of carrying lots of pathogens than normally expected. Chases are that these pathogenic microbes found on the ill workers may then be transmitted to the meat they work on with the risk endanger



public safety. Ill workers must report to management of the facility or the meat inspector of the slaughterhouse who will then decide if the worker is fit for work or leave till fully recovered the ailment.

2.5.14 Cleaning operations

Wholesome water is regularly essential for the cleaning of equipment, tools, floors and walls. Such procedure usually starts with the elimination of solid waste from meat, fat trimmings and pieces of bones. Water can be used to scrub blood clots and remove other waste materials on the floor. High-pressure water cleaning begins from the walls and finally ends with the floors (Medeiros et al., 2001).

The use of hot water spraying under pressure would be ideal for removing sticky waste from corners and drains. Detergents are suggested for cleaning of other surfaces such as tables and tools with the use of hard brushes. The use of liquid detergents is more effectual than normal soaps since they dissolve easily in water while absorbing dirt, which is finally removed by flushing. Powdered soap may also be dissolved in water and used (FAO, 1985).

2.5.15 Compliance and Regulation

To ensure the proper criminal, administrative and civil sanctions are meted to offenders of food inspection legislation or laws. Violations of these laws often include the sale of uninspected meat, the use of unhygienic equipment, contamination of the product, etc.

2.6 Demographic characteristics of slaughterhouse workers that influence their hygienic knowledge and practices

Brown et al. (2011) carried out a study on demographic information on the population of butchers and their assistants and reported that forty percent of the population was less than 40 years old; 35 per cent aged 50 years or more. Gandhi et al. (1995) in their statistical analysis revealed that majority of the respondents had the family size of 3.63 with nuclear families. Sathyanarayan



et al. (2010), reported that more than half (63.08%) of the livestock farmers lived in nuclear type family followed by joint family (36.92%) type. Goodwin and Koudele (1990) reported that household size did affect the purchase of meat. Sathyanarayan et al. (2010), reported that more than half (53.85 %per cent) of the livestock farmers belonged to medium family size category followed by small (40.00 %) and large family size (6.16 %) categories. Okwu and Umoru (2009) reported that the majority of the respondents (96.9 %) were Christians while only 3.16 were Muslims.

Gandhi et al. (1995) realized that of the total respondents, 62.0 per cent were agricultural farmers, 30.0 per cent were employees and remaining respondents had animal husbandry as their major occupation. Benedicte Lie (1999) reported that most butcher shops are family-run. People from outside are sometimes employed for assistance. Khadgi butchers can roughly be divided into 4 categories: wholesale dealers and retailers, Retailers; who buy the meat wholesale and sell in detail, Helpers; who do not have their own business, but work as helpers to other butchers, Processors; who buy the meat from the butchers, process it (vacuum packing, making sausages and other products) and sell to supermarkets, restaurants and hotels. Gandhi et al. (1995) reported that most of the respondents had education up to high school and intermediate (50.0 %).

Emuron et al. (2010) reported that the number of local chickens traded per week was positively correlated with the level of education of the traders or butchers involved. Brown et al., (2011), carried out a study on demographic information on the population of butchers and their assistants and reported that 48 per cent of the study group completed primary education; only 5 per cent attained a tertiary level education. Haile Selassie et al. (2013), studied educational status and building the capacity of meat handlers on personal hygiene practices of abattoir workers in Ethi-



opia and reported that out of total 26 abattoir workers interviewed 7.7 % of them were illiterate, 61.5% did not take any capacity building regarding meat hygiene and those who received the capacity building were not appreciating the effectiveness of training which only focused on the management of animal skin in the abattoir.

Gandhi et al. (1995) realized that majority (96.92 %) of the respondents belonged to low family income and an equal percentage of respondents belonged to medium (1.54 %) and high (1.54 %) family income categories. Gaurang and Yadav (2007) opined that island city of Mumbai is the economic progression engine and commercial capital of India. A combination of in-migration combined with a severe land shortage has resulted in Mumbai having one of the most expensive real estate in the world. As a result, the city faces a housing crisis with an estimated 60 per cent of its total population living in slums, adopting multiple non-formal housing tenures.

Karandikar (2010) stated that in a dense city like Mumbai, with a lack of affordable housing, Chawls provide a sustainable model for middle-class housing that should be maintained and can potentially serve as a model for future housing projects. Rees (2000) researched in Kenya and reported that between 40 to 70 % respondents reported government extension as an important source of information and for the smallholders are neighbours, family, markets and community-based organizations.

Kumari (1999) reported that farm women perceived television as the most effective source of information followed by radio & television. Warren (2010) reported that a small number had taken over the running of the business from their fathers and these second-generation butchers claimed to have picked up their skills from an early age. Brown et al. (2011) carried out a study on demographic information on the population of butchers and reported that 60 % of the study



population had over 10 years of exposure to the work environment, almost one-third of whom had more than 30 years of experience. Most of the studied population (95 %) had no formal training but learnt the job by observation at a slaughterhouse.

2.7 Challenges of slaughterhouse workers complying with hygienic standards practices in a meat preparation

Meat retailers conduct their businesses in butcher shops without complete adherence to rules and regulations governing the construction and operations that ensure a favourable hygienic environment which implies that consumers in general purchase meat confronted with the non-hygienic environment (Mtenga et al., 2000). Indicating inadequate implementation and supervision of rules and regulations governing health and hygiene supply of beef to consumers.

Improper hygiene practices during carcass handling have been suggested as sources of meat contamination (Haileselassie, 2013; Kariuki et al., 2013). Nabukenya et al. (2013) added that non-existence of protective clothing has been identified as an occupational health risk for brucellosis in slaughterhouse workers in Uganda and Tanzania. Emerging zoonotic diseases, such as Rift Valley fever (RVF), have been reported in people involved in slaughter suggesting that slaughterhouses workers might be “sentinels” for disease emergence (Swai et al., 2009).

Adeyemo, (2002) and Lawan et al. (2013) contended that in most slaughterhouses, slaughtering and processing amenities are not available, lack of proper sewage or waste disposal systems, inadequate portable water supplies and refrigeration. Furthermore, the paucity of records of slaughterhouse operations, vis-à-vis workers’ operational knowledge and compliance with the preventive practices in most Nigerian slaughterhouses is also an impediment to good slaughterhouse operations. Stull and Broadway (1990) attributed the dangerous working conditions in slaughter-



houses to be lack of hygiene and the physically demanding nature of the work it results in a high number of inexperienced labourers working in slaughterhouses.

Kumar and Kaul (2000), argues that most workers are not concerned about the status of slaughterhouse and unhygienic conditions in which they were working. Workers in the slaughterhouse were found smoking and spitting wherever they wish. Joshi et al. (2003), added that in many unindustrialized countries, inadequate of appropriate slaughtering facilities and unsatisfactory slaughtering techniques are causing loss of meat as well as valuable by-products from animal carcasses. Poor animal slaughtering facilities and meat handling practices contribute greatly to the spread of zoonotic diseases in human populations. Vaidya et al. (2004), discovered that the bleeding and evisceration procedures resulted in the highest bacterial counts and emphasize the education of butchers about personal hygiene, cleanliness and preservation of good sanitary practices in the slaughterhouses.

Legese et al. (2008) also contended that problems of butchers in unorganised purchasing system of abattoirs, poor market infrastructures like road, seasonality in production. Amy et al., (2010), stated that the illness and injury rate of workers was higher in slaughterhouses than in any other industries. Brown et al. (2011) reported that Butchers and slaughterhouse workers engaged in animal handling and slaughtering were frequently exposed to Leptospirosis.

2.8 Empirical Evidence

Faith (201), study microbiological analyses of beef slaughtering process and meat safety knowledge of handlers at selected high and low throughput abattoirs South Africa. The objective of the study was to evaluate meat hygiene practices among meat handlers and microbiological analysis of beef carcasses, slaughtermen hands, equipment and water from low throughput (LTA) and high throughput (HTA) abattoirs in the Eastern Cape Province of South Africa.



Overall, a significant adherence to basic hygiene practices and a satisfactory level of knowledge was observed. Workers from an HTA yielded comparatively better statistically significant scores.

Moreover, knowledge and practices of respondents were significantly associated due to educational level and professional training. Overall, the hands of slaughtermen and equipment in the dirty area (skinning and evisceration) yielded more bacterial counts compared to those in the hygienic area (slaughtering, inspection, washing and packing) from both abattoirs. For all the sampled carcasses, equipment and slaughter men hands, HTA yielded comparatively higher bacterial counts than the LTA. Although the results showed a significant adherence to basic hygiene practices, some aspects such as routine medical examination, health certificates and professional training of slaughtermen still need to be improved. Therefore, the outcome showed that slaughtermen, equipment and water can be sources of contamination during the slaughtering procedures.

Kehinde and Abiodun (2014) also looked at poor slaughterhouse waste management: Empirical pieces of evidence from Nigeria and implications on Achieving Millennium Development Goals. Data on knowledge, attitudes and practices of waste management of 390 randomly selected slaughterhouse workers in Nigeria were collected and analysed using multiple regression statistics. Their results revealed that the majority of the respondents had poor attitudes (75.6%) and practices (97.4%) of appropriate waste management, though 51.5% demonstrated good knowledge. While 51.3% knew that slaughterhouse wastes are related to diseases, 75.4% were unconcerned that poor management could be major public health and environmental hazards and 74.4% discharged slaughterhouse wastewater into surrounding streams. Gender, education and work experience were significantly associated with good knowledge. These poor attitudes and



practices have negative implications on environmental health conditions, access to safe water and quality of life.

Marin et al. (2017), study the knowledge, attitudes and practices of Brucellosis among slaughterhouse and community animal health workers in Wau, Western Bahr el Ghazal state, South Sudan. The study assesses the knowledge, attitudes, and practices of the slaughterhouse and community animal health workers in Wau Municipality, South Sudan. The study participants were interviewed using a pre-tested questionnaire. Out of 77 study participants (79.2% slaughterhouse workers and 20.8% community animal health workers) only (39 %) had ever heard about brucellosis. 68.8% and 96.4% mentioned joint and leg swelling as a common sign of brucellosis in humans and animals, respectively.

Taking the mean knowledge as the cut off value, 85.7% of the study participants had a low level of knowledge about brucellosis, 89.6% had positive attitudes and 59.7% had good practices towards brucellosis prevention. Majority of participants did not know about brucellosis in both humans and animals. Moreover, the overall knowledge of respondents was low although they indicated a positive attitude and good practices towards brucellosis prevention.

Chepkemai et al. (2015), study sanitation and hygiene meat handling practices in small and medium enterprise butcherries in Kenya - Case Study of Nairobi and Isiolo Counties. The study assessed sanitation and hygiene meat handling practices in SME butcherries in Nairobi and Isiolo counties, Kenya. There was high participation of more educated youth (20-35 years) in butchery operation in Nairobi County compared to middle age (31-40 years) in Isiolo County. About 70% and 82% of operators in Nairobi and Isiolo Counties respectively did not wear protective cloth-



ing. About 94% and 88% of operators in Nairobi and Isiolo Counties respectively did not have medical certificates. Again, 86% and 69% of operators in Isiolo and Nairobi Counties respectively had no training on meat handling hygiene. In the same way, 60% and 82% of operators in Nairobi and Isiolo counties respectively did not wash their hands before handling meat.

It has also been revealed that 90% and 87% of operators in Isiolo and Nairobi Counties, respectively handled meat concurrently with handling money. Again, 60% and 34% of operators in Isiolo and Nairobi Counties, respectively cleaned utensils by wiping with a reused cloth. It has again been reported that 58% and 27% of operators in Nairobi and Isiolo Counties, respectively used closed vehicles to transport meat from the slaughterhouse to the butcheries. The metallic containers or transport vehicles used were not refrigerated as the distances covered were below the minimum distance requiring refrigeration of meat during transportation. Again, 83% and 47% of the operators in Nairobi and Isiolo Counties, respectively stored meat by hanging it in open space in butchery. The study showed that meat handling practices in SME butcheries in Kenya do not meet the required minimum sanitation and hygiene standards.

Otupiri et al. (2000), study the detection and management of zoonotic diseases at the Kumasi slaughterhouse in Ghana. The study examines slaughterhouse reports and to explore the nature of the knowledge, attitude and practices of butchers who operate at this slaughterhouse, in relation to zoonoses. The study was largely descriptive, employing qualitative methods and tools. Butchers were interviewed and their practices along the production line observed. The study indicates that zoonotic diseases are frequently detected at the Kumasi slaughterhouse.



However, the knowledge, attitudes, practices and beliefs of the butchers are largely inadequate for their profession because of the important public health role that butchers play. The butchers have never received any form of training. It is recommended that the butchers receive training regularly and that laws be formulated and implemented to protect the health of the butchers and the general public.

Nyamakwerea et al. (2017), their study assesses the level of knowledge, attitudes towards meat safety and personal hygiene of slaughter personnel from low throughput (LTA's) and high throughput abattoirs (HTA's). About 40% of abattoir employees attained secondary education and this was significantly greater than those with no education (25%), primary (26.7%) and tertiary (8.3%) ($P < 0.05$). A significantly greater proportion of respondents (55%) had more than 5 years of experience compared to those with 5 years. Overall, a greater proportion of respondents had valid health certificates (62.5%), though significant proportions (35%) were from the HTA's. More medical examination defaulters (7.5%) were from LTA's compared to HTAs (2.5%) ($P < 0.05$). Majority (47.5%) of their respondents were treated for illnesses in clinics or hospitals, whereas some self-medicated (22.5%), visited traditional healers (22.5%) and 7.5% went to pharmacies. Secondary and tertiary educated respondents who received professional training revealed a significantly greater willingness to disinfect work clothes, contact surfaces and wear gloves. A significant proportion of respondents (70%) who received professional training showed greater willingness to report illness than untrained.

Bafanda et al. (2017), a study examined existing meat handling and hygienic practices among butchers and meat retailers in Jammu District of Jammu and Kashmir: A Socio-Economic Analysis. The animal was fatigued and soiled with faecal material and considerations were not given to avoid undue stress that might adversely affect the safety and suitability of meat. There was no



standard method of bringing the animal to the floor for slaughter. The animals were slaughtered without restraining them properly and are slaughtered in front of other animals causing great fear in them. Butchers used to bring even more than ten animals at a time and slaughter them one after other, even butchers and other workers moved freely over carcasses without caring for hygienic measures.

Animals were slaughtered (by both Halal and Jhatka method) and dressed in an unhygienic way. Butchers do not care for preventing the intestine from puncturing during evisceration which leads to contamination of carcass. The edible offal's pluck (heart, lungs, trachea and oesophagus) were pulled out as a unit and these were not hung on a hook instead it was placed on the floor, similarly, paunch (stomach and intestines) were also dropped on the floor. Meat retailers apart from selling meat from animals slaughtered at slaughterhouses significant proportion of respondents were also slaughtering animals (mostly sheep and goat) at their retail meat shops. Chickens were exclusively slaughtered at retail meat shops in front of the consumers. Personal hygiene was poorly maintained by meat handlers owing to their illiteracy, unawareness, lack of facilities and nature of work.

Aburi (2001), in his study, assesses hygiene practices used by small butchers and slaughter slabs in the beef value chain in Juba Town-South Sudan. The study assesses hygiene practices used by small butchers and slaughter slabs; and identify causes of unhygienic beef handling practices in small butcheries and slaughter sites, to improve food safety in beef chain. The survey result of the study shows that young men of ages range from less than 25-35 years old are dominant butchers, 26 of them are 10 primary and 16 secondary leavers, hired to work at butcheries. 35



small butchers were operating in open shelter butcheries and 21 of them did not have health card for operating butcheries; 5 small butchers were operating in kiosk butcheries. Only 9 small butchers attended training on hygiene practices in meat handling. On hygiene practices, 28 small butchers were transporting meat by open vehicles while the rest were using motorbikes; 33 small butchers hanged meat in the open air as a storage system and 3 small butchers stored meat inside fridges; 23 small butchers cleaned their tools by smearing with pieces of cloth, 8 small butchers used water and soaps, 7 small butchers have used sharpening of knives as a way of cleaning knives and 2 butchers only use water; also 75% of small butchers were willing to attend any training on meat hygiene.

The result of the case study revealed that currently, the governments (all levels) do not have a clear legal framework for maintaining food safety along the beef chain. The observational assessment comes with result that 3 slaughter slabs have a concrete floor and one is without any structure as animals were slaughter on bare ground; all slabs do not have necessary facilities for the provision of good hygiene condition, all are nearer to residential areas. Both lacks of a legal framework and insufficient knowledge of good hygiene practices in meat handling by small butchers led to deteriorated hygiene condition of slaughter slabs and butcheries, which will cause food risk for meat consumers in the study area.

Phumkrachai et al. (2013), also study hygienic practices, knowledge and perception on food safety and quality assurance systems in poultry slaughterhouses and slaughter poultry market in Yogyakarta, Indonesia. This study identifies perception, awareness and knowledge on food safety and quality assurance related to poultry slaughterhouses and slaughter poultry market places in



Yogyakarta, Indonesia. The results showed that knowledge of food safety and quality assurance is averagely good anyhow varying by slaughterhouses' owner or government. All stakeholders are aware of food safety, particularly related to meat quality and consumer health concerns. The standard for poultry slaughterhouses in Yogyakarta is currently being developed. The understanding of the hygienic practice and the demand of consumers for quality products may play an important role in the standard perception, behaviour change and increased food safety awareness in the community. The challenges towards standard implementation and its enforcement are the slaughtering practice and behaviour, required slaughterhouse reformation, owners and workers knowledge, the economic benefit of needed investment, and infrastructure with proper equipment.

Cook et al. (2017), studied working conditions and public health risks in slaughterhouses in western Kenya. The study assesses current conditions in slaughterhouses in western Kenya and the knowledge, practices of the slaughterhouse workers toward hygiene and sanitation. Many slaughterhouses had poor infrastructure, 65% (95% CI 63–67%) had a roof, cement floor and walls, 60% (95% CI 57–62%) had a toilet and 20% (95% CI 18–22%) had hand-washing facilities.

The meat inspector visited 90% (95% CI 92–95%) of slaughterhouses but the antemortem inspection was practised at only 7% (95% CI 6–8%). About 9% (95% CI 7–10%) of slaughterhouses slaughtered sick animals. Only half of the workers wore personal protective clothing - 53% (95% CI 51–55%) wore protective coats and 49% (95% CI 46–51%) wore rubber boots. Knowledge of zoonotic disease was low with only 31% (95% CI 29–33%) of workers aware that disease could be transmitted from animals. The current working conditions in slaughterhouses in western Kenya are not in line with the recommendations of the Meat Control Act of Kenya. Cur-



rent facilities and practices may increase occupational exposure to disease or injury and contaminated meat may enter the consumer market.

Adesokan and Raji (2014), in their study safe meat-handling knowledge, attitudes and practices of private and government meat processing plants' workers: implications for future policy. The study evaluated and compared the safe meat-handling knowledge, attitudes and practices (KAP) of private (PMPP) and government meat processing plants' (GMPP) workers in south-western Nigeria. A significant association was observed between the type of meat processing plants and their knowledge, attitudes and practices of safe meat-handling. Meat handlers in the GMPP were respectively, about 17 times (OR = 0.060, 95%CI: 0.018-0.203), 57 times (OR = 0.019, 95% CI: 0.007-0.054) and 111 times (OR = 0.009, 95%CI: 0.0010.067) less likely to obtain good knowledge, attitude and practice level of safe meat-handling than those from PMPP. Further, KAP levels were significantly associated with age group, education and work experience.

Latif et al. (2014), also studied food safety knowledge, attitudes and practices among abattoir workers' in Khartoum State. The study showed that the respondents had a satisfactory level of knowledge, excellent attitudes and poor practices toward food hygiene measures. They were asked about brucellosis, diarrhoea, and typhoid and their answers with correct option 80.0%, 75.7% and 56.7% respectively. Almost all of the participants (90-93.3%) agreed with various statements in the attitude part of the questionnaire. Good hygienic practices of food workers revealed that 93.3% wearing aprons, but 90% was agreed to using masks. The management of the slaughterhouse facilities should be used because they are responsible for the maintenance of hygienic standards. Food will be safe and several foods borne diseases will be eradicated.



Alhaji and Baiwa, (2015), studied factors affecting workers' delivery of good hygienic and sanitary operations in slaughterhouses in north-central Nigeria. The study assesses the levels of knowledge and preventive practices of workers on the hygienic and sanitary operations in slaughterhouses in Niger State, north-central Nigeria. A majority (94.0%) of the respondents were males and most (69.6%) were married. A majority (34.3%) of the workers were in the age group 30–39 years. The mean age of the workers was 40.8 ± 10.7 years. One in five (19.2%) were illiterates. Majority of the respondents 95.6% and 96.4% for meat hygiene and sanitation respectively did not have any previous training. About two-thirds of the workers (74.5%) had poor knowledge about good slaughterhouse operations and more than two-thirds (86.2%) engage in poor preventive practices.

The slaughterhouse workers in the age group 60-69 years were less likely [OR 0.1345; 95% CI 0.0397, 0.4553] to have poor knowledge of the operations than those in the 20-29 age group. The workers with secondary and tertiary education were less likely [OR 0.3557; 95% CI (0.1706, 0.7418) and OR 0.1259; 95% CI (0.0556, 0.2851) respectively] to have poor knowledge than those without formal education. Workers who know the correct definition of slaughterhouse hygiene were less likely [OR 0.3125; 95% CI (0.1862, 0.5244)] to demonstrate poor preventive practices, and those who are aware of the effects of improper operations on public and environmental health were more likely [OR 6.587; 95% CI (4.094, 10.6)] to demonstrate satisfactory preventive practices.

Jenpanich, (2015), in his study on the knowledge, attitudes and practices on Pig meat hygiene at Slaughterhouses and Markets in Chiang Mai Province, Thailand, the study assesses the level of knowledge, attitudes and practices (KAP) of food handlers and to assess the level of microbiological hygiene indicators at slaughterhouses and markets. The study revealed that higher scores



in personal hygiene and cross-contamination and lower scores in foodborne illness. There are some contract finding between attitudes and practices; for example, food handlers agreed that protective equipment can reduce cross-contamination, but they practically do not wear gloves and mask and still work when they got sick.

The study further indicated that some good hygiene measures are inappropriate in the context of their practical implementation and some of these hygiene practices are not following their socio-economic status.



CHAPTER THREE

STUDY AREA AND RESEARCH METHODOLOGY

3.1 Introduction

This chapter comprises of the methodology and the Profile of the Study Area, Research Design, Research Approach, Study Population, Sample Size and Sample Selection, Data Collection Instruments, Source of Data, Data Collection Procedure, Data Analysis, Validity and Reliability, and Ethical Considerations.

3.2 The geography of the study area

The Tamale Metropolitan Assembly is one of the 18 districts in the Northern Region. The Metropolis can be found in the central part of the Northern Region and is bordered by Sagnarigu to the North, Mion District Assembly to the East, Tolon to the West, Central Gonja to the South West and East Gonja to the South.



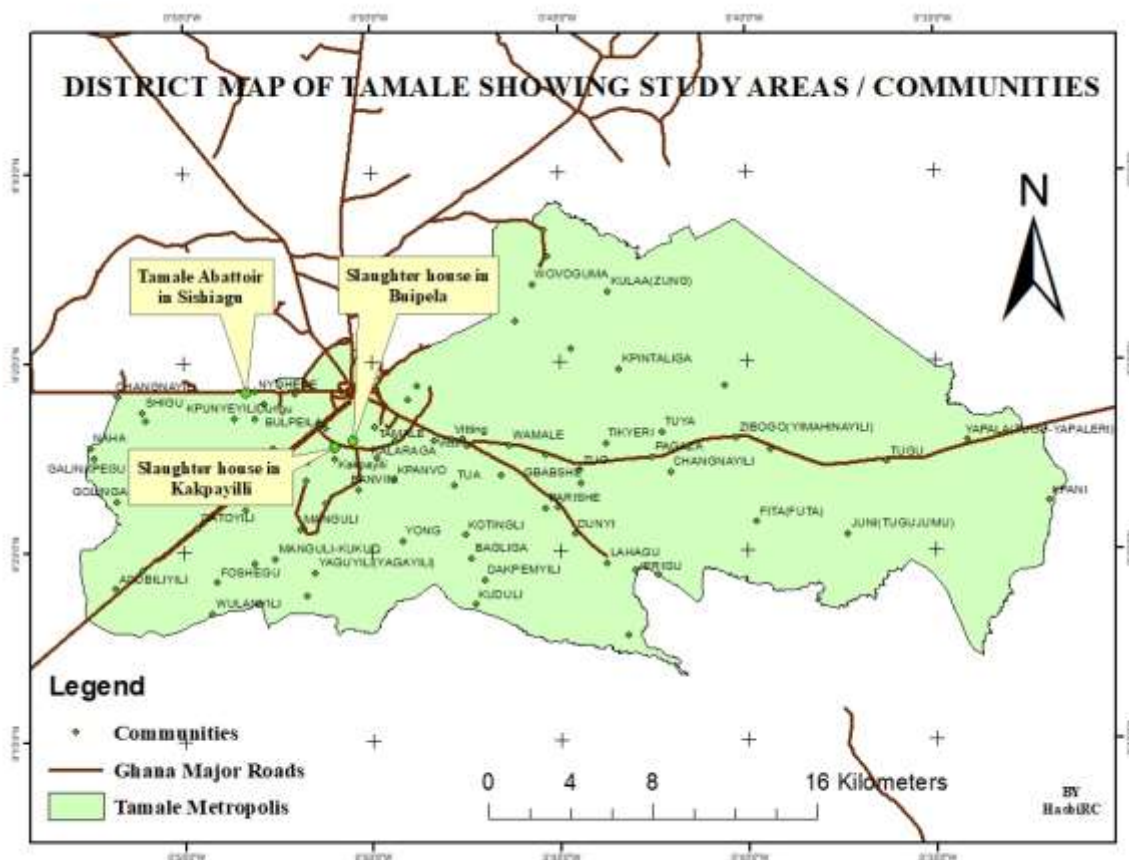


Figure 3.1: Map of Tamale Metro with Slaughterhouses locations

Source: Municipal metropolitan assembly annual report, 2017

The total estimated land size of the Metropolis is around 550 km sq which is about 12% of the total land area of the Region. The Metropolis is situated about 180 meters above sea level with some few isolated hills. It has only a single rainfall season (May - October) in a year, followed by Harmattan winds from November to February. Temperature: max– 40°C and min-25°C.

There is inadequate number of water bodies in the Metropolis. The Metropolis lies within the Savannah Woodland Region of the country. Sandstone, gravel, mudstone and shale are the main soil types that have weathered into different soil grades. Due to seasonal erosion, soil types emanating from this phenomenon are sand, clay and laterite Ochrosols. Dagombas are the majority ethnic group in the Metropolis. Other sectional ethnic groupings are Gonjas, Mamprusis, Akan,



Dagaabas, and tribes from the Upper East Region. The area has deep-rooted cultural practices such as festivals, naming and marriage ceremonies.

The Metropolis has about 42% of the working class in agriculture-related activities. Majority of the workforce in the Metropolis of 58% are engaged in Sales, Services, Transport and Production. This is as a result of rise in Marketing, Banking and other Non-Governmental activities in the Metropolis.

The 2010 Population Census estimated the population of the Tamale Metropolis as 371,351. This comprises with 185,995 men and 185,356 women. This is far advanced than the national and regional rates of 2.7% and 2.8% respectively (GSS, 2010). With an urban population of 67.1%, the Metropolis is the only district in the region which is primarily urban. The population density of 318.6 persons per square kilometre for the Metropolis is about 12 times higher than the Regional average density of 25.9 persons per square kilometre. There is a massive distinction between the densities of the urban and rural areas. This is an indication of the incursion of people to urban Tamale and gives credibility to the assertion that amenities and opportunities for modern employment are intense in a few central places.

The population structure of the metropolis indicates a broad base that gradually tapers off with rising age due to fatality. The youthfulness of the population indicate that the metropolis has an important human resource potential and that this tremendous potential will settle on the strength and resilience of the metropolis in pursuing social, economic and political growth goals.

However, the proportion of people aged sixty years and above is about 4.1 % lower than the regional and national averages of 4.5 % and 5.3% respectively, an indication of a comparably low life expectancy (GSS, 2000). The main religion in the Metropolis is Islam with 84 % of the



population affiliated to it, followed by Christians with a proportion of 13.7 % while the traditionalists constitute 1.6 % of the population. The rest of other religious denominations constitute 0.7 % of the population in the Tamale metropolis.

In terms of Schools, Tamale metropolis consist of 240 nurseries, 274 primaries, 89 Junior High, and 11 Senior High schools. Additionally there are two vocational and Technical schools, one Polytechnic and one campus of the University for Development Studies. The main health institutions in the Tamale metropolis are the Tamale Teaching Hospital, Tamale Central Hospital and the West End Hospitals. However, there are several other health centres and clinics in the metropolis. The high level of illiteracy and poverty, as well as limited access to potable drinking water and poor Sanitation, has combined to expose many people to health implications which accounts for the low standard of living of the people.

The top five diseases in the metropolis are Malaria and diarrhoea which have a severe effect on the lives of the people. Malaria alone contributes about 25 % of total deaths in the metropolis. The Tamale Metropolis is as vulnerable to the HIV/AIDS pandemic as other districts in the country. Some people especially women engage in unsafe sex practices due to high poverty rate which is a predisposing factor to the spread of sexually transmitted infection in the metropolis. However, when traditional farming is at its lowest ebb tide, it encourages a greater proportion of the youth particularly young women to move down south in search of non-existing jobs. Most of the young women who come to the cities become head porters or “kayaye”, which is another predisposing factor to the spread of the pandemic.

3.3 Political and Administrative Structure

The political head of the Metropolis is the Metropolitan Chief Executive. Tamale consists of two constituencies thus Tamale South and Tamale Central and two sub-metros (Tamale South and



Central). Tamale Metropolis has a total of 59 Assembly members comprising of 18 appointed and 41 elected members and also a total of a 205-unit committee members.

The Assembly has a very vibrant Sub-Committee member who works hard to accomplish the objectives and the goal of the Assembly. Recently, an active taskforce group known as the “BILCHINSI” was formed to succour in the Governance of the Metropolis by ensuring discipline among the youth in the Metropolis. This voluntary group is also assisting the police force in the Metropolis to reduce and prevent crime and violent acts by policing the neighbourhoods, particularly at night.

Aside the Local Government structures, some eminent traditional chiefs and sub-chiefs are also working hand in hand with the Metropolis in promoting peace, stability and improvement in the area. Traditionally, the Ya-Naa is the overlord of the area but he enskins the GukpeguNaa as his subject over the traditional administration of the Metropolis. (GSS, 2010).

3.4 Research design

The study design adopted for this study is a descriptive cross-sectional using mix method (qualitative and quantitative). This method was adopted considering the nature of the topic and the time at the disposal of the researcher.

3.5 Study population

The study population comprised of only slaughterhouse workers in the selected slaughterhouses, namely Sishiagu, Kakpayilli and Buipela in Tamale Metropolis aged 18 to 65 years of who handle meat.

3.6 Sample Size determination

The sample size was calculated with the assumption that the population proportion of Knowledge, Attitudes and Practices was 50%, a 10% margin of error at 95% confidence level.



The sample size was estimated using the following formula;

Using the formula Cochran's formula for sample size determination: $= \frac{t^2 \times p(1-p)}{m^2}$,

Where m = margin of error (10%)

p = Population proportion

t = Z-value for 95% confidence level (1.96)

Therefore $n = \frac{(1.96)^2 \times 0.5(1-0.5)}{(0.1)^2} = 96.04 \approx 96$.

However, a 40% contingency of 39 was added to give a minimum sample size of, $n = 135$.

3.7 Sample Selection

A cluster sampling design was used for the study where slaughtermen were selected from the three selected abattoirs (Sishiagu, Buipela and Kakpayili) in the Tamale Metropolis. The minimum sample size (n) for the study population was divided by the number of clusters (slaughterhouses) in the Metropolis, ($n / (\text{Number of clusters}) = 135/3 \approx 45$). 45 slaughterhouse workers was selected in each cluster (slaughterhouse) across board. Then at each abattoir, a list of slaughterhouse men was generated on the field and the 45 workers were further randomly sampled out of the field generated list using a simple lottery method.

3.8.1 Dependent variables

The main dependent variables in the study were the meat handling knowledge, attitude and practices of the slaughterhouse men.

3.8.2 Explanatory variables

The explanatory variables were age, marital status, parity, educational level, occupation, and religion.



3.1: Variable definition in the study

Variable name	Definition in study	Variable type
Age	Self-reported age of respondent at last birthday (<20yrs, 20-30yrs, 31-40yrs, 41-50yrs, 51-60yrs)	Categorical
Sex	Identified sex of respondent at the time of interview (male or female)	Categorical
Marital status	Self-reported marital status of the respondent at the time of interview (single, married, divorced)	Categorical
Educational level	The self-reported highest educational level attained (No education; Primary; Middle/Junior High School; Secondary; Tertiary)	Categorical
Religion	Religious denomination of slaughtermen at interview date (Traditional; Christian; Mus-	Categorical
Tenure of years in business	Self-reported number of the respondent in the butchery business (1-5yrs, 6-10yrs, 11+yrs)	Categorical
Meat handling personal hygiene knowledge of abattoir butchers	Assessed level of meat handling personal hygiene knowledge of the respondents at the time of the study (Low, High)	Categorical
Meat handling cross-contamination knowledge of abattoir butchers	Assessed level of meat handling cross-contamination knowledge of respondents at the time of the study (Low, High)	Categorical
Meat handling attitude of abattoir butchers	Assessed meat handling attitude of the slaughterhouse workers (Desirable, Undesirable)	Categorical
Meat handling practices of abattoir butchers	Assessed meat handling practices of the slaughterhouse workers (Recommended, Not Recommended)	Categorical
Use of local implements/equipment's in the slaughtering of animals	Respondents reported the use of local implements/equipment's in the slaughtering of animals (Yes, No)	Categorical
Butchery is a family business and no need for any training on meat handling	Respondents reported opinion on training on no need for meat handling (Yes, No)	Categorical
Wearing of protective clothing during operation	Respondents reported view on the wearing of protective clothing during operation (yes, No)	Categorical
No need for registration to work as a butcher	Self-reported response on no need for regulatory registration to work as a butcher (Yes, No)	Categorical
Skinning with local knives and bare hands	The self-reported practice of the use of local knives and bare hands for skinning animals (Yes, No)	Categorical



Access to potable water for the washing of carcasses after processing is a challenge	Respondent's reported opinion on the challenge of access to potable water for the washing of carcasses after processing (Yes, No)	Categorical
Maintaining the slaughterhouse environment clean and hygienic regularly is a challenge	Respondent's view on maintaining the abattoir environment clean and hygienic regularly as a challenge (Yes, No)	Categorical
Difficulty with disposal of solid far away from the abattoir	Respondent's view on difficulty with disposal of solid far away from the abattoir as a challenge	Categorical
Non-availability drains for liquid waste management in the slaughterhouse	Respondent's view non-availability drains for liquid waste management in the slaughterhouse as a challenge (Yes, No)	Categorical
The slaughterhouse is not shielded sufficiently to prevent the entry of pests	Respondent's view on the slaughterhouse is not shielded sufficiently to prevent the entry of pests is a challenge (Yes, No)	Categorical
Non-availability of fumigation activities as a pest control measure	Respondents reported view on non-availability of fumigation activities as a pest control measure is a challenge at the abattoir (Yes, No)	Categorical
Non-availability of hot water for cleaning and sterilization purposes	Respondents reported view on non-availability of hot water for cleaning and sterilization purposes at the abattoir is a challenge (Yes, No)	Categorical
Non-availability of waste bins for solid waste collection	Respondents reported view on non-availability of waste bins for solid waste collection at the abattoir is a challenge (Yes, No)	Categorical
Non-availability of elevators or lifters for raising carcasses off the floor	Respondents reported view on non-availability of elevators or lifters for raising carcasses off the floor at the abattoir is a challenge (Yes, No)	Categorical
Non-availability of separate areas for skinning /dehairing process of the carcass	Respondent's reported view on non-availability of separate areas for skinning /dehairing process of the carcass at the abattoir is a challenge (Yes, No).	Categorical



3.9 Source of data

Both primary and secondary data were used in this study. Primary data was used to obtain information about the study from the respondents through questionnaires. The sources of secondary data were acquired from the Annual Reports. Background information of the study area was extracted from these secondary sources.

3.10 Data collection procedures

Questionnaire administration through one-on-one interviews, focus group discussions and observations were the three main methods used to gather information for analysis in the study. The one-on-one interview was used to gather information on both quantitative and qualitative data while the focus group discussion and observation were used to gather information on qualitative data which provided deeper insight on the quantitative data.

3.11 Data collection tools

A structured questionnaire, key informant interview guide, focus group discussion guide and an observation check list were the main tools used to gather data in the study

3.11.1 Structured questionnaire

Given the nature of the topic, a structured questionnaire was the main and the most appropriate instrument used for data collection. This was used to gather information mainly on quantitative data. The questions were open-ended and closed formats. In closed format, the researcher allowed the respondents to choose from several options. The open-ended type also offered the respondents the opportunity to be expansive in expressing their opinions on the question(s) asked.

Closed-ended questions are easy to code, record, and analyse (Leung, 2001). The ordering of the questions was also given serious consideration. The questionnaire comprised of the following sections; section A which captured the demographic information of the slaughterhouse workers.



Section B also captured the various meats handling knowledge of the butchers, section C was used to gather information on the attitude and practice of respondents and then section D captured data on operational challenges experienced by the respondents.

A total of 135 butchers with 45 from each of the three abattoirs responded to the structured questionnaire. The 45 respondents from each abattoir were randomly selected to avoid selection bias.

3.11.2 Key informant interview guide

The key informant interview guide was used to mainly collect qualitative data which gave more insight on the findings from the quantitative data. In all, five (5) key informant interviews were conducted with the three (3) slaughterhouse heads of the three abattoirs involved in the study and two (2) animal health (veterinary) officers involved in the inspection and supervision of the meat processed at the abattoirs to ensure compliance with hygiene and safety standards. The key informants were purposively sampled based on their experience and the key roles they play in the operations of the three selected slaughterhouses in the study.

The key informant interview guide was largely made of open ended questions to allow for more elaborate responses from the key informants. The key informant interview guide was divided into four main sections, A to D. Section A focused on the demographic characteristics of the respondents, section B sort the views of the respondents on the personal hygiene knowledge of butchers operating at the abattoirs. Section C also focused on the attitude and practices of the butchers while Section D sort the views of the respondents on the challenges of both operators at the slaughterhouse and the inspectors which affect hygiene standards at the abattoirs.

Each key informant interview session was recorded and later transcribed into word document which was used for analysis in Nvivo10.1.



3.11.3 Focus group discussion guide (FGDs)

The focus group discussion guide was also used to collect mainly qualitative data which gave further insight on the findings from the quantitative data. A total of three (3) focus group discussions were conducted, one at each abattoir with eight (8) selected butchers per focus group discussion session as participants. Participants for the focus group discussion were also purposively sampled based on their experience and the key roles they play in the operations of the three selected slaughterhouses in the study.

The focus group discussion guide was made of open ended questions which also allowed for more elaborate responses from the participants that explained some of the findings from the quantitative data. The guide was also in four sections, A to D. Section A focused on the demographic characteristics of the participants while section B sort to gather information on the personal hygiene knowledge of butchers operating at the abattoir. Section C also focused on the attitude and practices of the butchers while Section D sort the views of the respondents on the hygiene challenges at the slaughterhouses.

Notes and recordings captured during the FGDs which were later transcribed and analysed using Nvivo 10.1.

3.11.4 Observational checklist

A tour of the three slaughterhouses in the study was made to examine the processes involved at various sections of the slaughterhouse and waste disposal systems among others. Visits were made to the slaughterhouses to assess its operations and to establish whether its operations conformed to the general code of good practice for abattoirs. Individual observational checklists were used in each section of the facility to identify existing practices.



The observational checklists were divided into three parts. The first part covered the working environment and the second section was used to observe the hygienic ways animal stocks were slaughtered. The third part was designed specifically for observing the processes and activities. This was also used to collect mainly qualitative data on the hygiene practices of the slaughterhouse workers.

3.12 Pre-testing of data collection tools

The quantitative questionnaire was pretested on a purposively selected slaughterhouses at Sanarigu Municipal on 12 butchers (approximately 10% of the total sample) while the key informant interview guide was pre-tested on five (5) purposively sampled butchers from the same previously sampled 12 butchers.

3.13 Validity and Reliability

The validity of the structured questionnaire were ensured by checking whether the content domains of each point on the scale was relevant to the purpose of measuring the meat handling knowledge, attitudes and practices of the study population. The pre-test data was used to run a reliability test for the 65-item questionnaire and found the scale was reliable at a Cronbach's Alpha level of 0.723.

Convenient locations such as offices were chosen for the face-to-face interviews with the respondent to reduce distraction during the interviews. In the case of the FGDs, a comfortable and conducive venue for the discussion convenient for participants to be free from interruptions was agreed upon by participants and the researcher. The Sitting arrangement was circular to enable participants to see and hear one another and maintain eye contact. Each discussion lasted an average of 53 minutes and before a discussion started, the moderator and note-taker introduced themselves and allowed participants the opportunity to do the same.



All the discussions were tape-recorded to ensure that the views of participants have been fully captured. In addition to the audio recordings, detailed field notes were taken during every discussion which helped to capture responses and non-verbal actions during the discussion processes. Threats to validity were addressed by the researcher through the collection of quality data in the research process; all audio recordings were transcribed verbatim by two independent people with similar experience and compared for consistency. No significant differences were found. Also, the researcher solicited feedback from participants by sharing the detailed notes recorded with them after each discussion to ensure that participants agreed with the notes like a true interpretation of their opinions. To minimize interviewer biases, the researcher ensured that not only one, but two facilitators moderated the discussions.

3.14.1 Quantitative Data Analysis

This section deals with the methods used to examine the data. The main tools employed to analyse the data was the Statistical Package for Social Sciences (SPSS version 23). Using the SPSS, a template was created for the questionnaire capturing all the variables. The variables were coded and each respondent question entered into the SPSS template. The results for the level of meat handling Knowledge, Attitude and Practices of the slaughterhouse workers were computed as indices using principal component analysis and then categorized based on 50th quartile score as low and high for knowledge, low desirable and high desirable for attitude and then high recommended and low recommended for practices. These were further summarized into percentages and subsequently presented as figures. The operational challenges of the butchers were also computed and presented as frequencies and proportions in tables. A bivariate chi-square test was used to test for associations between background characteristics of the slaughterhouse men and



their meat handling knowledge, attitude and practices. The relation between meat handling knowledge, attitude and practices of the butchers was also examined using the chi-square test.

Another chi-square test was again used to study the association between the meat handling knowledge, attitude and practices of the slaughterhouse workers and the operational challenges they face working at the abattoirs. The results from the chi-square tests that turned out to be statistically significant were further analysed to obtain the determinants of the slaughterhouse workers' meat handling knowledge, attitude and practices.

3.14.2 Qualitative data analysis

The key informant interviews and the FGDs were analysed with the aid of Nvivo version 10.1, where themes were formulated from the various responses and coded as nodes in Nvivo and reported as the summary of findings.

The qualitative data on the meat handling practices of the slaughterhouse workers were transcribed in full text, word-for-word and analysed using a five-steps thematic analysis approach adopted from Braun & Clarke (2006). This analytic technique was considered reliable and appropriate by the researcher for this study because of the flexibility it offers and provides a rich analysis of the data generated. The thematic analysis process followed was with the aid of Nvivo 10.1.

3.15 Research assistants

The researcher was assisted by three (3) research assistants for the data collection. The research assistants were trained for a day to help them understand the data collection tool. They were only used in the quantitative data collection which involved the administration of the structured questionnaire.



CHAPTER FOUR

RESULTS

4.1 Introduction

The chapter presents the findings of the research into four sections. Section one presents the biographic data of respondents involved in the study, thus the sex of respondents, age, marital status, level of education and the number of years engaged in business. Section two shows data on hygiene knowledge, attitude and practices applied in the slaughterhouses. Section three shows data on some common beliefs and practice of slaughterhouse workers that influence their hygiene knowledge practices, and section four presents the results on the challenges faced by slaughterhouse workers complying with standard hygienic practice in the Tamale Metropolis.

4.2. Background characteristics of study participants

A total of one hundred and thirty-five slaughterhouse butchers were recruited for this study at the time this research was conducted (Table 4.1). Out of 135 interviewed slaughterhouse workers, 129 (95.5%) of slaughterhouse butchers were males and 6 (4.5%) of them were females. Majority of the butchers at the slaughterhouses 59 (43.7%) were aged between 20-30 years of age and only a few 3 (2.2%) of them were within the age bracket of 51-60 years of age. Also, more than half (61.9%) of the slaughterhouse workers were married, over a quarter (36.6%) of them were single and only 3, representing (2.2%) were divorced.

Further, 62 (45.9%) of 135 of the butchers at the slaughterhouses had attained up to Junior High School education, 26.7 % said they had Senior High School education and 28 (20.7%) of them were unlettered or had no formal education. The study took into consideration the number years of working experience of the slaughterhouse butchers and found that 41 (30.4%) of the butchers



had 1-5 year of tenure in the business, 48 (35.6%) had between 6-10 years of work in the business and another 46 (34.1%) had 11 years and above worth of experience in butchery business.

Table 4.1: Background characteristics of abattoir butchers

Background characteristic	Number	Percent (%)
<i>Sex of respondents</i>		
Male	129	95.5
Female	6	4.5
<i>Age of respondents</i>		
Less 20yrs	28	20.7
20yrs-30yrs	59	43.7
31yrs-40yrs	35	25.9
41yrs-50yrs	10	7.4
51yrs-60yrs	3	2.2
<i>Marital Status</i>		
Single	49	36.6
Married	83	61.9
Divorced	2	1.5
<i>Level of education</i>		
Degree holder	8	5.9
Postgraduate	1	0.7
SSS/SHS	36	26.7
JHS	62	45.9
No formal education	28	20.7
<i>Tenure of years in business</i>		
1yr-5yrs	41	30.4
6yrs-10yrs	48	35.6
11yrs +	46	34.1

Source: Field survey, 2019

4.3.1 Knowledge of slaughterhouse workers on meat handling personal hygiene

Generally, the slaughterhouse workers were found to have low knowledge on personal hygiene protocols on meat handling. Majority of them did not know that wearing hand gloves, aprons, cap and mask were key personal hygiene protocols that should be observed during meat handling. Even though many of the butchers new washing hands before and after handling meat as well as after contaminating one's hands was critical in their work, majority of them did not know



how to properly wash their hands as they indicated washing hands with water alone was sufficient. Majority of them also did not know that touching hair and keeping long nails as well as handling meat with cut hands compromises hygienic standards during meat handling. Overall, the categorisation of the knowledge of the slaughterhouse workers revealed that about 77 % of them had low levels of meat handling personal hygiene knowledge whereas less than a quarter (23%) of them had high levels of meat handling personal hygiene knowledge.

4.3.2 Knowledge of slaughterhouse workers on cross contamination

The knowledge of the slaughterhouse workers on cross contamination was also found to be generally be low as many of them did not even know exactly what is meant by cross contamination. Many of them did not know that the use of hand gloves could reduce cross contamination of meat. Even though many of them knew that cleaning equipment could help reduce cross contamination, majority of them did not know how to properly clean the equipment as they did not think the use of hot water to clean the equipment was critical in preventing cross contamination.

Even though many of the slaughterhouse workers also knew it was good to clean equipment like cutting knives and boards they did not know such equipment could lead to diseases. Overall, the categorisation of the knowledge of the slaughterhouse workers showed that a little more than a quarter (30%) of the slaughterhouse workers had a high level of cross-contamination knowledge on meat handling process while 70 percent of them scored low level of cross-contamination knowledge on meat handling.

4.3.3 Meat handling attitude of slaughterhouse workers on cross contamination

The meat handling attitude of the slaughterhouse butchers was also found to be generally low. Even though most of the butchers believed that safe meat handling was an important part of their job as butchers and that knowledge in meat safety would be beneficial themselves and their cus-



tomers, they exhibited a very weak believe that producing a wholesome meat is more important to them. Majority of them were of the strong believe that worker with abrasions or cuts on their fingers and hands could still handle meat without gloves. Many of them were also of the strong believe that the use of mask is not really critical in reducing meat contamination. Majority of them did not believe the usage of aprons could reduce the risk of meat contamination just as many of them were also of the strong believe that the use of hand gloves is not very important in reducing the risk of meat contamination. Similarly, majority of the slaughterhouse butcher were also of the strong believe that the use of adornments like earrings, rings and watches could not cause meat contamination. Overall, the categorisation of the attitude of the slaughterhouse butchers on safe meat handling showed that more than two-third (72%) of them had low desirable attitude towards safe meat handling with less than one-third (28%) of them found to have desirable attitude towards safe meat handling.

4.3.4 Meat handling practices of slaughterhouse workers

Generally, the slaughterhouse butchers were observed to have poor meat handling practices. Even though most of the slaughterhouse butchers indicated they wash their hand before handling meat, majority of them also did indicate that they do so with only water without any detergent. Though most of the butchers also said they keep their nails short as they handle meat, many of them however said they do not remove their adornments like rings and watches before handling meat. While majority of the butchers said they do not handle meat when they had diarrhoea, most of them indicated that they handle meat even if they have abrasions and cuts on their hands and fingers. Most of them also said they wash their hands after toilet but did that with water only. Majority of the slaughterhouse workers also said they neither use mask nor cap in their daily work as they handle meat. Similarly, most of them also said they do not use apron nor hand



gloves in their daily activities as they handle meat. Overall, the results on categorisation of the practices of the slaughterhouse butchers showed that exactly three-quarters (75%) of them had low level of recommended meat handling practices with only a quarter (25%) of them who had a high level of recommended meat handling practices.

4.3.5 Common beliefs and practices of the slaughterhouse butchers

Results on the common beliefs and practices of the slaughterhouse butchers showed that more than half (54.5%) of the butchers see butchery as a family business that learnt from the family and does not require any formal training for one to become a butcher. About 40% of the butchers interviewed also believed there is no need for any form of registration with appropriate authorities before operating as a butcher. On their common practices, more than 60% of the butchers interviewed indicated they use local implements or equipment in slaughtering animals at the abattoir. Close to 60% of them also indicated they use protective wears in the course of their daily operations at the abattoir while more than half (53.8%) of them also said they use local knives and bare hands to skin animals at the abattoir. Table 4.2 below gives details on the common beliefs and practices of the slaughterhouse butchers.

Table 4.2: Common beliefs and practices of the slaughterhouse butchers

<i>Common belief/practice</i>	Number	Percent (%)
<i>Butchery is a family business and does not require any formal training</i>		
Yes	72	54.5
No	60	45.5
<i>No need for registration to work as a butcher</i>		
Yes	51	38.9
No	80	61.1
<i>Use of local implements in the slaughter of animal</i>		
Yes	82	62.6
No	49	37.4
<i>Wearing of protective wears during operation</i>		
Yes	77	58.8



No	54	41.2
<i>Skinning animals with local knife and bare hands</i>		
Yes	71	53.8
No	61	46.2

Source: Field survey, 2019

4.4 Operational bottlenecks/challenges of slaughterhouse workers

The study also examined the challenges the slaughterhouse workers go through in their daily operations at the abattoirs and found that 107 (82.9%) of them expressed concerns regarding access to water for washing carcasses during the carcasses dressing process of meat handling.

More than half, 80 (62.5%) of the abattoir butchers also mentioned that they are often confronted with the challenge of maintaining the abattoir environment clean and hygienic regularly. The findings also revealed that a considerable number (104) proportionally representing 81.9 % of the butchers asserted that the difficulties in disposing solid waste far away from the abattoir. Meanwhile, 115 (92.0%) of the respondents said there were enough available drains to dispose of liquid waste generated in the slaughterhouses. Further, 107 (84.3%) the respondents also stated that the slaughterhouses were prone pets' attacks since abattoir facilities were not pets prove or shielded from pet's invasion. More than three-quarters (78.2%) of the butchers stated that there no any form of fumigation activities to keep away pests and insects from their working facility. Half (50.4%) of the study participants said there was no hot water available for cleaning and sterilization of their equipment during whenever they were at work at the slaughterhouse. A good number (75) of the respondents, resenting 60.5% of them mentioned that waste bins were available at the abattoir for waste collection. More so, about 86.5% of the butchers interviewed said there were no elevators or lifters for raising carcasses off the floor of the abattoir. When it came to the availability of separate places for slaughtering and skinning/dehairing, almost half (49.6) said they were constraint with the availability of such workspace.



Table 4.3: Operational bottlenecks/challenges of slaughterhouse workers

Operational challenge	Number	Percent (%)
<i>Access to potable water for the washing of carcasses after processing is a challenge</i>		
No	22	17.1
Yes	107	82.9
<i>Maintaining the slaughterhouse environment clean and hygienic regularly is a challenge</i>		
No	48	37.5
Yes	80	62.5
<i>Difficulty with disposal of solid far away from the abattoir</i>		
No	23	18.1
Yes	104	81.9
<i>Availability drains for liquid waste management in the slaughterhouse</i>		
No	10	8.0
Yes	115	92.0
<i>The slaughterhouse is not shielded sufficiently to prevent the entry of pests</i>		
No	20	15.7
Yes	107	84.3
<i>Non-availability of fumigation activities as a pest control measure</i>		
No	27	21.8
Yes	97	78.2
<i>Non-availability of hot water form cleaning and sterilization purposes</i>		
No	63	49.6
Yes	64	50.4
<i>Non-availability of waste bins for solid waste collection</i>		
No	49	39.5
Yes	75	60.5
<i>Non-availability of elevators or lifters for raising carcasses off the floor</i>		
No	17	13.5
Yes	109	86.5
<i>Non-availability of separate areas for skinning /dehairing process of the carcass</i>		
No	63	49.6
Yes	64	50.4

Source: Field survey, 2019



4.5.1 Association between background characteristics of the slaughterhouse workers and their hygiene knowledge on meat handling

A bivariate analysis was run to examine the association between background characteristics of the slaughterhouse workers and their levels of knowledge on meat handling using a chi-square test of independence. The result returned from the chi-square test with a p-value of 0.05 or less were considered as statistically significant associations. The results showed that slaughterhouse workers with no formal education had better hygiene knowledge on meat handling compared to their counterparts who had formal education even though the association was not statistically significant with p-value of 0.334. The result further showed a negative association between the years of working experience in the slaughterhouse butchers and their level of hygiene knowledge in meat handling as butcher with low years of working experience of between 1- 5 years were more likely to have a high level of personal hygiene knowledge on meat handling than those with higher years of working experience of 6 – 10 years and 11+ years. However, this relationship was also not statistically significant with p=0.755. See table 4.4 for details.

Table 4.4: Association between background characteristics of slaughterhouse workers and their personal hygiene knowledge on meat handling

Background characteristic	Personal hygiene knowledge on meat handling		x ² (p-value)
	Low Personal Hygiene Knowledge N (%)	High Personal Hygiene Knowledge N (%)	
<i>Sex of respondents</i>			
Male	75 (76.5)	23 (23.5)	.306 (0.580)
Female	1 (100.0)	0 (0.0)	
<i>Level of education of respondents</i>			
Formal Education	61 (79.2)	16 (20.8)	.932 (0.334)
No formal education	16 (69.6)	7 (30.4)	



Age of respondents

Less 20yrs	17 (81.0)	4 (19.0)	1.017 (0.807)
20yrs-30yrs	30 (73.2)	11 (26.8)	
31yrs-40yrs	22 (81.5)	5 (18.5)	
41yrs+	8 (72.7)	3 (27.3)	

Number of years in business

1yr-5yrs	6 (18.8)	26 (81.3)	0.563 (0.755)
6yrs-10yrs	9 (26.5)	25 (73.5)	
11yrs +	8 (23.5)	26 (76.5)	

Source: Field survey, 2019

4.5.2 Association between background characteristics of the slaughterhouse workers and their knowledge on cross-contamination of meat

The results returned for a chi-square test between background characteristics of the butchers and their levels of cross-contamination knowledge show that only the level of education of the respondents was seen to be significantly related to knowledge on cross-contamination meat (Table 4.2.5.2). Surprisingly, the slaughterhouse workers with no formal education (52.9%) were more likely to have high knowledge on cross-contamination of meat than their counterparts with formal education (24.7) among study participants interviewed (p=0.021). The results also showed increasing knowledge on cross-contamination of meat with increasing years of working experience of the slaughterhouse workers even though the association was not statistically significant with p=0.392.

Table 4.5: Association between background characteristics of slaughterhouse workers and their knowledge on cross-contamination of meat

Background characteristic	Cross-contamination Knowledge		x²(p-value)
	Low Cross-contamination Knowledge N (%)	High Cross-contamination Knowledge N (%)	
Sex of respondents			
Male	62 (68.9)	28 (31.1)	1.335



			(0.248)
Female	3 (100.0)	0 (0.0)	
Level of education of respondents			
Formal Education	58 (75.3)	19 (24.7)	5.320 (0.021)
No formal education	8 (47.1)	9 (52.9)	
Age of respondents			
Less 20yrs	14 (63.6)	8 (36.4)	3.914 (0.248)
20yrs-30yrs	34 (79.1)	9 (20.9)	
31yrs-40yrs	14 (58.3)	10 (41.7)	
41yrs+	4 (80.0)	1 (20.0)	
Number of years of engagement in business			
1yr-5yrs	11 (36.7)	19 (63.3)	1.872 (0.392)
6yrs-10yrs	11 (31.4)	24 (68.6)	
11yrs +	6 (20.7)	23 (79.3)	

Source: Field survey, 2019

4.5.3 Association between background characteristics of the slaughterhouse workers and their attitude on meat handling

The researcher examined the association between background characteristics and the meat handling attitudes of the slaughterhouse workers (Table 4.6). It was found that all-female butchers (100.0%) had a higher tendency of undesirable meat handling attitude compared to the males (70.8%) at the time of the study ($p=0.202$). This finding was, however, not statistically significant. The results also showed a negative association between years of working experience of the slaughterhouse workers and their attitude towards meat handling with butchers with fewer working experience more likely to exhibit a more desirable attitude towards meat handling compared with those higher working experience but the association was not statistically significant ($p=0.564$). Table 4.6 gives more details.



Table 4.6: Association between background characteristics of the slaughterhouse workers and their meat handling attitude

Background characteristic	Meat handling attitude		χ ² (p-value)
	Undesirable	Desirable	
<i>Sex of respondents</i>			
Male	75 (70.8)	31 (29.2)	1.629 (0.202)
Female	4 (100.0)	0 (0.0)	
<i>Level of education of respondents</i>			
Formal Education	65 (72.2)	25 (27.8)	.005 (0.942)
No formal education	15 (71.4)	6 (28.6)	
<i>Age of respondents</i>			
Less 20yrs	20 (80.0)	5 (20.0)	1.239 (0.744)
20yrs-30yrs	36 (70.6)	15 (29.4)	
31yrs-40yrs	19 (70.4)	8 (29.6)	
41yrs+	5 (62.5)	3 (37.5)	
<i>Number of years of engagement in business</i>			
1yr-5yrs	8 (21.6)	29 (78.4)	1.147 (0.564)
6yrs-10yrs	12 (30.0)	28 (70.0)	
11yrs +	11 (32.4)	23 (67.6)	

Source: Field survey, 2019

4.5.4 Association between background characteristics of the slaughterhouse workers and their meat handling practices

Furthermore, the results showed that butchers with no formal education (28.0%) were more likely to practice recommended meat handling practices than those with formal education (24.2%) at the time of the study. However, this association was also not statistically significant (p=0.696). See table 4.7 for details. The likelihood of a butcher practicing recommended meat handling practices was also found to reduce with increasing age from the age of 20 years even though not statistically significant with p=0.206. See table 4.7.



Table 4.7: Associations between background characteristics of slaughterhouse butchers and meat handling practices

Background characteristic	Meat handling practices		x ² (p-value)
	Low recommended practice	High recommended practice	
<i>Sex of respondents</i>			
Male	84 (75.0)	28 (25.0)	.991 (0.319)
Female	3 (100.0)	0 (0.0)	
<i>Level of education of respondents</i>			
Formal Education	69 (75.8)	22 (24.2)	.153 (0.696)
No formal education	18 (72.0)	7 (28.0)	
<i>Age of respondents</i>			
Less 20yrs	18 (78.3)	5 (21.7)	4.568 (0.206)
20yrs-30yrs	35 (68.6)	16 (31.4)	
31yrs-40yrs	24 (75.0)	8 (25.0)	
41yrs+	10 (100.0)	0 (0.0)	
<i>Number of years of engagement in business</i>			
1yr-5yrs	8 (24.2)	25 (75.8)	1.784 (0.410)
6yrs-10yrs	14 (31.1)	31 (68.9)	
11yrs +	7 (18.4)	31 (81.6)	

Source: Field survey, 2019

4.6.1 Association between common beliefs and practices of the slaughterhouse workers and their meat handling knowledge

The bivariate results return from the chi-square test (Table 4.8) showed that the butchers who believed that the butchery work required registration with the appropriate authorities were more likely to have high knowledge in meat handling compared those who did not believe it required registration with the appropriate authorities. The association was however not statistically significant (p=0.224). Also, butchers at the slaughterhouses who employ the use of local implements in the slaughtering of animals were more likely to have high meat handling hygiene knowledge



relative to their counterparts who were not using local implements for slaughtering animals but the association was not also statistically significant (p=0.055).

Table 4.8: Association between common beliefs and practices of the slaughterhouse workers and their meat handling personal hygiene knowledge

Common belief/practice	Personal hygiene knowledge on meat handling		x ² (p-value)
	Low Personal Hygiene Knowledge N (%)	High Personal Hygiene Knowledge N (%)	
<i>Born into a family of butchers and are not trained on handling carcass</i>			
Yes	38 (74.5)	13 (25.5)	.650 (0.420)
No	39 (81.3)	9 (18.7)	
<i>Working in the slaughterhouses do not require registration with appropriate authorities for regulations</i>			
Yes	32 (84.2)	6 (15.8)	1.477 (0.224)
No	45 (73.8)	16 (26.2)	
<i>Wearing of protective clothing during operation</i>			
Yes	37 (72.5)	14 (27.5)	1.528 (0.216)
No	39 (83.0)	8 (17.0)	
<i>Use of local implement/equipment in slaughtering animals</i>			
Yes	42 (71.2)	17 (28.8)	3.671 (0.055)
No	35 (87.5)	5 (12.5)	
<i>Knife skinning and the use of bare hands is part of the work of the people</i>			
Yes	40 (76.9)	12 (23.1)	.046 (0.830)
No	37 (78.7)	10 (21.3)	

Source: Field survey, 2019



4.6.2 Association between common beliefs and practices of the slaughterhouse workers and their knowledge on cross-contamination of meat

In a bivariate test for association between the common beliefs and practices of the butchers and their knowledge on cross-contamination, only the practice of the use of local implements in the slaughtering of the animal, wearing of protective clothing during operation, and the believe that working in the slaughterhouses do not require registration with appropriate authorities for regulations were significantly related to meat handling cross-contamination knowledge of the slaughterhouse butchers (Table 4.9).

The slaughterhouse butchers who said they do not use local implements/equipment in the slaughtering of animals (43.9%) had a high level of knowledge on cross-contamination of meat than those who use local implements or equipment in the slaughtering of animal (18.9%) at the abattoir ($p=0.008$). The slaughterhouse workers who said they do not wear of protective clothing during the operation were more likely to have a high level of knowledge on cross-contamination compared to those who said they wear protective clothing during operations ($p=0.007$). The study participants who were of the believe that they do not need to register with the appropriate authority to operate as butchers were more likely to have a high level of meat handling cross-contamination knowledge (37.5%) than those who saw the need for registration before operating as a butcher (18.4%) at the time of the study ($p=0.047$).



Table 4.9: Association between common beliefs and practices of the slaughterhouse workers and their meat handling cross-contamination knowledge

Common belief/practice	Cross-contamination Knowledge (Binned)		x ² (p-value)
	Low Cross-contamination Knowledge N (%)	High Cross-contamination Knowledge N (%)	
<i>Working in the slaughterhouses do not require registration with appropriate authorities for regulations</i>			
Yes	31 (81.6)	7 (18.4)	3.940 (0.047)
No	35 (62.5)	21 (37.5)	
<i>Born into a family of butchers and are not trained on handling carcass</i>			
Yes	38 (71.7)	15 (28.3)	.128 (0.720)
No	28 (68.3)	13 (31.7)	
<i>Wearing of protective clothing during operation</i>			
Yes	43 (81.1)	10 (18.9)	7.398 (0.007)
No	22 (55.0)	18 (45.0)	
<i>Use of local implement/equipment in slaughtering animals</i>			
Yes	43 (81.1)	10 (18.9)	6.927 (0.008)
No	23 (56.1)	18 (43.9)	
<i>Knife skinning and the use of bare hands is part of the work of the people</i>			
Yes	41 (77.4)	12 (22.6)	2.967 (0.085)
No	25 (61.0)	16 (39.0)	

Source: Field survey, 2019



4.6.3 Association between common practices of the slaughterhouse workers and their attitude towards meat handling

Further, the chi-square test of independence returned a result that showed that only the use of local implements/equipment for the slaughtering of animals was significantly associated with the meat handling attitude of butchers (Table 4.10). Butchers who indicated they use local implements or equipment for animal slaughter had significantly more desirable meat handling hygiene attitude (35.8%) than those who said they don't use local implements/equipment in slaughtering animals (15.9%) at the abattoir at the time of the study (p=0.022).

Table 4.10: Association between common practices of the slaughterhouse workers and their meat handling attitude

Common practice	Meat handling attitude		x ² (p-value)
	Undesirable	Desirable	
<i>Use of local implements/ equipment in the slaughtering of animals</i>			
Yes	43 (64.2)	24 (35.8)	5.231 (0.022)
No	37 (84.1)	7 (15.9)	
<i>Wearing of protective clothing during operation</i>			
Yes	46 (74.2)	16 (25.8)	.154 (0.695)
No	34 (70.8)	14 (29.2)	
<i>Knife skinning and the use of bare hands is part of the work of the people</i>			
Yes	46 (78.0)	13 (22.0)	2.174 (0.140)
No	34 (65.4)	18 (34.6)	

Source: Field survey, 2019

4.6.4 Association between common beliefs of the slaughterhouse workers and their meat handling practices.

A bivariate analysis using the chi-square test showed that butchers who believed that butchers are born into the families of butchers and that they do not require any formal training were more



likely to have low recommended heat handling practices compared to those who did not have such beliefs. Similarly, butchers who also believed that the butchery work did not require any registration with appropriate authorities were also found to have low recommended meat handling practices compared to those who did not have such belief. Both associations were however not statistically significant as the p-values were far more than 0.05. See table 4.11 for details.

Table 4.11: Association between common beliefs of the slaughterhouse workers and their meat handling practices

Common belief	Meat handling practices		x ² (p-value)
	Low recommended practice	High recommended practice	
<i>Born into a family of butchers and are not trained on handling carcass</i>			
Yes	47 (77.0)	14 (23.0)	.288 (0.591)
No	40 (72.7)	15 (27.3)	
<i>Working in the slaughterhouses do not require registration with appropriate authorities for regulations</i>			
Yes	35 (79.5)	9 (20.5)	.781 (0.377)
No	52 (72.2)	20 (27.8)	

Source: Field survey, 2019

4.7.1 Association between operational challenges of slaughterhouse workers and their personal hygiene knowledge on meat handling

All the variables on operational challenges expressed by the butchers were used in a chi-square test with variables on knowledge, attitude and practices of the slaughterhouse workers. The chi-square test revealed that only non-availability of waste bins for waste collection and non-



availability of separate places for slaughtering and skinning /dehairing process at the abattoir were the operational challenges that significantly associated with meat handling personal hygiene knowledge of the slaughterhouse workers (Table 4.12). The butchers who responded no to non-availability of waste bins for waste collection as an operational challenge at the abattoir were more (34.1%) inclined to have a high knowledge on meat handling personal hygiene than those who responded yes to the non-availability of waste bins for waste collection as an operational challenge (14.0%) at the slaughterhouse at the time of the study ($p=0.023$).

Similarly, butchers who did not have the non-availability of separate areas for slaughtering and skinning as an operational challenge were also found to have higher (39.4%) personal hygiene knowledge on meat handling compared to those who had the non-availability of separate areas for slaughtering and skinning as an operational challenge (4.4%) at the slaughterhouse ($p=0.000$). The results further showed that butchers who had non-availability of fumigation activities as an operational challenge at the slaughterhouse had higher (27.5%) meat handling personal hygiene knowledge compared to those who did not have non-availability of fumigation activities as an operational challenge (9.1) at the slaughterhouse. This association was however not statistically significant with $p=0.074$.

Table 4.12: Association between operational challenges of the slaughterhouse workers and their personal hygiene knowledge on meat handling

Challenge	Personal hygiene knowledge on meat handling		χ^2 (p-value)
	High Personal Hygiene Knowledge N (%)	Low Personal Hygiene Knowledge N (%)	
<i>Access to potable water for the washing of carcasses after processing is a challenge</i>			
No	2 (11.1)	16 (88.9)	1.559



Yes	19 (24.7)	58 (75.3)	(0.212)
<i>Maintaining the slaughterhouse environment clean and hygienic regularly is a challenge</i>			
No	11 (30.6)	25 (69.4)	2.270 (0.132)
Yes	10 (17.2)	48 (82.8)	
<i>Difficulty with disposal of solid far away from the abattoir</i>			
No	4 (23.5)	13 (76.5)	.050 (0.822)
Yes	16 (21.1)	60 (78.9)	
<i>Availability drains for liquid waste management in the slaughterhouse</i>			
No	39 (33.3)	6 (66.7)	.788 (0.375)
Yes	17 (20.5)	66 (79.5)	
<i>The slaughterhouse is not shielded sufficiently to prevent the entry of pests</i>			
No	3 (20.0)	12 (80.0)	.068 (0.794)
Yes	18 (23.1)	60 (76.9)	
<i>Non-availability of fumigation activities as a pest control measure</i>			
No	2 (9.1)	20 (90.9)	3.197 (0.074)
Yes	19 (27.5)	50 (72.5)	
<i>Non-availability of hot water for cleaning and sterilization purposes</i>			
No	12 (24.0)	38 (76.0)	.170 (0.680)
Yes	9 (20.5)	35 (79.5)	
<i>Non-availability of waste bins for solid waste collection</i>			
No	14 (34.1)	27 (65.9)	5.151 (0.023)
Yes	7 (14.0)	43 (86.0)	
<i>Non-availability of elevators or lifters for raising carcasses off the floor</i>			
No	2 (18.2)	9 (81.8)	.153 (0.696)
Yes	19 (23.5)	62 (76.5)	
<i>Non-availability of separate areas for skinning /dehairing process of the carcass</i>			
No	19 (39.6)	29 (60.4)	16.404 (0.000)
Yes	2 (4.4)	43 (95.6)	

Source: Field survey, 2019



4.7.2 Association between operational challenges of slaughterhouse workers and their knowledge on meat handling cross-contamination

The results returned from the bivariate chi-square test showed that several variables such as access to clean water for the washing of carcasses after processing as a challenge, non-availability of fumigation activities as a pest control measure and availability of waste bins for the solid waste collection were significantly associated with the knowledge of the butcher on cross-contamination (Table 4.13).

It further revealed that the slaughterhouse workers who had no challenge with access to clean water for the washing of carcasses after processing had a high (50.0%) level of knowledge on cross-contamination than their colleagues who had challenge with access to clean water for the washing of carcasses after processing (25.0%) at the time of the study ($p=0.032$). Similarly, the slaughterhouse butchers who had no challenge with fumigation activities as a pest control measure at the slaughterhouse had higher (58.3%) level of knowledge on cross-contamination of meat than those who had challenge with availability of fumigation activities at their slaughterhouse (21.5%) at the time this study was conducted ($p=0.001$). Furthermore, the slaughterhouse workers who had no challenge with the availability of waste bins for their solid waste collection had significantly higher cross-contamination knowledge (45.0%) than those who had challenge with availability of waste bins for their solid waste collection (18.1%) at their slaughterhouse ($p=0.008$).

Butchers who also had no challenge with their slaughterhouse not being shielded sufficiently to prevent the entry of pests were also found to have higher (50.0%) compared to those who had challenge with their slaughterhouse not being shielded sufficiently to prevent pests entry (27.3%). This association was however found not to be statistically significant with p-value greater than 0.05.



Table 4.13: Association between operational challenges of the slaughterhouse workers and their cross-contamination knowledge levels

Challenge	Cross-contamination Knowledge		x ² (p-value)
	High Cross-contamination Knowledge N (%)	Low Cross-contamination Knowledge N (%)	
<i>Access to clean water for the washing of carcasses after processing is a challenge</i>			
No	10 (50.0)	10 (50.0)	4.621 (0.032)
Yes	18 (25.0)	54 (75.0)	
<i>Maintaining the abattoir environment clean and hygienic regularly is a challenge</i>			
No	14 (40.0)	21 (60.0)	2.275 (0.131)
Yes	14 (25.0)	42 (75.0)	
<i>Difficulty with disposal of solid far away from the abattoir</i>			
No	8 (47.1)	9 (52.9)	2.604 (0.107)
Yes	20 (27.0)	54 (73.0)	
<i>Availability drains for liquid waste management in the slaughterhouse</i>			
No	1 (16.7)	5 (83.3)	.626 (0.429)
Yes	27 (32.1)	57 (67.9)	
<i>The slaughterhouse is not shielded sufficiently to prevent the entry of pests</i>			
No	7 (50.0)	7 (50.0)	2.872 (0.090)
Yes	21 (27.3)	56 (72.7)	
<i>Non-availability of fumigation activities as a pest control measure</i>			
No	14 (58.3)	10 (41.7)	11.005 (0.001)
Yes	14 (21.5)	51 (78.5)	
<i>Non-availability of hot water form cleaning and sterilization purposes</i>			
No	17 (34.7)	32 (65.3)	.768 (0.381)
Yes	11 (26.2)	31 (73.8)	
<i>Non-availability of waste bins for solid waste collection</i>			



No	18 (45.0)	22 (55.0)	7.069 (0.008)
Yes	9 (18.8)	39 (81.3)	
<i>Non-availability of elevators or lifters for raising carcasses off the floor</i>			
No	6 (46.2)	7 (53.8)	1.524 (0.217)
Yes	22 (28.9)	54 (71.1)	
<i>Non-availability of separate areas for skinning /dehairing process of the carcass</i>			
No	12 (26.1)	34 (73.9)	1.108 (0.292)
Yes	16 (36.4)	28 (63.6)	

Source: Field survey, 2019

4.7.3 Association between operational challenges of slaughterhouse workers and their attitude on meat handling

A chi-square test of association showed that only two operational challenges namely; non-availability of fumigation activities as a pest control measure and non-availability of separate areas for skinning /dehairing process of the carcass were significantly associated with meat handling attitude. The slaughterhouse workers who said they had challenge of non-availability of fumigation activities to ward off pest at the abattoir had a more desirable (30.8%) meat handling attitude compared to those who did not have challenge of lack of fumigation activities to control pests at their slaughter facilities (8.0%) as at the time of the study ($p=0.023$). The results also found butchers who did not have challenge of lack of separate areas for slaughtering and skinning animals at their slaughterhouse to have more desirable (40.0%) meat handling attitude compared to those who had challenge of lack separate areas for slaughtering and skinning animals (14.5%) at their slaughterhouse with $p=0.003$.



The results further showed some association between access to water for washing carcasses and butchers' attitude on meat handling. Butchers who had challenge with access to clean water for washing of carcasses after processing were found to have more desirable meat handling attitude (28.4%) compared to those who had access to clean water for washing carcasses after processes. This association was however not statistically significant with $p=0.256$. See table 4.14 for details.

Table 4.14: Association between operational challenges of the slaughterhouse workers and their meat handling hygiene attitudes.

Challenge	Meat handling hygiene attitude		$\chi^2(p\text{-value})$
	Desirable	Undesirable	
<i>Access to clean water for the washing of carcasses after processing is a challenge</i>			
No	3 (15.8)	16 (84.2)	1.288 (0.256)
Yes	25 (28.4)	63 (71.6)	
<i>Maintaining the abattoir environment clean and hygienic regularly is a challenge</i>			
No	10 (26.3)	28 (73.7)	.008 (0.986)
Yes	18 (26.5)	50 (73.5)	
<i>Difficulty with disposal of solid far away from the abattoir</i>			
No	6 (30.0)	14 (70.0)	.140 (0.708)
Yes	22 (25.9)	63 (74.1)	
<i>Availability drains for liquid waste management in the slaughterhouse</i>			
No	2 (40.0)	3 (60.0)	.539 (0.463)
Yes	25 (25.3)	74 (74.7)	
<i>The slaughterhouse is not shielded sufficiently to prevent the entry of pests</i>			
No	5 (35.7)	9 (64.3)	.846 (0.358)
Yes	22 (24.2)	69 (75.8)	
<i>Non-availability of fumigation activities as a pest control measure</i>			
No	2 (8.0)	23 (92.0)	5.201 (0.023)



Yes	24 (30.8)	54 (69.2)	
<i>Non-availability of hot water form cleaning and sterilization purposes</i>			
No	12 (23.1)	40 (76.9)	.375 (0.540)
Yes	15 (28.3)	38 (71.7)	
<i>Non-availability of waste bins for solid waste collection</i>			
No	13 (32.5)	27 (67.5)	.933 (0.334)
Yes	15 (23.8)	48 (76.2)	
<i>Non-availability of elevators or lift-ers for raising carcasses off the floor</i>			
No	2 (18.2)	9 (81.8)	.478 (0.489)
Yes	26 (28.0)	67 (72.0)	
<i>Non-availability of separate areas for skinning /dehairing process of the carcass</i>			
No	20 (40.0)	30 (60.0)	8.678 (0.003)
Yes	8 (14.5)	47 (85.5)	

Source: Field survey, 2019

4.7.4 Association between operational challenges of slaughterhouse workers and their meat handling practices

The results from a chi-square test (Table 4.15) also showed that only non-availability of drains for liquid waste in the slaughterhouse as a challenge and non-availability of waste bins for the solid waste collection was found to be significantly associated with the meat handling practices of the butchers working at the abattoir. The slaughterhouse workers who said non-availability of drains for liquid waste management in the slaughterhouses was a challenge were more (77.0%) into non-recommended meat handling practices than their colleagues (28.6%) who said non-availability of drains in the slaughterhouse for waste management was not a challenge ($p=0.005$). Again, recommended meat handling practices varied significantly between slaughterhouse workers who said non-availability of waste bins for solid waste collections at the abattoirs was a challenge and those who stated it was not a challenge with the former exhibiting more recommended meat handling practices than the latter ($p=0.028$).



Table 4.15: Association between operational challenges of the slaughterhouse workers and their meat handling hygiene practices.

Challenge	Meat handling hygiene practices		x ² (p-value)
	Recommended practices	Not Recommended practices	
<i>Access to potable water for the washing of carcasses after processing is a challenge</i>			
No	5 (27.8)	13 (72.2)	.061 (0.805)
Yes	23 (25.0)	69 (75.0)	
<i>Maintaining the abattoir environment clean and hygienic regularly is a challenge</i>			
No	10 (22.7)	34 (77.3)	.287 (0.592)
Yes	18 (27.3)	48 (72.7)	
<i>Difficulty with disposal of solid far away from the abattoir</i>			
No	6 (31.6)	13 (68.4)	.418 (0.518)
Yes	22 (24.4)	68 (75.6)	
<i>Availability of drains for liquid waste management in the slaughterhouse is a challenge</i>			
No	5 (71.4)	2 (28.6)	7.941 (0.005)
Yes	23 (23.0)	77 (77.0)	
<i>The slaughterhouse is not shielded sufficiently to prevent the entry of pests</i>			
No	7 (38.9)	11 (61.1)	1.968 (0.161)
Yes	21 (23.1)	70 (76.9)	
<i>Non-availability of fumigation activities as a pest control measure</i>			
No	8 (32.0)	17 (68.0)	.525 (0.469)
Yes	20 (24.7)	61 (75.3)	
<i>Non-availability of hot water form cleaning and sterilization purposes</i>			
No	14 (23.7)	45 (76.3)	.259 (0.611)
Yes	14 (28.0)	36 (72.0)	
<i>Non-availability of waste bins for solid waste collection</i>			
No	6 (13.6)	38 (86.4)	4.821 (0.028)
Yes	20 (32.3)	42 (67.7)	



Non-availability of elevators or lifters for raising carcasses off the floor

No	4 (26.7)	11 (73.3)	.009 (0.926)
Yes	24 (25.5)	70 (74.5)	

Non-availability of separate areas for skinning /dehairing process of the carcass

No	14 (25.9)	40 (74.1)	.012 (0.911)
Yes	14 (25.0)	42 (75.0)	

Source: Field survey, 2019

4.8 Determinants of meat handling personal hygiene knowledge, cross-contamination knowledge, attitude and practices of slaughterhouse workers

The results from the chi-square tests meant to test the association between the knowledge, attitude and practices of the slaughterhouse workers against other domains that turned to show a statistically significant association were further used in a binary logistic regression to examine the determinants of the slaughterhouse workers' knowledge, attitude and practices.

4.8.1 Determinants of meat handling personal hygiene knowledge of slaughterhouse workers

After controlling for other factor, it was found that slaughterhouse operators who had the challenge of non-availability of waste bins for solid waste collection and disposal at the slaughterhouse were about 3 times [(AOR: 2.844, 95%, CI: 0.918 - 8.810, p=0.070)] more likely to have a high meat handling personal hygiene knowledge compared to those who did not have the challenge of non-availability of waste bins for solid waste collection at their abattoir.

However, this finding was not statistically significant. On the other hand, independently, the odds of high meat handling personal hygiene knowledge among slaughterhouse operators who had non-availability of separate areas demarcated for slaughtering and skinning processes as an operational challenge at the slaughterhouse was 14 folds [(AOR: 14.126, 95%, CI: 2.994 -



66.645, $p < 0.01$)] higher than the odds for their counterparts who did not have that operational challenge at their slaughterhouse (Table 4.16).

Table 4.16: The Determinants of meat handling personal hygiene knowledge of slaughterhouse workers

Determinant	Personal hygiene knowledge of the slaughterhouse men		
	AOR	(95% C.I)	p-value
<i>Non-availability of waste bins for solid waste collection</i>			
No	1		
Yes	2.844	(0.918 - 8.810)	0.070
<i>Non-availability of separate areas for slaughtering and skinning /dehairing process of the carcass</i>			
No	1		
Yes	14.126	(2.994 - 66.645)	0.001

Source: Field survey, 2019

4.8.2 Determinants of meat handling cross-contamination knowledge of slaughterhouse workers

After controlling for variables such as wearing of protective clothing during operation, access to clean water for the washing of carcasses, and slaughterhouse shielded sufficiently to prevent the entry of pests, it was found that no need for registration to work as a slaughterhouse operator and non-availability of waste bins for solid waste collection was seen as significant predictors of cross-contamination of knowledge of slaughterhouse workers (Table 4.17). The likelihood of slaughterhouse operators who did not see the need for registration and regulation of slaughterhouse workers having a high cross-contamination knowledge was about 35% lower [(AOR: 0.648, 95%, CI: 0.430 - 0.976, $p < 0.05$)] than their colleagues who saw the need for the registration and regulation of their activities at the slaughterhouses by an authority.



The results further revealed that, slaughterhouse workers who had the challenge of non-availability of waste bins for solid waste collection at the slaughterhouse as an operational challenge at the facility had more than 3 times the odds [(AOR: 3.443, 95%, CI: 1.097 - 10.805, p<0.05)] of having a high cross-contamination knowledge relative to those who did not have that operational challenge.

Table 4.17: Determinants of cross-contamination knowledge of the slaughterhouse workers

Determinant	Cross-contamination knowledge of slaughterhouse men		p-value
	AOR	(95% C.I)	
<i>Wearing of protective clothing during operation</i>			
No	1		
Yes	0.750	(0.501 - 1.122)	0.161
<i>No need for registration to work as a butcher</i>			
No	1		
Yes	0.648	(0.430 - 0.976)	0.038
<i>Access to potable water for the washing of carcasses after processing is a challenge</i>			
No	1		
Yes	1.786	(0.486 - 6.559)	0.382
<i>The slaughterhouse is not shielded sufficiently to prevent the entry of pests</i>			
No	1		
Yes	3.292	(0.851 - 12.735)	0.084
<i>Non-availability of waste bins for solid waste collection</i>			
No	1		
Yes	3.443	(1.097 - 10.805)	0.034

Source: Field survey, 2019

4.8.3 Determinants of meant handling hygiene attitude of slaughterhouse workers

The results from the logistic regression revealed that after controlling for factors such as the use of local implements/equipment in the slaughter of animals and non-availability of fumigation activities as a pest control measure at the slaughterhouse, non-availability of separate areas for



skinning/dehairing process of the carcass as an operational challenge was still a significant predictor of the slaughterhouse workers' meat handling hygiene attitude (Table 4.18).

The slaughterhouse operators who had the challenge of non-availability of separate areas for slaughtering and skinning/dehairing of carcasses as an operational challenge had about 3 times the odds [(AOR: 3.136, 95% CI: 1.107 - 8.883, $p < 0.05$)] of having a highly desirable meat handling hygiene attitude compared their counterparts who did not have that as an operational challenge.

Table 4.18: Determinants of meat handling hygiene attitude of slaughterhouse workers

Determinant	Meat handling attitude of the slaughterhouse men		
	AOR	(95% C.I)	p-value
<i>Use of local implements/equipment in the slaughtering of animals</i>			
No	1		
Yes	1.508	(0.510 - 4.461)	0.458
<i>Non-availability of fumigation activities as a pest control measure</i>			
No	1		
Yes	0.429	(0.078 - 2.371)	0.332
<i>Non-availability of separate areas for slaughtering and skinning /dehairing process of the carcass</i>			
No	1		
Yes	3.136	(1.107 - 8.883)	0.031

Source: Field survey, 2019

4.8.4 Determinants of meat handling hygiene practices of slaughterhouse workers

The results returned from the binary logistic regression showed that, independently, non-availability of drains for liquid waste management in the slaughterhouse and non-availability of waste bins for solid waste collection were all statistically significant predictors of recommended meat handling hygiene practices (Table 4.19).



The results revealed that, slaughterhouse workers who had the challenge of non-availability of drains for liquid waste management in the slaughterhouse as an operational challenge were about 43 times more likely [(AOR: 42.845, 95%, CI: 4.757 - 385.915, $p < 0.01$)] to have high recommended meat handling hygiene practices relative to their counterparts who did not have that operational challenge at their slaughterhouse. Further, the slaughterhouse workers who also mentioned the non-availability of waste bins for solid waste collection and disposal as one of the operational challenges of their work had 0.124 odds of having a high recommended meat handling hygiene practice compared to the operators who did not that as an operational challenge

Table 4.19: Determinants of meat handling hygiene practices of the slaughterhouse workers

Determinant	Meat handling practices of the slaughterhouse workers		
	AOR	(95% C.I)	P-value
<i>Non-availability drains for liquid waste management in the slaughterhouse</i>			
No	1		
Yes	42.845	4.757 - 385.915	0.001
<i>Non-availability of waste bins for solid waste collection</i>			
No	1		
Yes	0.124	0.032 - 0.483	0.003

Source: Field survey, 2019

4.9 Qualitative results

Twelve key informant interviews were held with 12 men aged 32-54 years who had a lot of insight into the operation of the three main abattoirs and the day-to-day activities of the slaughterhouse men in the Tamale metropolis. The interviewer allowed the interviewees the opportunity to share their own experiences and thoughts freely regarding how meat processing was handled among the slaughter men or workers at the various slaughterhouses.



To stimulate confidentiality, the interviewee in each interview session was given a unique number ranging from one to twelve as names which they used throughout the session. For example, key informant one was given number one and referred to as I1 in the analysis, participant two was given number two and known as I2 in that order till the last participant. Direct observations of the operations of the slaughterhouse men at the abattoir during operation hours were also made in all three slaughterhouses in the Metropolis visited during the period of the study.

4.9.1 Themes emerging from key-informant interviews and FGDs

The major themes that emerged from the key informant interviews conducted are summarized under the various headings below.

4.9.1.1 Participants view on meat handling practice at the abattoir

Participants were asked about the meat handling practice used for daily abattoir operations and where they were carried out. Almost all of them mentioned that bleeding (slaughtering) was carried out with local knives inside or outside the abattoir on the concrete floor. They also carry out dehairing and hide finishing, evisceration and cutting of the carcasses at the same place the bleeding is been carried out. After which the meat is certified by the public health inspectors and conveyed to the various meat retail houses, shops and tables in the Metropolis for sale.

“Here the cow is put on the floor and slaughtered. After that, we move the animal a little away from the slaughtering area and then use knives and hands to skin the carcass. After that, we proceed to remove the offal and wash them before we then cut it into sizes for the retail butchers to come and take. Sometimes we finish early before the retail butchers come so we hang the cut parts



on the hooks inside the abattoir till they arrive to pick the meat”. (I₃, Sishiagu abattoir)



Figure 4.1: Picture of eviscerated offal on the floor at Sishiagu abattoir



Figure 4.2: Picture of cut carcasses hanged off hooks at Sishiagu abattoir

Source: Field Survey, 2019

“When we finish slaughtering and it’s a small animal like sheep, the dehairing is by skinning so we just do it at the same place the slaughtering was done with small knives. Sometimes the owners of the carcass will say they will prefer the dehairing done by fire leaving the hide attached to the meat. In such instances, the carcass is taken to where the fire is set for the dehairing process. After



that, we wash the carcass and then do evisceration on zinc sheets or sometimes on the concrete pavement of the abattoir backcourt”. (I7, Kakpayili abattoir)



Figure 4.3: Picture of skinned carcass at the slaughter/bleeding area at Kakpayili abattoir



Figure 4.4: Picture of skinning a carcass on a floor at the Kakpayili abattoir.

Source: Field Survey, 2019

4.9.1.2 Sterilization and waste management practices

This study also focused on unearthing the hygienic meat handling practices of the abattoir butchers in the Metropolis. Findings from the key-informant interviews revealed that the slaughterhouse workers do not carry out any form of sterilization of the equipment they use in the meat processing operations at the abattoir. Water is often used to wash off any bloodstain on the butchers' knives. Liquid waste such as blood from the bleeding/slaughtering of animals is left to

dry up on the concrete floor unattended to outside most of the abattoir facilities. Water is also used to rinse off blood and other tissue remnants on the floor on very few occasions.

“We clean our knives after the day’s operations. We use water to wash off any dirt on it and then wipe off the water on it then it is ready for another job the next day or almost instantly” (I₁₂, Buipela, abattoir).

When the animal is slaughtered outside the abattoir, we normally don’t clean the blood again. Sometimes some people need fresh blood and they come to collect it. If no one comes for it, it is left like that on the floor and it dries by the next day (I₅, Kakpayili abattoir)

4.9.1.3 Common beliefs and practices of the slaughterhouse workers

Respondents said that all the equipment and tools they use are locally made to suit their work. They have high regard for such implements as they can combine such locally customised equipment and their hands perfectly in their butchering job.

They also mentioned that one can become a butcher by learning on the job from the family or coming to the abattoir to learn through observation under the guidance of a master. However, the respondents hold a divided opinion on the need for regulatory registration by an authority before operating as a butcher at the slaughterhouse. While others held the view that it should be made mandatory, others played down on such an attempt with the claim that some of them come from families of butchers already and so are good on the job and hence require no regulatory registration before an operating as butchers. Majority of them also did not find the use of protective clothing during operational periods necessary enough to influence their output anyway. So, they don’t use such garments in the course of their work.



“As for butchery, if I want to enjoy doing it as a job, I will require my local butchery knives to be able to work well. Everyone and how he wants the shape and size of his knife to be able to work well with it. I started working as a butcher at a very young age and I always go to the blacksmiths to get me customised knives for my work. This allows me to work very well and without injuries” (I₅, Kakpayili abattoir)

If it was left to me alone, registering us as butchers will be a good thing so that they can check those who know how to do the work well and prevent spoiling of certain things in the job”. (I₁, Sishiagu abattoir)

“Ooh! To registers us? For what? I don’t think it’s necessary, we grew up us butchers, some of us. If you know the job, you know it and if you don’t know you don’t know. Some also come and learn and they know how to do the work”. (I₁₀, Buipela, abattoir)

4.9.1.4 Challenges of the slaughterhouse workers

When study participants were asked what their most pressing challenges were as slaughterhouse workers. A good number mentioned water as one of the major constraints to their work operations. Other said complained about the erratic nature of the business as their major problem.

“As for here the most pressing problem we face is water. We have to bring water from our homes in these gallons to work with. Sometimes we have to call on motor-king to fetch us some water with the gallons to use for the work. You know as for the intestines you need water to wash them well”. (I₃, Sishiagu abattoir)



“You know this work is every day that there are a lot of animals to kill. So, there are times that the work is good like during ‘EduAdha’ and certain festive occasions. Other times only one or two animals are killed that whole day”.
(I11, Buipela, abattoir)



CHAPTER FIVE

DISCUSSION

5.1 Introduction

This chapter of the study discusses the main findings of the study and relates them to available literature where appropriate. This was done to show how the findings of this study are similar or differ from those of other researchers on the subject matter. It also helped to make meaning from the main findings of that study by interpreting the findings to give their meanings, implications and for public health. The discussion is done under the following headings meat handling knowledge, attitude and practices of the slaughterhouse workers, common beliefs and practices of the slaughterhouse workers, challenges of the slaughterhouse workers and factors associated with the meat handling knowledge, attitude and practices of the slaughterhouse workers.

5.2.1 Meat handling personal hygiene knowledge of slaughterhouse workers

The findings of this study however, showed that about 77% of the butchers had low level of knowledge in meat handling personal hygiene. This means that their level of knowledge in meat handling personal hygiene is not satisfactory. This finding of the study does not compare favourably with the findings elsewhere by Faith (2011). Faith (2011) found that in South Africa, butchers had a satisfactory level of knowledge on meat handling processes.

Furthermore, much like the findings from South Africa, Yakubu et al., (2013) found that in a Northern Nigerian state of Kano, there was an increase in the level of meat handling personal hygiene knowledge of slaughterhouse workers. The low level of meat handling personal hygiene knowledge of the slaughterhouse workers in this study could be due the fact that they do not receive any form of formal training in the butchery work as the findings of this study also showed that the slaughterhouse workers mostly learn the butchery work from their masters who are most-



ly family members whom they follow and observe to learn. The low level of meat handling personal hygiene knowledge of the slaughterhouse workers could also be due to their low level of education as it was also found that more than 67% of them had their educational level being below the senior high school level. This may hinder their ability to find, read and appreciate educational materials on meat handling personal hygiene.

The low level of meat handling personal hygiene knowledge of the slaughterhouse workers could be a contributory factor in their poor meat handling attitude and practices that were also found in this study as knowledge is said to influence attitude and practices to a very large extent. The low level of meat handling personal hygiene knowledge of the slaughterhouse also means that authorities like the veterinary officers, sanitary officers and others who are responsible for regulating the activities of the butchers are perhaps not engaging them enough as they should particularly in terms of giving them orientation and training on personal hygiene and sanitation issues related to safe meat handling. Training helps to improve overall employee knowledge of meat safety (Finch & Daniel, 2005; Roberts et al., 2008). According to Gould (1994), all meat handlers must participate in a training programme of a kind, particularly in the areas of personal hygiene, good manufacturing practice, cleaning and disinfection procedure before starting to work in a slaughterhouse as a butcher. Poor hygiene practices during carcass handling have been suggested as sources of meat contamination (Haileselassie, 2013; Kariuki, et al., 2013).

The lack of knowledge on meat safety practices and proper meat handling processes cannot reduce foodborne ailments (Redmond & Griffith, 2005) and therefore can lead to poor meat quality produced at abattoir since low level of knowledge on recommended meat handling practices right from pre-slaughter handling, conditioning of the lairage, slaughtering process and dressing play a significant row in the quality of the meat produced (Guerreso et al., 2013).



5.2.2 Meat handling cross-contamination knowledge of slaughterhouse workers

The results also revealed a very low general knowledge on meat handling cross-contamination knowledge among the slaughterhouse worker as only 30% of them were found to have high meat handling cross-contamination knowledge while 70% them had low meat handling cross-contamination knowledge. This finding is contrary to the finding of Faith (2011) who found that in South Africa, butchers had a satisfactory level of knowledge on meat handling processes.

The low level of meat handling cross-contamination knowledge of the slaughterhouse workers could also be due their general low level of education below senior high schools level and the traditional way of their training without any form of formal training as revealed in this study. This is against the recommendation by Gould (1994) that, all meat handlers must participate in a training programme of a kind, particularly in the areas of personal hygiene, good manufacturing practice, cleaning and disinfection procedure before starting to work in a slaughterhouse as a butcher. The training is said to improve overall employee knowledge of meat safety (Finch & Daniel, 2005; Roberts et al., 2008). This can help improve meat handling practices and safety as poor hygiene practices during carcass handling have been suggested as sources of meat contamination (Haileselassie, 2013; Kariuki, et al., 2013).

The low level of cross-contamination knowledge of the slaughterhouse workers could be the reason for some of the poor meat handling attitude and practices also found in this study. One common such poor practice revealed by this study among the slaughterhouse operators is skinning and dressing with local knives and bare hands which can introduce virulent organisms on the surface of the carcass leading to cross-contamination. It is therefore recommended that, operators wash their hands after each passage of every carcass to avoid contamination of the carcass Reij et



al. (2003). This is so because the hands as well as contaminated gloves serve as vectors for transmission of transient microorganisms (Fendler et al., 1998).

5.2.3 Meat handling attitude of slaughterhouse workers

The results of the revealed that about three-quarters (72%) of the slaughterhouse workers interviewed had undesirable meat handling attitude, whereas a little more than a quarter were found to have desirable meat handling attitude. These demonstrate a general poor meat handling attitude by the slaughterhouse butchers. Even though most of the butchers believed that safe meat handling was an important part of their job as butchers, they exhibited a very weak believe that producing a wholesome meat is more important to them. This contradicts the believe of Desenclos et al., (1996) that the ultimate aim of hygienic meat handling practises per recommended healthy standards at the slaughterhouse level of meat handling and processing is to significantly reduce the levels of disease-causing microbes in processed carcasses to make it wholesome for consumption.

Majority of them were of the strong believe that worker with abrasions or cuts on their fingers and hands could still handle meat without gloves. This also contradicts the view that hands serve as vectors for transmission of transient microorganisms (Fendler et al., 1998) which can lead to contamination. Also, the butchers were of the strong believe that the use of clothing such as mask, aprons and hand gloves were not that critical in reducing meat contamination contrary to the believe that such clothing and personal hygiene of slaughterhouse worker if properly enforced, should control contaminations from workers' bodies to the meat they produce (Restino& Wild, 1990; Kasprowiak & Hechelman, 1992).

The poor meat handling attitude of the slaughterhouse workers could be due their low level of meat handling personal hygiene and cross-contamination knowledge as found in this study as



knowledge greatly influence attitude. The poor meat handling attitude of the slaughterhouse workers could also lead to poor meat handling practices as revealed in this study as attitude feeds directly into behaviour and practice. There is therefore the need for authorities to prioritise awareness creation on proper meat handling through periodic orientation and trainings improve the knowledge, attitude and for that matter practices of the slaughterhouse workers to guarantee safety of the meat they produce.

5.2.4 Meat handling practices of slaughterhouse workers

The ultimate aim of hygienic meat handling practises per recommended healthy standards at the slaughterhouse level of meat handling and processing is to significantly reduce the levels of disease-causing microbes in processed carcasses (Desenclos et al., 1996).

Contrary to the findings of Faith, (2011) which found that in South Africa, butchers significantly adhered to basic hygiene practices, the findings of this study showed that majority (75%) of the slaughterhouse workers had low levels of recommended meat handling practices. This means that three-quarters of the butchers in this study were engaged in poor meat handling hygiene practices. This is against the fact that durable attitude and recommended practices on meat handling right from pre-slaughter handling, conditioning of the lairage, slaughtering process and dressing play a significant role in the quality of the meat produced (Guerreso et al., 2013). Sub-standard meat handling procedures in the form of non-sterilization of knives and other implements or equipment, cleaning of floors with only room-temperature water without any form of detergent or antiseptic as revealed from this study exposes meat processed from these facilities to potential unwholesome bacteria likely to be consumed by unsuspecting customers.



The study also notably found some factors such as the use of local implements/equipment in slaughtering and processing of animals. The use of these local implements may not necessarily be something out of order. However, the cleaning of these implements with suboptimal procedures as found in these studies could be a serious source of public health concern going forward if something is not done about it.

In the case of our part of the world, particularly the study area, bleeding is often done in a manner in which the animal is not stunned before the slaughtering. None the less, the need for utmost adherence to high hygiene protocol in the process cannot be compromised. Bleeding without stunning may not directly affect meat quality, however, it has been well established that a contaminated knife has a higher likelihood of pass on bacterial into animal tissue during the initial stages of bleeding, particularly at moments when the animal's heart is still breathing (Reij et al., 2003).

Another common poor practice revealed by this study among the slaughterhouse operators is skinning and dressing with local knives and bare hands which can introduce virulent organisms on the surface of the carcass. This is so because the hands as well as contaminated gloves are said to serve as vectors for transmission of transient microorganisms (Fendler et al., 1998). Therefore, operators must wash their hands after each passage of every carcass to avoid contamination of the carcass (Reij et al., 2003). The low level of cross-contamination knowledge among the slaughterhouse workers seen in this study may just affirm this observed skinning and dressing practice with bare hands.

The standard operations procedure mandates that each time an authorized officer or an operator of the slaughterhouse is to enter the slaughterhouse he or she should undergo a critical disinfection regimen at the entrance of the facility (Adler, 1999). The findings from this study were how-



ever contrary to this recommendation in term of practice. With a suboptimal level of disinfection observed by workers of the slaughterhouses on the premises of the facilities in this study, another critical issue revealed by the findings of this study had to do with the challenges of waste management (both solid and liquid waste) generated at the slaughterhouse. From observation, this challenge was partly attitudinal as was partly the nature of the facilities. Solid waste such as hooves and horns were disposed of in nearby bushes as a form of easy and quick disposal strategy, whereas bloodstain on floors and insides drains were not properly cleaned owing to limited availability of running water at the slaughterhouse. The water used for cleaning the floor was neither hosed nor warm for effective clean as well. This calls for urgent attention from appropriate authorities, particularly the Tamale Metropolitan Assembly responsible for the building, maintenance/management of these facilities to ensure the availability of enough running water at these facilities.

The general poor meat handling hygiene practices of the slaughterhouse workers could be due to their low levels of meat handling personal hygiene and cross-contamination knowledge. This is because knowledge is said to influence attitude and behaviour of individuals. This calls for authorities to ensure that the slaughterhouse workers are periodically sensitised and trained on proper meat handling hygiene and processes as training helps to improve overall employee knowledge of meat safety (Finch & Daniel, 2005; Roberts et al., 2008). According to Gould (1994), all meat handlers must participate in a training programme of a kind, particularly in the areas of personal hygiene, good manufacturing practice, cleaning and disinfection procedure before starting to work in a slaughterhouse as a butcher. Poor hygiene practices during carcass handling have been suggested as sources of meat contamination (Haileselassie, 2013; Kariuki, et al., 2013). This poor hygienic nature of meat handling practices contributes greatly to the spread



of zoonotic diseases in human populations (Joshi et al., 2003). The level of meat handling operations at the abattoir such as bleeding and evisceration leads to high bacteria proliferation. Therefore, emphasis on butcher education to increase their knowledge on hygiene, cleanliness and maintenance of good sanitary practices in the slaughterhouse is crucial (Vaidya et al., 2004).

The study also found that butchers who do not use local implements for slaughtering and processing meat in their daily operations at the slaughterhouses were more likely to have a high level of recommended meat handling practice than their counterpart who resorts to the use of local implements in their daily operations. This was quite evident from the direct observation of how the butchers processed meat at the abattoir. Skinning was mainly done with small local knives and bare hands throughout the entire process of the operation. The use of traditional or local implements clearly may as well be influenced by the lack of knowledge of the recommended or approved safe and modern standard of operations at a slaughterhouse.

More so, the slaughterhouse workers who acknowledge that availability of drains in the abattoir for liquid waste management was a challenge were found to be associated with high recommended meat handling practices. This probably points towards the direction of awareness being a probable factor in adhering to desirable meat handling practices, attitude and knowledge. This consequently only reemphasizes the importance or need for education, training or capacity building for the slaughterhouse workers on meat handling processes, all in the bid to improve wholesomeness of the meat that ends up in the cooking pots of many homes in the Metropolis.

5.3 Common beliefs and practices of the slaughterhouse butchers

Majority (61.1%) of the slaughterhouse workers were of the belief that butchery does not need registration and regulation from any authority. This is contrary to worldwide standard operation requirement of mandatory inspection of the level of hygiene and sanitation before, during and



after meat production process to help reduce contamination of carcasses produced (FAO). This wrong belief by the slaughterhouse workers could as well be due to their low level of meat handling hygiene and cross-contamination knowledge as revealed by the findings of this study.

This is because knowledge influences belief and attitude to a very large extent. Registration and regulation of operations of butchers at the abattoir with regards to meat handling safety will be relevant in the effort against foodborne illness related to meat as it will help ensure compliance with hygiene and sanitation standards by the slaughterhouse workers.

Another common belief among the slaughterhouse workers was that they believed that butchery is a family job that one learns by following and observing the master who mostly is a family member and that it does not require any formal training. This is also contrary to the recommendation by Gould (1994) that, all meat handlers must participate in a training programme of a kind, particularly in the areas of personal hygiene, good manufacturing practice, cleaning and disinfection procedure before starting to work in a slaughterhouse as a butcher.

These beliefs could account for the low level of meat handling personal hygiene and cross-contamination knowledge of the slaughterhouse workers as revealed by this study which can impact negatively on their hygiene and sanitation practices which have also been found to be below recommended standard practices in this study. These wrong beliefs reiterate the need for the butchers to be trained and oriented to increase awareness on their standard operation procedures.

The study also assessed some common practices of the slaughterhouse workers and found that a large proportion of the butchers, (62.6%) work with locally made implements or equipment with bare hands. The use of bare hands and knife for skinning can similarly host contaminating organisms on the surface of the carcass (Reij et al., 2003). More than half, 58.8 percent of the slaugh-



terhouse worker said they wear protective clothing as part of their work culture. Contrary to this study's finding, Chepkemai et al., (2015), found that 70% and 82% slaughterhouse worker in Nairobi and Isiolo Counties, respectively do not dress in protective clothing in the course of the daily operations at the abattoir. This is a good practice that can help reduce contamination of meat as protective clothing are said to limit contamination from workers' bodies (Restino & Wind, 1990; Kasprowiak & Hechelmann, 1992). It was further discovered in this study that butchers use customised local knives and do not sterilize them for reuse. Knives used to slaughter each animal were not washed and rinsed in hot water as recommended. It is recognized that a contaminated knife can pass on bacteria into the animal tissues during the early stages of bleeding, that is, when the heart is still beating (Reij et al., 2003).

5.4 Operational challenges of the slaughterhouse butchers

The operational challenges of slaughterhouse men manning abattoirs are crucial for the safety of the meat being processed or public safety as well as the safety of the workers themselves. The study found that waste (both liquid and solid) management, access to water for washing of carcasses and seasonality of market in terms of operations were largely acknowledged as key operational challenges by most of the butchers. This finding is not fully in agreement with another finding from a study by Legese et al., (2008), where the main problems of butchers working in abattoirs, were rather poor market infrastructures like road, and seasonality in production. However, the findings of Adeyemo, (2002) and Lawan et al., (2013) favourably support the finding of this study as they also found that in most slaughterhouses in Nigerian, the slaughtering and processing facilities such as good sewage or waste disposal systems, adequate clean water supplies and refrigeration that aid the work of butchers were not also available.



These challenges contribute partly and greatly to the poor state of meat handling hygiene and sanitation practices during meat processing which can lead to the outbreak of foodborne diseases (Bryan, 1988; Shapiro et al., 1999) and the spread of zoonotic diseases in human populations (Vaidya et al., 2004). Authorities particularly the Tamale Metropolitan Assembly should work to ensure adequate supply of clean water and waste management of equipment and systems at the various abattoirs within the metropolis.

5.5.1 Determinants of meat handling personal hygiene knowledge of the slaughterhouse workers

Theoretically, a greater level of knowledge in the meat handling hygiene process, the right or desirable attitude towards meat handling personal hygiene coupled with recommended meat handling hygiene practices are crucial to avoid meat contamination (Haileselassie, 2013; Kariuki, et al., 2013). It is therefore important to understand the factors that determine the meat handling personal hygiene knowledge of the slaughterhouse workers in order to inform decision making to help authorities improve knowledge of the butchers to help improve their meat handling hygiene attitude and practice to improve meat quality.

The findings in the current study suggest that slaughterhouses with no operational challenges of non-availability of separate areas for skinning/dehairing process of the carcass were the only strong predictor of personal hygiene knowledge of the slaughterhouse workers. This may be an indication that the working environment for these operators plays a significant role in how much they know to keep themselves and their products safe. A factor that could adversely affects both meat quality and public health safety. This means that slaughterhouses with separate areas for skinning/dehairing process of the carcass and for that better environmental outlook should be targeted by consumers when buying their meat as butcher there are likely to have high meat handling personal hygiene knowledge which can influence their practices positively to avoid con-



tamination and foodborne diseases as such diseases are the results of improper personal hygiene in handling foodstuffs (Bryan, 1988; Shapiro et al., 1999).

5.5.2 Determinants of meat handling cross –contamination knowledge of the slaughterhouse workers

The results of the study also revealed that having operational challenge of non-availability of waste bins for solid waste management was associated with high level of knowledge on meat handling cross-contamination. This means that the ability to appreciate and acknowledge a meat handling hygiene related challenge where it actually exist, demonstrates knowledge in meat handling cross-contamination.

Therefore poor sanitary and hygienic conditions at a slaughterhouse may not necessarily mean a lack of knowledge related to cross-contamination. To ensure public safety, there is the need for authorities urgently supply all abattoirs within the Tamale metropolis with waste collection bins to help enhance the sanitary and hygienic practices of butchers to avoid contamination and reduce foodborne diseases which are as a result of improper personal hygiene in handling foodstuffs (Bryan, 1988; Shapiro et al., 1999). This will help improve public safety

5.5.3 Determinants of meat handling personal hygiene attitude of the slaughterhouse workers

The results showed that slaughterhouse workers who had the challenge of lack of separate areas for slaughtering and skinning animals at their slaughterhouse had more desirable meat handling hygiene attitude compared to those who did not have challenge of lack separate areas for slaughtering and skinning animals. This also means that the ability to appreciate and acknowledge a meat handling hygiene related challenge where it actually exist is a demonstration of desirable meat handling attitude. It also means that such butchers can easily be supported to improve their



meat handling hygiene practices by the provision of appropriate working areas for slaughtering and skinning to improve hygiene practices.

The Tamale metropolitan assembly should therefore step in to provide the need structures and facilities at the various abattoirs in the metropolis to ensure separate areas for slaughtering and skinning of animals to improve the hygiene practices and standard operations of the butchers to ensure public safety.

5.5.4 Determinants of meat handling hygiene practices of the slaughterhouse workers

On the determinants of meat handling hygiene practices of slaughterhouse workers, the results of the study showed that two operational challenge variables, non-availability of waste bins for solid waste collection and non-availability of drains for liquid waste management strongly predicted the meat handling hygiene practices of the slaughterhouse workers. Butchers who had no challenge with the lack of waste bins for solid waste collection had higher recommended meat handling practices than those had that challenge. This means that butchers who have waste bins for their solid waste collection generally try to uphold recommended meat handling practices compared to those who have no waste bins.

It was further revealed that butchers who had challenge with the lack of drains for liquid waste management had higher recommended meat handling practices compared to those who did not have such challenge. This also means that the non-availability of drains for liquid waste management is an issue of lack of capacity on the part of the butchers to do as it is more capital intensive rather than an issue refusal to comply with standard operation protocol. Considering the nature of the slaughter facilities in the study area, where there exist scarce resource and low level of law enforcement in terms of regulatory activities. It is therefore common to find a lot of chal-



lenges right from the building specifications, equipment and other essential supplies that will ensure utmost public health safety in all aspects of the slaughterhouse's operations. This therefore calls for the attention of the Tamale metropolitan assembly to step in to construct drainage systems and provide other operational needs to the various abattoirs within the metropolis to help improve sanitary and hygienic practices of the slaughterhouse workers to help ensure public health safety.



CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study explored the determinants of slaughterhouse men's meat handling Knowledge, Attitude and Practices using both quantitative and qualitative methods. The purpose was to identify factors which influence the level of acceptable or recommended meat handling Knowledge, Attitude and Practices at the abattoir level of meat processing. The study found that most butchers at the slaughterhouse have low levels of various meats handling knowledge, low levels of desirable meat handling attitude and low recommended meat handling practices.

The proportion of slaughterhouse workers with high meat handling personal hygiene knowledge was less than a quarter (about 23%), those with high knowledge on meat handling cross-contamination was also less than one-third (30%). The percentage of the slaughterhouse men who were found to have a high level of desirable meat handling attitude was about only 28% of the respondents while those with high level of recommended meat handling practice was just a quarter (25%) of the respondents. Quite a good proportion, more than half (61.1%) of the slaughterhouse men believed that there is the need for regulatory registration for their trade.

Independently, a factor such as level of education significantly associated with the cross-contamination knowledge of the slaughterhouse workers. Common practices of the slaughterhouse men such as the use of local implements/equipment in the slaughtering of animals were found to be associated with their meat handling attitude and practices. The operational challenges expressed or observed by the slaughterhouse men including non-availability of waste bins for solid waste collection and non-availability of a separate area for skinning/dehairing process of the carcass were found to be significantly associated with their meat handling per-



sonal hygiene knowledge levels. Access to clean water for washing carcasses after processing, non-availability of fumigation activities as a pest control measure, and non-availability of waste bins for solid waste collection as operational challenges were independently related to the cross-contamination knowledge of the butchers.

Another major finding was that operational challenges facing the butchers working in the abattoirs such as non-availability of fumigation activities as a pest control measure and non-availability of separate areas for skinning /dehairing process of the carcass were more likely to significantly influence the meat handling attitude of the butchers. With regards to the level recommended meat handling hygiene practices of the slaughterhouse workers, it was found that the workers who had non-availability of drains for liquid waste management in the slaughterhouse as an operational challenge were more likely to have a high level of recommended meat handling hygiene practices compared to those who did not have that operational challenge. Non-availability of waste bins for the solid waste collection as an operational challenge was also found to be significantly associated with high level of recommended meat handling hygiene practice of the slaughterhouse men.



6.2 Recommendations

Based on the findings of this study, the researcher puts forward the following as recommendations;

- First, the Tamale metropolitan assembly should organize training and capacity building on recommended meat handling practices at various stages of meat processing for the slaughterhouse butchers will serve them a world of good in their trade while protecting public safety at the same time. The training will improve their level of appreciation of the dangers of unsafe meat handling practices and processes at the abattoir level. Improvement in their meat handling knowledge through such training and a capacity-building may translate into improved practices and consequently meat safety in the Tamale Metropolis.
- Second, the Metropolitan Assembly may need to renovate or factor into its plan of abattoir buildings the provision of facilities and work stations according to recommended standards. These features of a state-of-the-art abattoir will compel workers there to abide by meat safety standards in their routine operations. This will see the transition of the use of local equipment and implements to modern equipment. This ensures both ease of daily operations and improved hygienic meat handling practices at the slaughterhouse and other hand improved revenue generation for the Metropolitan Assembly as well.



- Finally, at the policy level, the Metro assembly should consider formulating a by-law following the modern recommended meat safety and handling hygiene standards regarding abattoir operations to match the facilities equipment. The use of local ‘unsafe’ equipment/implements for meat handling process should be regulated to ensure safety compliance. Importantly, the slaughterhouse workers should be required by the provisions in the by-law to undergo a compulsory meat handling safety and hygiene training and certified for operating as slaughterhouse workers. This will ensure sanity in the meat industry in the Metropolis particularly at the abattoir level for starters.



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APPENDIX I

Data Collection Instruments

UNIVERSITY FOR DEVELOPMENT STUDIES, TAMALE

QUESTIONNAIRE

TOPIC: HYGIENE KNOWLEDGE, ATTITUDE AND PRACTICES OF SLAUGHTERHOUSE WORKERS IN TAMALE METROPOLIS.

INFORM CONSENT

My name is **Solomon Ossom Asare**, a student from the Department of Public Health, University for Development Studies, conducting a research project on the above-mentioned topic. This research is part of the requirements of the University for the fulfillment of the award of Master's Degree in Public Health (MPH).

These questionnaires may take about 20-30 minutes or less to complete. Whatever information you provide will be strictly confidential. You can decline to answer any question you do not feel comfortable answering. I hope that you will participate in this study since your views are helpful and important.

Be assured that, information gathered will be confidential and you will remain anonymous. No name or identifier will be used in any publication or reports from this study.

Do you agree to participate in this interview? **Yes** ___ **No** _____

Thank you for your time and expertise



SURVEY QUESTIONS

Please choose the option that applies to you by placing a tick in the bracket of your choice.

Please give only ONE answer.

Section A: Bio Data

1. Sex

Male

Female

2. Age

< 20 years

20-30 years

31 – 40 years

41–50 years

51 – 60 years

3. Marital status

Single

Married

Divorced

Widowed(Optional)

4. Which of the following best describes your level of education? (Optional)

Degree holder

HND

Postgraduate

SSS/SHS

JHS

Non formal education

5. Number of years you have engaged in the business

1-5 yeas

6-10 years

11-15 years

16+ years



Section B: Level of hygiene knowledge, attitude and practices applied in the slaughterhouses

With a **Likert**-scale, for each statement; indicate the extent of your agreement or disagreement by ticking the appropriate check box. Please tick () where appropriate

Key: 1= Strongly Agree, 2= Agree, 3= Not sure, 4= Disagree, 5= Strongly Disagree

Knowledge	1	2	3	4	5
Personal hygiene					
Wearing gloves is one part of personal hygiene					
Wearing apron is one part of personal hygiene.					
Wearing cap is one part of personal hygiene.					
Wearing mask is one part of personal hygiene.					
Washing hands regularly before work is one part of personal hygiene.					
Washing hands regularly after work is one part of personal hygiene.					
Washing hands regularly after hand contamination is one part of personal hygiene.					
Washing hands properly reduce risk of contamination.					
Washing hands with only water is not clean enough.					
Employees should avoid touching their hair after washing hands.					
Employees cannot wear adornments.					
Employees cannot have long nails and make coloring.					
When employees have wound on hands, we touch meat directly.					
Cross-contamination					
Contamination is the transfer of harmful microorganisms to carcass from other foods or non-food-contact surfaces.					
Use of gloves reduce the risk of transmitting infection to consumers.					
If gloves are broken, you need to change new one.					
Use hot water to clean equipment still decrease risk of contamination.					
Equipment such as cutting board can transfer diseases.					
Equipment such as knives can transfer diseases					
Cleaning equipment after work can reduce cross					



contamination.					
Separate between dirty and clean zone.					
Attitudes of slaughterhouse workers					
Safe meat handling is an important part of my job responsibility					
I believe meat safety knowledge will be beneficial to my personal life.					
I believe meat safety knowledge will be beneficial to butchers and consumers.					
Producing wholesome meat is more important.					
I believe good personal hygiene can prevent meat spoilage.					
Washing hand before handling meat reduces risk of meat spoilage.					
Worker should make sure their nails are short and clean.					
Workers with abrasion or cuts on fingers and hands can still handle meat without gloves.					
Using mask is not important in reducing risk of meat contamination.					
Using apron is important in reducing risk of meat contamination.					
Using gloves is not important in reducing risk of meat contamination.					
The use of adornments, such as earrings, rings and watches, cannot cause meat contamination.					



Key: 1= Always, 2 = Often, 3 = Sometimes,4 = Rarely, 5 = Never

Practices of slaughterhouse workers	1	2	3	4	5
You wash your hands before processing meat.					
You use detergent to wash your hands.					
You keep your nails short and remove all adornments before starting activities.					
You handle meat at work when you have diarrhea.					
You handle meat at work when you have abrasions or cuts on your hands.					
You wash your hands with soap after visiting the toilet.					
You use mask at work daily.					
You use apron at work daily.					
You use cap at work daily.					
You use gloves at work daily.					
You go for a medical examination every year.					

Section C: Common beliefs and practices of the slaughterhouse butchers

With a **Likert**-scale, for each statement; indicate the extent of your agreement or disagreement by ticking the appropriate check box. Please tick () where appropriate

Key: 1= Strongly Agree, 2= Agree, 3= Not sure, 4= Disagree, 5= Strongly Disagree

Common beliefs and practices of the slaughterhouse butchers	1	2	3	4	5
Use of local implements/equipment's in slaughtering of animals					
Personnel working in the slaughter houses are born into family of butchers and are not trained to handle carcass					
Personnel working in the abattoir do not wear protective clothing during operation					
Working in the slaughter houses do not require registration with the Ministry of health because of the culture of the people					
Knife skinning and the use of bare hands is part of the culture of the people which can hosts contaminating organisms on the surface of the carcass					



Section D: Challenges faced by slaughterhouse workers complying with standard hygienic practices in meat preparation

With a **Likert**-scale, for each statement; indicate the extent of your agreement or disagreement by ticking the appropriate check box. Please tick () where appropriate

Key: 1= Strongly Agree, 2= Agree, 3= Not sure, 4= Disagree, 5= Strongly Disagree

Challenges faced by slaughter house workers complying with standard hygienic practice	1	2	3	4	5
Access to clean water for the washing of carcasses after processing					
Maintaining the abattoir environment clean and hygienic regularly					
Receive animals/meat that appear not to be healthy from homes without supervision					
Dumpsite for waste is not significantly distanced from the slaughter house.					
Drains were provided for liquid waste to pass through in the slaughter house					
The slaughter house is not shielded sufficiently to prevent the entry of pests					
The slaughter house is never fumigated during the period of my stay in this business and there were no records on fumigation of the place					
Sanitizers or warm water readily available for frequent cleaning and sterilizing of hands and equipments					
The knives used for the process are not cleaned in warm water periodically					
Waste bins are provided at the area to collect waste					
The process is carried out on the floor instead of an elevated position					
Skinning /dehairing process of the carcass is done at a separate place from the slaughter Area					



Key informant Interview Guide

Interview schedule on Hygiene Knowledge, Attitude and Practices of Slaughter House Workers in Tamale Metropolis.

Introduce yourself to the respondent

Explain the purpose of the interview briefly.

Assure the respondent on confidentiality and that this data is only for the purpose of learning and no names will be in the interview schedule but only codes.

Ask the respondent to give you signed consent to proceed

Interview schedule code number -----

Date of interview -----

Name of Division -----

Name of Sub location -----

Starting time -----

End time -----

1. Sex

Male []

Female []

2. Age (Age bracket in years)

18 – 25 []

26 – 35 []

36 – 45 []

46 – 55 []

56 – 66 []



3. Education level

Secondary

College

University

4. How many slaughterhouses are in the metropolis?

5. Explain the structure of the organization and the responsibilities that are related to the slaughterhouse

6. Explain the policies and the processes that are related with meat hygiene in the slaughterhouse

7. How do you check the movement of animals from farms, market, and homes to the slaughterhouse? Probe for the hygienic aspect

8. Please share your experience with regards to the level of hygiene knowledge, attitude and practices applied in the slaughterhouse by the workers?

9. Please give some account of Common beliefs and practices of the slaughterhouse butchers that influence their hygienic knowledge practices?

10. Give some challenges faced by slaughter house workers in complying with standard hygienic practices in meat preparation?



FOCUS GROUP DISCUSSIONS (BUTCHERS)

Interview schedule on Hygiene Knowledge, Attitude and Practices of Slaughter House Workers in Tamale Metropolis.

Introduce yourself to the respondent

Explain the purpose of the interview briefly.

Assure the respondent on confidentiality and that this data is only for the purpose of learning and no names will be in the interview schedule but only codes.

Ask the respondent to give you signed consent to proceed

Interview schedule code number -----

Date of interview -----

Name of Division -----

Name of Sub location -----

Starting time -----

End time -----

11. Sex

Male []

Female []

12. Age (Age bracket in years)

18 – 25 []

26 – 35 []

36 – 45 []

46 – 55 []

56 – 66 []



13. Education level

- Secondary
- College
- University

1. Do you follow tradition/customs in the killing and processing of animals?

Yes No

2. If yes what traditions are followed when:

Slaughtering.....

Evisceration.....

Processing.....

Cleaning/washing.....

Cutting meat
.....

3. Do you follow these traditions all the time? Yes No

4. Do you think some of these traditions compromise meat quality? Yes No

5. If Yes which of the traditions?
.....

6. Are you willing to change/ abandon the traditional practice if a new method/approach is introduced? Yes No

7. If No Why?



.....

8. Give some challenges faced by slaughter house workers in complying with standard hygienic practices in meat preparation?

