KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

COLLEGE OF SCIENCE



# AN ASSESSMENT OF THE SANITARY CONDITIONS OF SLAUGHTER HOUSES IN GHANA: A CASE STUDY OF THE TULAKU SLAUGHTER HOUSE IN THE ASHAIMAN MUNICIPALITY

A THESIS SUBMITTED TO THE DEPARTMENT OF THEORETICAL AND APPLIED BIOLOGY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE (ENVIRONMENTAL SCIENCE)

BY

FRANCIS OFOSU-KORANTENG

# CHAPTER 1

# INTRODUCTION

## 1.1 Background to the Study

A slaughterhouse, alternatively known as an abattoir, is a place where animals are killed to provide food. It may also be defined as any premise that is used for the slaughter of animals whose meat is intended for human consumption. The slaughtering of animals for human consumption is important in most nations of the world and dates back to the ancient times (Bello and Oyedemi, 2009). Public slaughter houses can be traced to the Roman civilization and in France by the 15th and 16th centuries, and were among the public facilities. In Italy, a law from 1890 stipulated 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 Rumania (Jode, *et al*., 1996). The most commonly killed animals for food are cattle, sheep, pigs, goats, and fowl, for poultry meat.

The practice of slaughtering livestock (whether cattle, goat or sheep) and its resultant meat supply also provides very useful by-products such as skin and leather. By 2007, the latest year for which comparable statistics is available, world meat consumption had risen from as low as 70 metric tonnes in 1961, to a whopping 268 metric tonnes in 2007. During that same period, the amount of meat consumped worldwide per each individual increased from 22 kg to a staggering 40 kg annually (The Economist, 2012).

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 any time in our history, people are consuming more meat. This calls for global and national effort towards ensuring that the meat processing medium is adequate to ensure that meat that leaves the slaughtering houses is wholesome, uncontaminated and right for human consumption. It is absolutely 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 proper hygiene practices are steps that can be taken to control the chances for meat contamination (Desenclos *et al*., 1996).

Abattoirs or slaughterhouses exist primarily to provide the appropriate environment for slaughtering livestock and controlling waste spill. According to Alonge (1991), an abattoir or slaughterhouse is a premise approved and registered by the controlling authority for hygienic slaughtering and inspection of animals, processing, effective preservation and storage of meat products for human consumption.

The Ghana Food and Drugs Authority (FDA) describes an abattoir as a facility/ place that is approved and registered for slaughtering and dressing of animals for human consumption (FDA/APBD/CP-SH/2013/08). The FDA further requires any facility being used as an abattoir should have equipment for slaughtering, holding, processing, storing and distributing the carcass.

These guidelines indicate a number of issues to ensure that meat is wholesome for human consumption;

- slaughtering of livestock should take place in a facility that has been duly registered by the authority/agency that is mandated to do so
- slaughtering of livestock should be done under hygienic conditions as inspected and approved by the controlling authority
- the facility should contain all the appropriate equipment for the various stages of livestock processing.

These are the guidelines that are deemed appropriate by the regulating authority as that which will ensure that wholesome meat is produced for human consumption under acceptable hygienic conditions and practices**.**

## 1.2 Statement of the Problem

The FDA guideline FDA/APBD/CP-SH/2013/08 is one of many guidelines, laws and regulations for the operation of slaughter houses in Ghana. These regulations provide the criteria for maintaining minimum standards at the abattoirs based upon which the abattoirs will be inspected and certified. These minimum standards cover the following:

- Sanitary conditions of the abattoir
- State and nature of infrastructure to include but not limited to equipment, source of water and the regularity of supply , the drainage system in place and how effluent is discharged
- Personnel – health certification and neatness of uniform. In addition the manager or assistant should have been trained in a formal institution on food safety
- Type, state and availability of storage and transportation facilities of the abattoir

- The number of Veterinary Assistants available at post and records on both pre-slaughter of the animal and post-slaughter carcass inspections.

These guidelines are critical to protecting human lives and avoiding the spread of any infection that might be due to the consumption of meat slaughtered under unhygienic conditions. A number of negative consequences may occur if such guidelines are not adhered to. As Meadows (1995) describes it, livestock waste spills for example, can introduce enteric pathogens and excess nutrients into surface waters and contaminate ground waters. This assertion by Meadows (1995) is one reason why there is the need for regulations to properly dispose of such spills.

The slaughtering activities of slaughter houses generate organic waste that have relatively high levels of suspended solid, liquid and fat. The solid waste includes condemned meat, undigested ingesta, bones, horns, hairs and aborted fetuses. The liquid waste is usually composed of dissolved solids, blood, gut contents, urine and water. Animal food is always microbiologically contaminated by organisms living in it naturally or entering it from the surrounding, such as those resulting from processing operations (Lewicki, 1993). This presents a serious risk to consumers if the meat is not treated adequately before consumption. In addition, meat products often undergo prolonged storage periods, and there is a high risk of massive spoilage or food-poisoning bacteria growth if prior care is not taken in hygienic handling of the meat.

In Ghana, the putting into practice of these guidelines leaves much to be desired. Meat is seen being sold in the open market without much consideration to any of the guidelines that calls for proper storage of slaughtered animals.

The slaughtering of animals takes place in very dilapidated structures under very unwholesome environmental conditions and there is hardly any monitoring of the equipment that is used and the slaughtering processes.

### 1.3 Justification of the study

Any study on the sanitary conditions of Ghana's abattoirs is very critical, considering that meat has become a major component of the daily food consumption of the average Ghanaian. Adherence to the approved sanitary practices and hygienic conditions is important to avoid the consumption of unwholesome and contaminated meat by the thousands of Ghanaians who eat meat every day. Consuming wholesome meat is critical in avoiding all kinds of food poisoning that may result from consuming contaminated meat.

The choice of study area for this research work was also critical because meat from this slaughter house is sold on markets all over the Accra metropolis and Tema metropolis.

Nsawam, Nkawkaw, Koforidua and Suhum are communities outside the Greater Accra Region where meat from this slaughter house is sold. Considering the possibility of meat from this slaughter house being consumed by any individual in any part of the country (as seen in the dispersed nature of patronizing markets) it is important that meat from this slaughter house is produced under sanitary conditions to avoid possible food contamination or food poisoning and infections. To ensure this, the study sought to provide the basis for proper and strict implementation of Ghana's occupational health and safety laws and guidelines at the Tulaku slaughterhouse and at the same time provide the opportunity for workers and stakeholders at the

site to identify their specific and respective roles in health and safety and how this can be brought to bear towards improving and ensuring improved sanitary conditions at the facility. The research will also provide recommendations that can be adopted by the facility's controlling authorities to inform their strategies in implementation of health and safety guidelines at the abattoir.

The findings of this research work will serve as a reference material for government agencies and departments responsible for formulating health and sanitary policies on Ghana's abattoirs. The research will also serve as a basis for further research and study into the general sanitary conditions in Ghana's abattoirs and bring to bare the awareness that is required to ensure the much needed corrective actions and commitment towards ensuring appropriate operations of abattoirs in Ghana.

## 1.4 Objectives of the study

The study sought to find out the extent to which the slaughter house adheres to the guidelines relating to the operations of abattoirs/slaughter houses in Ghana.

### 1.4.1 Specific Objectives:

- Assess the current conditions of infrastructure and sanitary conditions of the Tulaku slaughter house and the possible implications on public health
- Assess the extent of adherence of Tulaku slaughter house to the guidelines for the regulation of abattoirs and slaughter slabs in Ghana in its operations
- Identify possible microbial contamination of the meat produced from the facility.
- Identify possible microbial contamination of the water used for cleaning purposes at the facility.

## 1.5 Research Questions

In order to achieve the objectives of the study, the researcher will be guided by a number of research questions which include but not limited to the following.

- What is the current state of infrastructure and sanitation at the slaughter house?
- How does it impact on public health
- What are the laws guiding the operations of the slaughter house
- Who is responsible for ensuring that the laws guiding the operations of the slaughter house are adhered to?
- How effective has the implementation of these laws been so far?
- What factors have affected the implementation of these laws
- What can or must be done differently

Respondents will include the officials in-charge at the regulatory authority (FDA), some butchers and consumers who patronize meat products from the slaughter house to be used for this research work.

## 1.6 Limitations of the Study

Firstly, as is anticipated, the staff and respondents at the slaughterhouse may be skeptical as to how the researcher might use the information gathered from them. Thus some amount information may be withheld from the researcher. This might pose some limitation to this research work.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Sanitation in the slaughter house

Sanitation may be defined as the process involved in the ensuring good health by means of preventing human contact with the hazards of wastes. Such hazards can be physical, microbiological, biological or chemical agents of disease (Hui *et al., 2003*). The major goal for the food processing industries is to provide safe, wholesome and acceptable food to the consumer and control of microorganisms is essential to meet this objective (Baggen-Ravn *et al*., 2003). In line with this, a slaughterhouse should be designed to ensure the flow of operations from the live animal holding area through to discharge areas. Meat products should, therefore, proceed progressively through cleaner areas of the operation, without backtracking to areas where the product was previously handled. Edible and inedible areas must be physically and operationally separate. Separation of raw and cooked products must be maintained throughout the plant. In planning a plant, provisions for expansion should not disrupt the flow of operations or interfere with efficient processing. Primarily there are several key factors that a slaughter house should observe to be able to satisfy the necessary conditions which will contribute to adequate sanitation for the prevention of contamination.

## 2.2 Infrastructure and planning of the slaughter house

### 2.2.1 Preparation and contents

Where possible, a competent architect, engineer, or other person experienced in slaughterhouse design should be employed to prepare drawings and specifications.

Drawings must be to scale and include the following:

a) A plot plan showing the boundaries of the plant property; location of the plant in respect to other buildings or structures; streets; driveways and parking sites including drainage systems and surfacing materials (e.g. gravel, pavement etc.); railway lines; sewer lines; potable water sources (e.g. wells); gas and water mains; and power lines. The scale and the north point should be shown;

b) A floor plan of each level of the plant, showing the purpose for which each room is to be used, location of walls, partitions, windows, doors, posts, conveyor rails and all equipment on the floor or in an elevated position, (e.g. draw-off fans, refrigeration units), hose bibs, sanitizers and hand wash stations;

c) A floor plan showing location and size of floor drains, location and size of direct drains for pieces of equipment using large amounts of water; curbing, gutters and slope of floor towards drains and the hot and cold water outlets;

d) The exterior elevations of the building, showing doors, windows, and platforms;

e) A cross section of the plant showing ceiling heights;

f) A roof plan showing skylights, vents, drainage and other pertinent information;

g) A schedule of room "finishes" must be on or attached to the plans, including a schedule of door sizes, construction and type of door frame; lighting intensity for each room;

h) An equipment layout with accompanying "flow charts" of operations. The design and construction of the equipment must be shown and, where necessary, cross-sections provided to show method of construction and operation;

i) Where the plans refer to alterations or changes within an existing plant, sufficient description should be made of the surrounding rooms as well as those above and below. Copies of plans of the existing layout and construction should be attached to explain the nature, extent, and effect of proposed changes (Critical Design, Operational and Equipment Guidelines for Licensed Abattoirs, 2012).



### 2.2.2 Site of Building

Ideally the slaughterhouse should be located away from residential areas to prevent possible inconvenience to dwelling-places either by way of pollution from slaughter wastes or by way of nuisance from noise (FAO, 1985). There must be free access for animals to the site by road and the slaughterhouse should be situated in areas where flooding is unlikely to happen. If the slaughterhouse is of regular buildings construction the ground should be free of bushes or vegetation in the vicinity of the structure (FAO, 1985).

### 2.2.3 Size

The number of animals to be slaughtered should take into account the size of slaughter facility and the number of animals to be slaughtered is of great importance to avoid sanitary problems due to overcrowding (Tove, 1985).

### 2.2.4 Building / facility

The buildings or facilities involved in such processes are normally described as places which stand for good sanitation and hygiene. According to international norms, such buildings should normally have clean and unclean processes separated (Eriksen, 1978). Walls and ceilings must be smooth, level, hard and consist of impervious material such as accepted prefabricated panels

and, glazed tile, and free from pitting, indentations, cracks, crevices and ledges. All corners and junctions of walls and floors must be coved in kill floor, coolers, condemned and processing areas, and other areas subject to frequent cleaning and moisture. Ceilings should be at least 3.3m in height. Ceilings of rooms intended for livestock receiving, slaughtering and dressing should be at least 4.8m in height. All mortar joints must be smooth and flush. Scoring cement plaster walls should be discouraged. To promote light reflection and sanitation, wall and ceiling surfaces should be white or light-coloured. Whenever practical, materials that do not require painting should be used. Materials that are absorbent and difficult to keep clean must not be used. Examples of unacceptable materials include wood, plasterboard and porous acoustic-type boards. Walls should be provided with suitable sanitary-type bumpers or sloped curbs to protect them from damage by hand trucks or lifters (Critical Design, Operational and Equipment Guidelines for Licensed Abattoirs, 2012).

### 2.2.5 Walls and Floors

The flooring of the facility which is one of the major sources of contamination must be hard, free of cracks, evenly leveled and impervious, and sloping adequately towards a drain to allow cleaning with water and disinfection. The walls as well must be smooth enough to be easily cleaned by water, and recommended materials are, for instance, stone, lava blocks, bricks or concrete. To provide shade, a good environment and finally to keep down the internal temperature in the slaughter line, a roof made up of concrete would be ideal (Eriksen, 1978).

### 2.2.6 Lighting system

As a matter of hygiene, the slaughterhouse should have a proper lighting system inside the slaughter line to allow proper functioning and avoid accidents, moreover will act as a deterrent to insects and rodents (Critical Design, Operational and Equipment Guidelines for Licensed Abattoirs, 2012).



### 2.2.7 Ventilation system

The internal temperature inside the slaughter house shall be maintained to prevent proliferation of unwanted microorganisms and also to cater for a good working environment. Ventilation must be as appropriate as possible to reduce the atmospheric microbial load and to prevent stuffiness in the facility which can induce sweating and sneezing (Critical Design, Operational and Equipment Guidelines for Licensed Abattoirs, 2012).

### 2.2.8 Equipment

Equipment for undergoing such process, normally have to follow certain norms and regulations, it has been reported that such equipments have to be of non-corrosive materials, for example stainless steel (Tove, 1985). Structures like tables, hooks and machines should be positioned such that, they will be easy to relocate to facilitate cleaning and disinfection. The key step for the hygienic handling of carcasses is the equipment for elevating the carcass when slaughtered. In the processing line, cranes are preferred to working tables due to hygienic practices. Procedures that provide for the regular cleaning of hoists should be implemented and should be adhered to. However, the cleaning and disinfection is usually complicated or simply impossible because of

the complexity of the machines that may be involved (Tove, 1985). Due to this, equipments that may be easily unassembled for easy relocation are preferred.

### 2.2.9 Water supply

Water is a vehicle for the transmission of several agents of disease and continues to cause significant outbreaks of disease in developed and developing countries (Kirby and Carl, 2003); several instances were purported to have been affiliated with poor quality water. For example;

- cholera epidemic in Jerusalem in 1970 was traced back to the consumption of salad vegetables which were irrigated with raw waste water (Shuval *et al.*, 1986).
- in Canada, an outbreak of *E. coli* was reported (Kondro, 2000) and
- in the USA, Cryptosporidium affected approximately 400,000 consumers and caused 45 deaths in 1993 due to the consumption of contaminated water (Kramer *et al.,* 1996, Hoxie *et al.,* 1997).

Since slaughtering is a process which generates a lot of wastes, to cater for the good running of the processes and minimize contamination, there should be a good supply of water of drinking quality to allow processing and cleaning procedures which will ensure hygienic quality products. Working routines should be planned in such a way as to economically use the consumption of water because of waste water disposal (Kirby *et al.,* 2003). It is also important to ensure that water storage vessels are properly covered, and cleaned regularly to maintain the water in a potable state.

### 2.2.10. Sanitary facilities

Several water points, sterilizers for hand tools, hoses and cleaning equipment are the keys to providing a good standard of hygiene and these must be sufficiently provided.

The availability of hot water in preference to chemical disinfectants should be emphasized. The facility should also be supplied with sterilizers and hand sanitizers wherever possible (Adler 1999). Sanitary facilities must also include an adequate number of toilets and arrangements for changing of clothes, hand-washing and even for bathing (showering). Such facilities must be clean and well-kept at all times and the toilets should possess hand wash basins along with soap, disinfectants, antiseptics, nailbrushes and clean towels readily available. A mess room for resting and eating should be provided for the staff. This room should be separated from the processing line to assure that the carcasses and the food for the personnel cannot be mixed (FAO, 1985).

### 2.2.11 Environmental hygiene

As in all sectors of hygiene, the external and internal environment of the slaughter house should be protected against any infestation. Insects, birds and rodents have been recognized as important carriers of pathogens and other microorganisms (Olsen and Hammack, 2000). To avoid these, a strict control should be exerted over the following:

**a) Pests control**

Good Hygienic Practices (GMP) should be employed to avoid generating an environment favourable to pests. Pest control system for pest must include the following:

- Good Hygienic Practices should be used to avoid creating an environment conducive to pests.
- Pest control programmes could include preventing access to principal site, eliminating harborage and establishing monitoring detection and eradication systems.

- Physical, chemical and biological agents should be properly applied by suitably qualified personnel (CAC, 1997b).

**b) Proper fencing**

Insects, birds and rodents have been recognized as important carriers of pathogens and other microorganisms (Urban and Broce, 2000). In one interesting case a Salmonella outbreak was traced back to amphibians, which had accidentally entered a production facility (Parish, 1998).

The aim is to prevent access of unauthorized persons, the public in general, dogs and other animals around the slaughterhouse premises. The fencing should have direct contact with the ground and should be sufficiently high to prevent access into the premises (Urban and Broce, 2000).

**c) Bird control**

Allowing birds to fly inside the slaughter house might cause contamination through its droppings. Birds are often attracted by food supplies, water, special vegetation around buildings, and these attractions should be removed. (Fenlon, 1983) demonstrated that some aquatic birds spread for Salmonella and other human pathogens in the environment.

The best control is to prevent them from accessing the buildings by placing nets on the openings and windows.

**d) Slaughtering Processing**

The hallmark for hygiene principle in processing is that the procedures considered as clean and unclean should be efficiently separated. This requires a well-structured plant layout, where the

purpose of any structure should be the protection of the end product against accidental contamination (CAC, 1997a).

**e) Transportation**

The animals are hauled from pastures or farms to the slaughterhouse. All necessary precautions during transportation should be considered to minimize stress and injury to the animals. This is important because when animals are injured prior to their slaughter, they may grow sick and this can result in an unplanned death. Also when animals are stressed, it is observed that their meat is usually of less quality as compared to when they are well rested and relaxed before slaughter (Tove, 1985). Road transport is probably cheaper and more convenient means for conveying animals. Below are some precautions that are worthwhile noting during road transportation of the animals to slaughter:

- The transport facility should be designed and modified to convey the stock;
- They should provide for sufficient ventilation and lighting;
- For open trucks the top should be covered with a tarpaulin to protect the animals from bad weather conditions,
- They should be equipped with appropriate loading and unloading mechanisms to prevent injuries, and most importantly;
- They should be as comfortable as possible for the animals (Tove, 1985).

Containers, pumps or tanks used for holding or transporting unprocessed raw materials, have occasionally been used for processed products without any cleaning and disinfection (Morgan *et al*.1993, Evans *et al*., 1998, Hennessy *et al.,* 1996, Llewellyn *et al.,* 1998). It is therefore necessary that all equipments in the slaughter house, that come in contact with food, should be

fashioned in such a way as to ensure adequate cleaning, disinfection and proper maintenance to avoid contamination (CAC 1997a)

**f) Lairage**

Lairage is a place where livestock are kept temporarily (Critical Design, Operational and Equipment Guidelines for Licensed Abattoirs, 2012). This is a specific area inside the premises of a slaughter house where the animals are conveyed for rest. Rest is an important factor because when animals are stressed, carcasses of lower quality result from slaughter. There should be sufficient space for the animals and a good supply of potable water for drinking purposes. A washing system where the animals can be cleaned before passing to the slaughter house is generally recommended (FAO 1985).

## 2.3 Common methods for stunning

Stunning refers to the process of causing animals to become immobile or to render them unconscious, without killing the animal. This is usually done before the animal is slaughtered for food (Tordrup and Kjeldsen, 1994).

a. Captive Bolt Pistol (CBP)

- This stunning method is extensively used for all agrarian animals. Gun powder (cartridge), compressed air and spring under tension, propels the bolt through the skull of animals. The name captive means that the bolt is shot out of the barrel but remains in the pistol (Tordrup and Kjeldsen, 1994).
- Concussion stunning: A mechanically operated instrument which delivers a blow to the brain. Used for cattle, sheep and calves. Another method which consisted of knocking or

striking a hammer on the head of the animal is now banned with regards to humane practices in some countries (Nigel, 2002).

- Free bullets: are generally used on animals which are difficult to handle for instance, wild pigs, bison and deer.

b. Electric Stunning

c. Head-Only Stunning: generally cattle, sheep and pigs are all stunned by the use of this method. The technique involves the application an electric shock using a pair of tongs on either side of the animals head. An electric current is passed through the brain and this leads to the temporary loss of consciousness (Daly *et al.*, 1986).



### 2.4 Slaughtering and Bleeding

After stunning, the animal is vertically hanged lifting the animal (head down) to a convenient height. The bleeding operation is made by inserting a knife through the neck behind the jaw bone and below the first neck bone. The aim is to sever the carotid artery and jugular vein and let the blood to drain out. The exsanguination process should be as fast and complete as possible due to hygienic norms since insufficient bleeding and slow death could result in blood clotting in the deep tissues and this might be hazardous in the later stages of slaughtering. Elevation bleeding is more hygienic and is preferred to other alternatives. This is because it reduces the risk of contaminating the carcass (Laurie, 1992).


Fig. 1.0 Elevation Bleeding.
Source :http://siteresources.worldbank.org/INTUSWM/Resources/463617205264154387/Marlow2.pdf

This process is usually separated from the operations which will follow. If the blood is not intended for use it should be drained away into a separate pit and should not be allowed to drain into the waste water (Tove, 1985).

**2.5 Skinning (dehairing)**

This is the process of carefully removing the skin of animals. Although the process may vary according to the animal (pigs, cattle, sheep or goat), the process follows a similar procedure. Cutting of the skin is made around the leg with the aim of exposing and loosening the tendon of the animal's lower leg joint to be used for hanging the carcass. After this the entire skin is removed and the body is prepared for evisceration (Small and Buncic, 2009). This process is usually meant for cattle, goat, deer and sheep.

Dehairing is a process normally done in the slaughter of pigs. It consists of releasing the bled animal into a pool of boiling water for a couple of minutes and then pulling it out for removal of the hairs before proceeding for evisceration.

### 2.6 Evisceration

Evisceration is the process which consists of removing the internal organs of the abdominal and thoracic cavities. The internal organs are also known as offal and they fall into two categories:

- Red offal such as the heart, liver and lungs (pluck).
- Grey offal such as the stomach or intestine (paunch).

To avoid contamination of the carcass through accidental punctures of the intestines and stomach, it is important that the carcass is placed in the hanging position.

The body cavity is severed and the intestinal mass and the stomach (the paunch) are pushed slightly out. The liver is held out carefully during this process. This is to prevent an accidental release of the bile content onto the carcass and as such spoil the taste of the meat. The last stage in evisceration is the removal of the contents from the chest cavity. By cutting the diaphragm which separates the thoracic cavity from the abdominal cavity, the pluck can be pulled out as a single unit (Tove, 1985). Leakage from the rectum is prevented by tying the anus with a process called bagging.

### 2.7 Splitting and trimming

The carcass is cut down along the backbone and split into two halves using a brisket saw and is then subjected to inspection from an authorized officer for detection of diseases. Trimming is a process that should be performed by trained employees and consists of the removal of visible

contamination. All equipment (hooks and knives) should be sanitized between each use to reduce cross-contamination between areas (Reij *et al.*, 2003). Carcasses which have been railed out for visible contamination, such as fecal contamination, should be re-conditioned as quickly as possible to get the carcass through the process and back into the system (CAC 1997a).

### 2.8 Delivery

After undergoing all processes in the slaughter line, the carcass is weighed and finally labeled for identification and sent for delivery on the local markets.

### 2.9 Precautions that have to be maintained during slaughtering

a) Disinfection on entering the premises

Every time an authorized officer or member of staff is to enter the slaughter house, he should undergo a process of disinfection by dipping his boots in a footbath, which is a basin situated at each entrance of the slaughter line, to avoid carrying infectious agents that might stick to the boots via soil particles (Adler 1999).

b) Bleeding and exsanguinations

The knife used to slaughter each animal should be cleaned and rinsed in hot water. It is known that a contaminated knife can pass on bacteria into the animal tissues during the initial stages of bleeding, that is, when the heart is still beating (Reij *et al*., 2003).

c) Skinning

Knife skinning and the use of bare hands can similarly hosts contaminating organisms on the surface of the carcass.

As such washing of the hands is a must after the passage of each carcass to avoid contamination of same (Reij *et al.*, 2003).

d) Evisceration

Extreme care should be taken not to puncture the intestines. The slaughtermen should follow the procedure of tying the end part of the intestine and the severed end of the esophagus, then removing intestine and stomach first, followed by the pluck (heart, liver, and lungs of an animal used as meat (FAO, 1985). The pluck should be hung on a hook while the paunch (stomach) should be dropped in a paunch container. As a matter of hygiene, the stomach and intestines should not be processed while carcass dressing is in operation as any minor splash from same can easily cause contamination of the meat.

e) Washing

It is the process by which the carcasses undergo washing with clean potable water. If water is a problem then a dry slaughter process by trained slaughter men should be used as alternative as it is more appropriate as a safety measure for carcasses to be dry clean than to contaminate them with polluted water (Odeyemi, 1991).

f) Offal handling

The offals (stomach and intestines) are the organs from the carcass which contain the greatest load of infectious organisms and for preventive measure must be moved to a separated chamber provided for them. At first they should be emptied of their contents, dried, and then cleansed with water.

g) Personnel

The personal hygiene of the workers is a primordial factor in slaughtering operations. The reason is simply that, contamination of food and disease transmission, depend upon the human factor as well as on the tools and mode of operation. Transfer of microorganisms by personnel particularly

from hands is of vital importance (Bloomfield, 2003). During handling, bacteria are transferred from contaminated hands of workers to the food and subsequently to other surfaces (Montville *et al*., 2001). Low doses of infectious organisms such as *Shigella* and pathogenic *Escherichia coli* have been linked to hands as a source of contamination (Snyder, 1998). Poor hygiene, particularly deficient or absence of hand washing has been identified as the causative mode of transmission. Proper hand washing and disinfection has been recognized as one of the most effective ways to control the spread of pathogens, especially when considered along with the restriction of sick workers (Montville *et al*., 2002). Moreover persons with unhygienic habits 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 into the premises during the time of slaughter. All personnel that are allowed access should also be dressed in the appropriate personal protective clothing, e.g. clean trousers and wearing appropriate waterproof aprons. Boots should be worn with the trousers neatly folded inside (fig 2). The hallmark is that the workers must strictly abide to a formal code of hygiene.

Fig 2: Staff of a slaughterhouse dressed in personal protective clothing. Source: http://siteresources.worldbank.org/INTUSWM/Resources/463617-1205264154387/Marlow2.pdf

h) Hand-washing

As stated by the Centers for Disease Control and Prevention: "It is well-documented that one of the most important measures for preventing the spread of pathogens is effective hand washing (Montville *et al*., 2002). Fundamentally the good habit of careful and frequent hand-washing will definitely reduce contamination. Therefore hand-washing facilities with sufficient water supply must always be provided for use by the workers. Basically the mess room and the working area is where there should be several hand-washing points. If it is situated away from working places, the risk that they will not be used is higher and would probably result in contamination of the meat (Tove, 1985).

It is important that members of staff wash their hands regularly, especially;

- before they begin the slaughtering of animals,

- after visiting to the toilets
- after coming into contact with dirty objects and materials
- after smoking and eating

The staff should understand that the hands are prone to contamination if used for scratching the skin, the hair, clothes and picking the nose. Such acts may cause bacteria to be transmitted to the hands and thereafter infect the meat which is handled by the same hands. The management of slaughter house should provide antiseptic soap or germicidal, coupled with the use of brush for washing of hands since bacteria are often under the nails (FAO, 1985).

i) Cleaning Operations

For the purpose of sanitation clean water is usually required for the cleaning of equipment, tools floors and walls. Such operation normally starts with the removal of solid waste of meat and fat trimmings and pieces of bones from the area. Blood clots and other waste materials on the floor may be dealt with by scrubbing them off the floor. High pressure water cleaning begins from the walls and finally ends with the floors. Hot water hosing under pressure would be ideal for removing sticky waste from corners and drains. For scrubbing of other surfaces such as tables, and tools, the use of hard fibre brushes and detergents is suggested. Liquid detergents are more effectual than ordinary 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. Knives also should be sterilized or boiled in water (FAO, 1985).

## 2.10. Waste Management

The easiest disposal method is to divert effluents into existing pools, rivers or lakes. However, this method cannot be recommended in view of the consequent contamination of water sources for humans, and domestic and wild animals. For the safe disposal of liquid and solid waste, the following action should be taken:



- Separation of blood
- Screening of solids
- Trapping of grease

a. The blood from slaughtered animals will coagulate into a solid mass, which may block up both open and closed drains. It is therefore recommended that the blood is collected and used for human consumption, stock feed production or fertilizers, if the religious and cultural traditions allow the use of blood.
b. Solids (meat or skin trimmings, hair, pieces of bones, hooves, etc.) must be screened. This may be done by providing the drains with vertical sieves.
c. Effluents from slaughterhouses always contain small amounts of fat (melted fat or small pieces of fatty tissues). Grease traps should be installed in the drains. The fat solidifies, rises to the surface and can be removed regularly (Ockerman and Hansen 2000)

## 2.11 Diseases Associated With Unhygienic Slaughtering

There are many different ways by which an infectious organism can make its way through the slaughtering process of animals and cause very subsequent diseases. Below are some of the common diseases related to slaughter houses:

**a) Anthrax**

Anthrax is a naturally-occurring bacterial disease of animals caused by *Bacillus anthracis*, which forms spores that generally survive for years in the environment. Cattle, sheep, and goats are at the highest risk but humans can also contract the disease. Most animals are infected by oral ingestion of soil contaminated with the spores. People may acquire anthrax when they come in contact with infected hides or hair of animals. The organism is inhaled from contaminated dust, or eaten in undercooked meat from infected animals. It may also penetrate any exposed wound on the skin. Animals that died of anthrax may have blood secreted from the mouth, nose, and anus (Kirby *et al*., 2003). During the slaughtering process, the bacteria can be transferred from hides of infected animals to the hides of the healthy ones during the immediate pre-slaughter phase in lairage (Small and Buncic 2009). As such if no particular precaution is taken when removing the hides, the probability of contaminating the carcass is very high.

**b) Brucellosis**

Brucellosis is an infectious disease caused by contact with animals carrying bacteria called Brucella which affects a wide variety of animals including dogs, cattle, pigs, sheep, goats and horses. The disease has been known as Malta fever, Bang's disease, Mediterranean fever, rock fever, and goat fever (Goldman and Salata, 2007). Humans can be infected if they come into contact with infected meat or placenta of infected animals. The slaughter of a diseased animal is a threat since contamination may result if, for instance, blood from the infected carcass came into contact with the knife of the slaughter-man and the same knife is used for processing another uninfected carcass

during the slaughtering. In case of ingestion of infected meat, symptoms in humans are undulating fever, headache, joint pain, weakness, and night sweats (Nørrung *et al*., 2009). People who handle meat should wear personal protective gear such as protective glasses and clothing for protection of wounds from infection. Detecting infected animals prior to slaughter controls the infection at its source. Vaccination is actually available for cattle, but not humans (Goldman and Salata, 2007).



**c) *Escherichia coli***

*Escherichia coli* are bacteria which are normally found as normal flora in the intestines of man and animals. One can get infected after handling or being exposed to faeces of a carrier animal (Buncic and Avery, 1998). Animals usually carry the bacteria without being symptomatic to its effects. However, when humans are infected, the toxins cause serious illness which ranges from diarrhoea to kidney failure. Personal hygiene is very important, particularly after contact with animal faeces, since very few organisms are required to cause infection in humans (Buncic, *et al*., 2009).

E-coli can easily contaminate the carcass in the slaughtering process if;

- the workers do not wash their hands after visiting the toilet, the bacteria will be transferred when handling the meat.
- care is not taken at the evisceration step when disemboweling the carcass, as such if the intestines get perforated and intestinal matter comes into contact with the meat (Buncic, 2006)

Prevention focuses on hand washing and proper hygiene. Hands and all equipment should be properly disinfected after touching or handling raw meat (Nørrung *et al*., 2009).

**d) Salmonellosis (Gastroenteritis)**

*Salmonella* sp. are bacteria that live in the intestinal tract of carrier animals. The bacteria are shed into the faeces of animals which are particularly stressed during steps such as being yarded and transported (Small *et al*., 2002).

As in *E-coli* contamination, salmonella can be transferred to the carcass in the slaughtering line by:

a. slaughtermen who are handling meat after being to the toilet without proper hand washing,
b. fecal matter being in contact with the meat at the evisceration process, if the anus is not bagged properly, and
c. Also if the intestines get punctured upon removal and intestinal matter is in contact with the meat.

If hands are not properly washed after contact with infected feces, the accidental ingestion of bacteria may occur (Nørrung *et al*., 2009). Infection also occurs as a result of equipments that are unsanitary. Symptoms generally include fever, foul smelling diarrhea, and severe dehydration, especially in young children and infants. Life-threatening diseases like meningitis and septicemia may also occur (Reid *et al*., 2002).

**e) Q-fever (Query fever)**

Q fever is a bacterial infection that can affect the lungs, liver, heart, and other parts of the body. It is found around the world and is caused by the bacteria *Coxiella burnetii* (Jim and Herbert, 1991). The bacteria affects sheep, goats, cattle, dogs, cats, birds and rodents as well as some other animals (Buncic, 2006).

Humans normally acquire fever, night sweats, and pneumonia and hepatitis in the worst cases (Reid *et al*., 2002). Abattoir workers (particularly those dealing with foetuses), veterinarians and farm workers are the people who are most at risk of contracting this disease (Hutchison *et al.,* 2007). In slaughtering, meat can be contaminated in the process of evisceration whereby feaces of contaminated animals have been transferred to the hands of the slaughtermen which in turn contaminates other healthy carcasses. To prevent further spread of Q fever, dead fetuses and reproductive tissues should be buried or burned. Wearing of protective equipment such as gloves and eyewear (PPE) when assisting in birthings and washing of hands thoroughly afterward are highly recommended (Reid *et al*., 2002).

# CHAPTER 3

# MATERIALS AND METHODS

## 3.1 The Study Area

The study area was the Tulaku slaughter house. The Tulaku slaughter house is situated in Ashaiman in the Greater Accra Region.

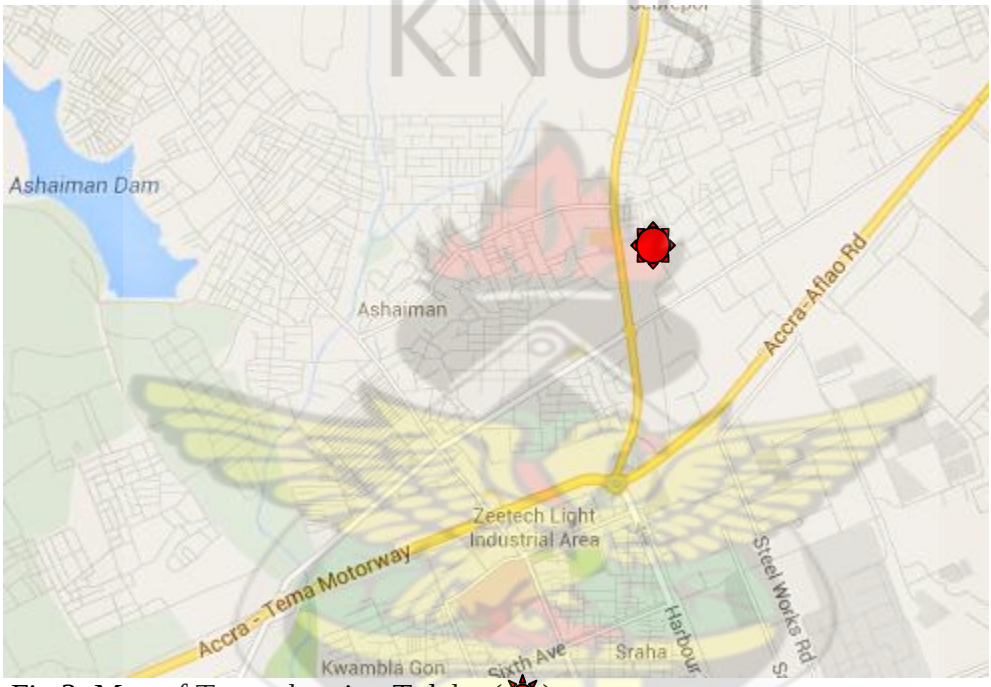


Fig 3: Map of Tema showing Tulaku (✸)
Source: https://maps.google.com.gh/maps

Fig. 4: Map of Ashaiman showing sampling point (✹)
Source: https://maps.google.com.gh/maps

Tulaku cattle market can rightly be described as a regional cattle market or abattoir as it serves the many parts of Accra and Tema as well as Nsawam and other neighboring communities. An untarred road leads into the wood- fenced facility. Two buildings are situated at the entrance of the facility. On the left-hand side, as one approaches the facility, is a hostel for foreign cattle dealers. The other is a block of offices sheltering the Tema Metropolitan Assembly, landlord of the facility. The facility charges Twenty (20) cedis for each cow brought in. One of the offices belongs to the Veterinary Department. The abattoir has six (6) sections;

- A large fenced field for cattle, goats and sheep, demarcated respectively (lairage),

- Slaughtering and bleeding section,
- Skinning section,
- Evisceration section,
- Splitting and trimming section and
- Delivery section.



### 3.2 Sources of Data

The methods used in collecting data for the research were in two categories; primary sources and secondary sources. The primary source comprised interviews, and observations. The secondary source comprised data from books, magazines, journals as well as websites.

### 3.3 Sampling for Laboratory Analysis

Meat products that were ready to leave the facility to consumers were obtained as samples for the laboratory analysis through stratified random sampling technique. The process was repeated six times at two sampling points during the period of the study. Water samples were also collected from the storage vessels aseptically and taken for analysis at the Microbiology laboratory of the Ghana Standards Authority. The process was also repeated at two weeks intervals for an entire period of twelve weeks.

### 3.4 Data Collection Procedure

The descriptive survey design was adopted for this study. A descriptive survey is a study that involves a planned collection of data over a large area for the purpose of making a well-informed description (Oppenheim 1992).

A descriptive survey was selected because it provided more elaborate information of the characteristics, for example behaviors, opinions, abilities, beliefs and knowledge of a particular individual, situation or group (Burns and Grove, 2005). Here, the sanitary conditions at the Tulaku slaughter house was observed using descriptive statistical analysis. The study made use of both qualitative and quantitative tools in analyzing the data gathered through interviews and personal observations.



### 3.5 Research Instruments

#### 3.5.1 Personal Observation

A tour of the Tulaku slaughter house was made to examine the processes involved at various sections of the slaughter house and waste disposal systems among others. Visits were made to the slaughter house to assess its operations and to establish whether its operations conformed to the general code of good practice for abattoirs. Individual observation checklists were used at each section of the facility to identify existing practices. The checklists were divided into two parts. The first part covered the general information on the sections that was being observed. This was common for all the sections of the facility. The second part was designed specifically for each of the sections as the work environment and the activities of the sections were unique to each of them. The questions were based on the literature review and covered two major headings;

1. Infrastructure- This involved observations on the location of the facility, the materials for construction, water supply, sanitary facilities, lairage etc.
2. Practices- This involved observations at the various segments on the activities that are carried out there. For eg. Slaughtering, skinning, evisceration, cleaning activities, etc.

### 3.5.2 Microbial Analysis of meat and water samples.

Samples of the finished products that were being sold to the general consuming public, together with samples of the water that was used in operations at the facility were taken for laboratory analysis. This was done to obtain information on microbial contamination of the meat products when they were bought from the facility. It also provided an idea of the sanitary conditions at the place since water was used to clean all equipments at the place and also used to wash many products coming out of the facility.



**a) Sampling of Meat**

Five hundred grams of the meat was obtained and chopped into sizeable pieces. They were then placed into the zip lock bags and placed in the ice chest. The samples were aseptically conveyed to the microbiology laboratory of the Ghana Standards Authority. The meat samples were analyzed for the presence of *Salmonella sp.*

**b) Sampling of water**

A clean sterile one liter bottle was used to obtain the water sample. The cap of the sterile bottle was removed using one hand whilst holding the container at the base with other hand. The container was completely immersed into the water (lip of bottle first) until the container was approximately twelve inches below surface of water. The end of the bottle was turned open and allowed to fill. The container was removed from the water leaving at least one inch of air space at top of bottle to allow for adequate mixing. The samples were placed in the ice chest and transported to the laboratory.

The samples were aseptically conveyed to the microbiology laboratory of the Ghana Standards Authority. They were then analyzed for *E. coli* and feacal coliforms.

**3.5.3 Laboratory analysis of meat samples**

**a) Test Procedure**

- Twenty five grams of the beef sample was inoculated into 225ml of buffered peptone water. The mixture was then homogenized with the stomacher at the speed of 8000rpm for 2 minutes and then incubated at 37°C ±1°C.
- One tenth of a milliliter of the culture obtained in pre-enrichment was transferred into a tube containing 10 ml of the RVS broth.
- One milliliter of the culture obtained in pre-enrichment were also transferred into a tube containing 10ml of MKTTn broth.
- The inoculated RVS broth was incubated at 41.5°C ±1 °C for 24 ±3 h and the inoculated MKTTn broth was also incubated at 37°C ±1°C for 24 ± 3h.
- The culture obtained after the incubation, was streaked on XLD and BSA agar media, and incubated at 37°C for 24 ± 3hrs
- Pure cultures obtained were used for biochemical and serological confirmation.

The microbiological laboratory follows the policy and procedure documented in the quality manual section ISO 6579-2:2002 (E).

**d) Interpretation of results**

*Salmonella* species /25g Detected or Not detected/25g

The standard used was ISO 6579: 2002

**e) Acceptance Criteria**

Negative and positive controls and media controls were done along each batch of test.

### 3.5.4. Laboratory Analysis of Water for *E. coli.*

Below is the test procedure employed in enumeration of *E. coli* in water sample.

**a) Test procedure**

- Five tubes of double strength (100ml) selective enrichment medium (Lauryl Trptose broth) were inoculated with 100ml of the test sample (water).
- Five tubes of the single/full strength (10ml) liquid selective enrichment medium (Lauryl Trptose broth) are inoculated with 1ml of the test sample.
- Five tubes of the single/full strength (10ml) liquid selective enrichment medium (Lauryl Trptose broth) were inoculated with 1ml of the$10^{1}$ dilution of the test sample.
- Five tubes of the single/full strength (10ml) liquid selective enrichment medium (Lauryl Trptose broth) were inoculated with 1ml of the $10^{-2}$ dilution of the test sample.
- The tubes containing the double strength selective enrichment medium were incubated at 37°C ±1 °C for 24 ±3 h.
- The tubes containing the single strength medium were also incubated at 37°C ±1 °C for 24 ±3 h
- The tubes were all examined further for gas production or opacity preventing the detection of gas formation.
- An equal number of tubes of the liquid selective medium (EC Broth) were inoculated with the cultures from the tubes of the double strength selective enrichment medium, and

with the cultures from the tubes of the single strength selective enrichment medium in which gas formation or opacity preventing the detection of gas formation were noted.

- The tubes selected from this process are then incubated at 44°C ±1 °C for 48 ±3 h and the tubes were examined for gas formation.
- Another series of tubes containing indole-free peptone water were inoculated with the cultures from the tubes of EC broth in which gas formation or opacity preventing the detection of gas formation were noted.
- The tubes selected for this process were then incubated at 44°C ±1 °C for 48 ±3 h and then 0.5ml of indole reagent was added and mixed well for a minute. The tubes were examined for indole formation (red ring colour formation).
- Tubes showing opacity, cloudiness or gas formation in the liquid selective medium and whose subcultures produced gas in the EC Broth and indole in the presence of water at $44^0$C were considered to contain presumptive *Escherichia coli* in 100ml of the water.
- Pure cultures obtained were used for biochemical and serological confirmation.

**b) Positive and Negative Control of *E. coli***

- Below is the table showing control samples.

Table 2: Positive and Negative control samples for detection of *E. coli*

| CULTURE | LSTB | EC Broth | Indole reagent |
|---|---|---|---|
| *E. coli* | Gas formation | Gas formation | Indole production |
| *S. aureus* | No Gas formation | No Gas formation | No Indole production |

**c) Interpretation of results**

Presumptive *Escherichia coli* was presented as MPN per 100ml of the water

**d) Acceptance Criteria**

Negative and positive controls and media controls were done along each batch of test.

**3.5.5. Laboratory Analysis of Water (Feacal Coliforms).**

**a) Test procedure**

- Five tubes of double strength (100ml) selective enrichment medium (Lauryl Tryptose Broth) were inoculated with 100ml of the test sample (water).
- Five tubes of the single/full strength (10ml) liquid selective enrichment medium (Lauryl Tryptose Broth) were inoculated with 1ml of the test sample.
- Five tubes of the single/full strength liquid selective enrichment medium (Lauryl Tryptose Broth) were inoculated with 1ml of the $10^{-1}$ dilution of the test sample.
- Five tubes of the single/full strength liquid selective enrichment medium (Lauryl Tryptose Broth) were inoculated with 1ml of the $10^{-2}$ dilution of the test sample.
- The tubes containing the double strength selective enrichment medium Lauryl Tryptose Broth) were incubated at $37^0$C for 24h.
- The tubes containing the single strength medium were also incubated at $37^0$C for 24h.
- The tubes were all examined further for gas production or opacity preventing the detection of gas formation.
- An equal number tubes of the confirmation medium (EC Broth) were inoculated with the cultures from the tubes of the double strength selective enrichment medium, and with the

cultures from the tubes of the single strength selective enrichment medium in which gas formation or opacity preventing the detection of gas formation had been noted.

- The tubes selected from this process are then incubated at $37^0$C for another 48h and the tubes were examined for gas formation.
- When the result was obtained, the Most Probable Number of coliforms per milliliter or per gram of the sample was calculated from the number of tubes in the selected series showing the gas formation.
- Pure cultures obtained were used for biochemical and serological confirmation.



**b) Positive and Negative Control**

- Below is the table showing control samples.

Table 3.0: Positive and Negative control samples for detection of feacal coliforms

| CULTURE | LSTB | BGLBB |
|---|---|---|
| *E. coli* | Gas formation | Gas formation |
| *S. aureus* | No Gas formation | No Gas formation |

**c) Interpretation of results**

Results obtained were represented as MPN Index per 100ml of the water

**c) Acceptance Criteria**

Negative and positive controls and media controls were done along each batch of test.

### 3.6 Secondary Sources:

Secondary data refers to data that is collected for some other purposes other than the research in question. Examples of secondary data sources include magazines, encyclopedia, textbooks, journals, internet, websites, newspaper and articles. Secondary data is inexpensive and readily available. Some related shortcomings of secondary data however are that, it may be liable to alterations, it may also not be presented in the preferred state and it may also be from an incorrect source. This study made use of secondary data very extensively in the second chapter.

### 3.7 Problems Encountered

The slaughter house could not provide the researcher with information on how much meat is processed on a yearly basis which is imperative information to be maintained by the administration. The Hausa language was the predominant language at the facility and this occasionally served as a language barrier between the researcher and the working staff. Some of the staff were initially intimidated and unsure as to the effect of the interactions on their employment and this may have influenced the answers they provided.

In a view to avoid biasness from the staff interviewed, several surprise visits had to be effected to confirm the practices and observations made were the normal practices and not a charade. As such the survey lasted for twelve weeks.

### 3.8 Data Analysis

In analyzing the data collected, the responses were classified and summarized on the basis of the information provided by the respondents.

The analysis was done using both qualitative and quantitative tools. With the quantitative tools, tables, percentages, and statistical tools such as graphs, maps, diagrams were used. Microsoft

Excel was used in analyzing the raw data. The qualitative made use of descriptive analysis, visual presentations as well as microbiological analysis.

# CHAPTER 4

# RESULTS AND DISCUSSION

## 4.1. Observations on Infrastructure

The observations pertaining to infrastructure that were made at the facility were tabulated and evaluated. The findings are tabulated below



Table 4.1 Observations of Infrastructure at Various Sections of the Tulaku Slaughter House

| | |
|---|---|
| Site/Location of Facility | 1. The facility is close to residential premises.<br>2. The facility has easy access to roads and transportation<br>3. The area is not a flood prone area. |
| Size | 1. There is adequate space for movement of people and animals<br>2. Liarage facilities were never overcrowded during the study period. |
| Constructional Materials, walls, Floors | 1. Walls were not even throughout the structure<br>2. There was sloping towards the drains<br>3. The roof and walls were not smooth and easy to clean. |
| Ventilation | 1. The facility was not properly enclosed and this provided sufficient ventilation although it presented other challenges |
| Illumination | 1. The facility was very open and allowed sufficient illumination into the working area |

| | |
|---|---|
| Water Supply | 1. The main source of water was from storage tanks (polytanks) as well as an exposed ground reservoir.<br>2. Water was also stored in open drums for immediate use.<br>3. Working routines were planned to ensure economic use of the water available. |
| Sanitary Facilities | 1. There were washing rooms provided for staff but they were not equipped with liquid soaps or hand sanitizers.<br>2. Water was provided for use but the storage vessels were not effectively covered and allowed access to some pests.<br>3. Hot water was not provided to staff at the working areas<br>4. There was no rest room provided for eating or resting for staff. |
| Lairage | 1. There was sufficient space for the animals to rest<br>2. Drinking water was available for the animals whilst being kept at the liarage. |



### 4.1.2. Observations on Practices

The observations pertaining to practices that were conducted at the facility were tabulated and evaluated. The findings are tabulated below

Table 4.2 Observations of Practices at Sections of The Tulaku Slaughter house

| | |
|---|---|
| Transport to and from the facility/ Liarage condition | 1. The animals were not transported to the facility under humane conditions. They were usually overcrowded and the vehicles were often not covered.<br>2. They were also transported away on motor bicycles or tricycles or taxi. These did not provide the right temperature for the animals.<br>3. There were adjustable barriers that were put in place to guide the animals when they arrived.<br>4. The animals were beaten to guide them through the barriers to the various lairage quicker and more effectively. |
| Stunning | 1. No distinguished method of stunning was established as a practice in the facility. |
| Slaughtering | 1. The process was done quickly to reduce blood clotting<br>2. The animals were mostly slaughtered on the ground rather than being elevated |
| Bleeding | 1. The animals were tied on ropes and hung on wooden bars for the exsanguination process<br>2. The process was not adequately separated from the other activities at the working area. |

| | |
|---|---|
| Skinning /dehairing | 1. The process is done at a separate place from the slaughter area<br>2. The place is not adequately shielded from pests and is not cleaned regularly. Bins are not provided at the area to collect the waste. |
| Evisceration | 1. The process is carried out on the floor instead of an elevated position.<br>2. Waste bins are provided at the area to collect waste. |
| Splitting and trimming | 1. There is inspection by the veterinary officer<br>2. The knives used for the process are not cleaned in warm water periodically |
| Disinfection on entering the premises/personal hygiene. | 1. The staff changed into their working gear but this was not always clean or always appropriate (eg worn t-shirt)<br>2. There were no hot baths for cleaning the feet.<br>3. Staff did not have sanitizers or warm water readily available for frequent cleaning and sterilizing of hands and equipments |

| | |
|---|---|
| Pest Control | 1. The facility was never fumigated during the period of study and there were no records on fumigation of the place<br>2. The facility provided cracks and crevices which are ideal hiding places for pests<br>3. The facility was not shielded sufficiently to prevent the entry of pests |
| Waste Management | 1. There were bins provided for waste disposal but these were uncovered.<br>2. The dumpsite for the waste was not significantly distanced from the facility.<br>3. Drains were provided for liquid waste to pass through. |



**4.2 Rating of findings**

The researcher repeated the process with two different observers namely Mr Theophilus Addo from Environmental Protection Agency Mr. William Yirenkyi from Food and Drugs Authority and. The results from the observations (Appendix Table 5) provide the information on the ratings that were deducted from the observation both from table 4.1, as well as from pictorial/visual presentations/observation of the facility (Appendix 2).

The averages obtained from the collective ratings of the observers were put into a graph (Figure 5) below.

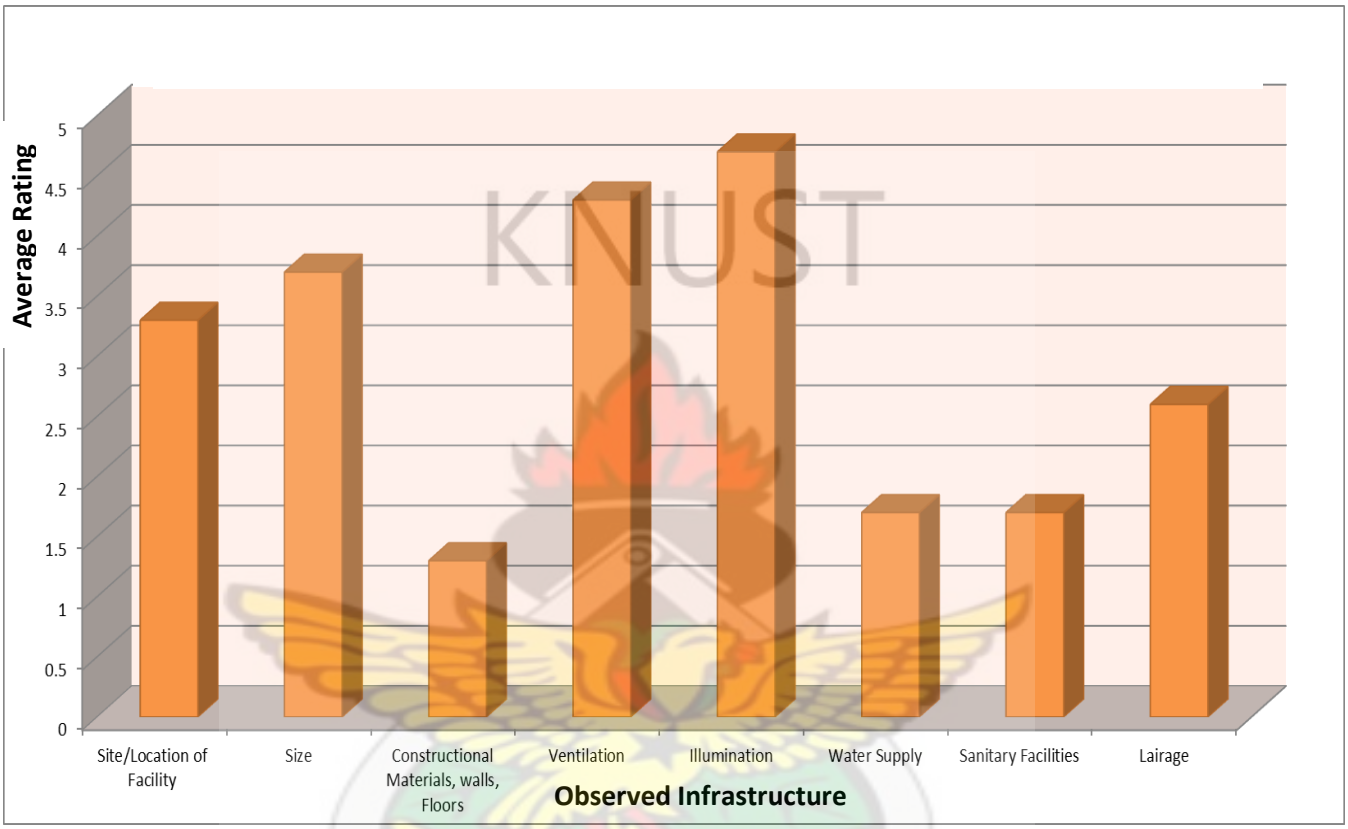


Fig 5: Rating of observations of infrastructure at various sections of the Tulaku abattoir

From Fig 5, it can be observed that the facility had very good illumination and ventilation. This can be attributed to the construction of the facility. The walls of the slaughter area are short (about one meter long) and although this presents other challenges like easy access to pests, it ensures that ventilation is optimum. This design also ensures that illumination at the area is optimum as it allows sunlight to add up to the light produced by fluorescent tubes fixed at the area to produce light. In effect the ambient illumination and ventilation effectively served their purpose throughout the period of study. The size and siting of the facility were very satisfactory.

This could largely be attributed to the demarcation of the cattle market away from residential facilities. As such, all legally constructed buildings are at least 300m from the site. Also, residents around the facility are always cautious when going close to the cattle market. This is because there can be an accident which may result in serious injury to the victims. Because of this risk, people in general do not want to site their places of residence near such facilities and this contributed to the reasonable good location and siting of the facility. From the result, the constructional materials, walls and floors were inadequate. It was realized that from the time of its establishment, the facility had received no major rehabilitation work. This left holes in the floor and the walls, some wooden materials used in the construction were old and weak, whilst others were broken, worn out, dirty or simply inadequate for the purpose of use. The staff also did not exhibit good maintenance culture and this also contributed to the state of the facility. Finally the management of the cattle market did not pay enough attention to the slaughter house in terms of maintenance and renovations. Transportation of animal to and from the facility was also inadequate as seen in the findings. This can be attributed to the lack of education and lack of regulatory efforts at the facility. The animals were forced through beating into the liarage. This can affect the quality of the meat if the animals are not provided with enough rest afterwards. In addition, the high numbers of the animals put together may increase the possibility of contraction of diseases, suffocation and eventual loss of the animals. Also the vehicles that bring the animals from long distances are often uncovered, exposing the animals to dust and harsh weather conditions which may harm the animals. Cold vans were also not available to transport the slaughtered animals to other markets.

This allowed consumers to use tricycles and taxis to convey the carcasses to their destination. This is against the FDA guideline FDA/APBD/CP-MT/2012/01 which indicates that only specific vehicles that have been prepared and dedicated for meat transportation may be used for such activity. The observed practice can easily result in cross contamination resulting in adverse health effects to the consumers. The available sanitary facilities like the washrooms and the sources of water were inadequate. FDA guidelines require that sanitary facilities be equipped with hand washing facilities and materials like soap and hand tissues or towels. Management of the facility insisted that although they equipped the facilities with these items, the maintenance culture of the staff resulted in damages, misuse, and even stealing of these resources and this has led to the discontinuation of the service. This also means that the staff were not sensitized to the need of these resources and therefore abused them whenever they were provided.

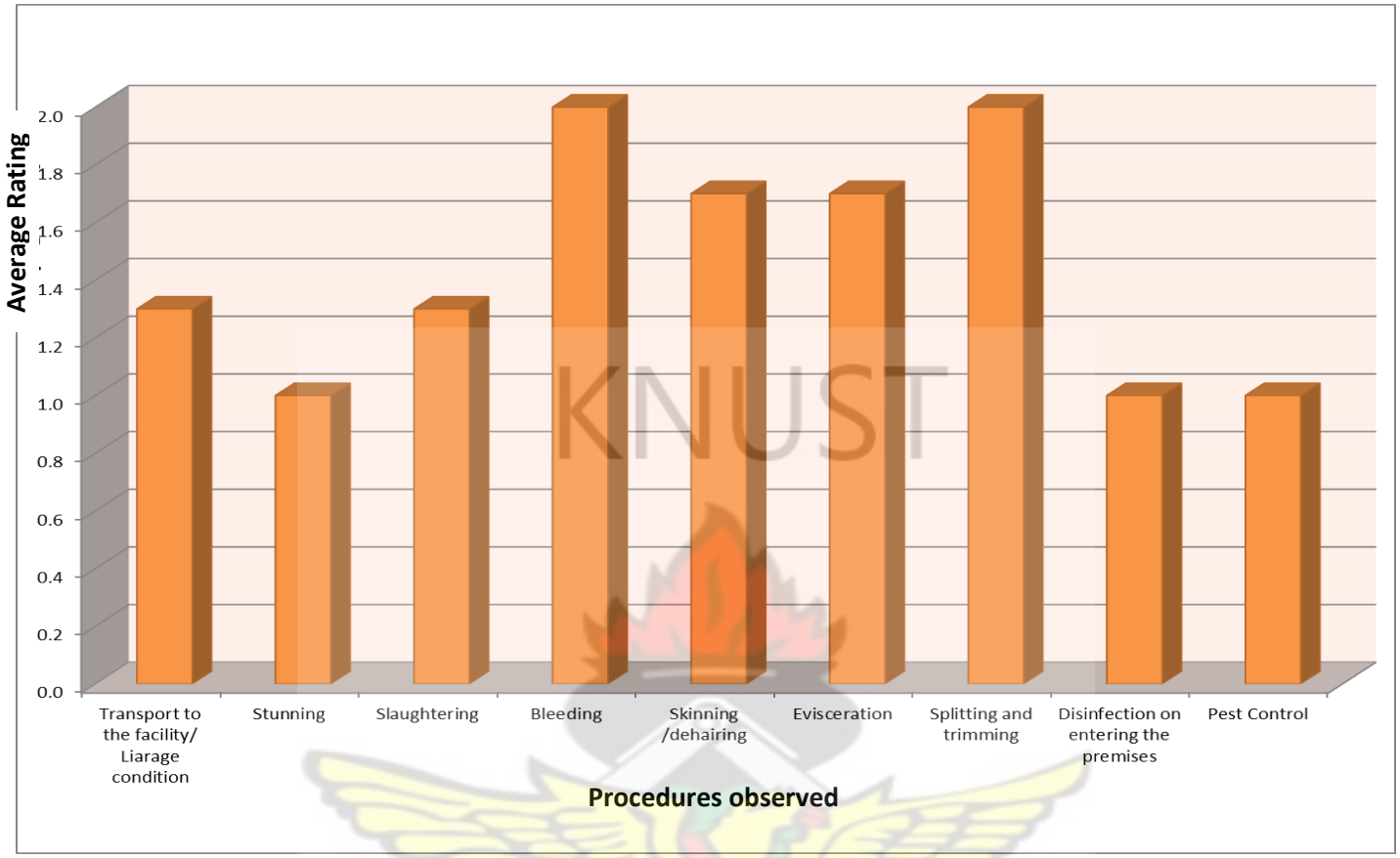

Fig 6: Rating of Observations on practices of various sections of the Tulaku Slaughter house

The observations on the procedure at the facility revealed that none of the practices was in compliance with the requirements in the literature. The process of stunning the animals before slaughter was never observed and this is viewed often as an inhumane act. The animals were restrained with ropes and slaughtered on the slaughter floor. This can be a very dangerous practice because the animals may overpower the restraints and render serious or even fatal injuries, to the staff. The staff did not realize the need for stunning since they preferred the challenge of restraining the animals during slaughter. This was linked with the strength and skill of the slaughter men as they were required to overpower the animal for slaughter in the restrains to prove their skill and capability. Unfortunately this practice easily leads serious occupational

hazards including the loss of life. Disinfection of the premises was also not adequately conducted. After every slaughtering session, the floor is cleaned with water. Other surfaces that have contact with the animal are also cleaned with water. On occasions, a member of staff may use a disinfectant in the water that was used for cleaning the floor. This was not a regular practice. A similar observation was made for pest control activities of the facility. There was no specific program laid down for pest control. The members of staff did not pay much attention to this as they explained that the activity was carried as and when the need arose. That meant that, the activity was carried out only when pests were observed at the facility. The observations on waste management practices revealed that the activity was also not adequately done. The waste bins provided were insufficient and were uncovered, allowing insects to settle on the waste in the bins and cross contaminating the meat that was nearby. There was also a refuse dump near the facility where the bins were emptied. The location of the refuse dump was not sufficiently far from the slaughterhouse. Here again the problem was that the staff did not appreciate the risk involved with dumping refuse near the slaughter house. This predisposed the slaughter house to birds and other pests that visited the refuse dump.

### 4.3 Laboratory analysis of meat for *Salmonella*.

The results of the analysis are tabulated and presented in Table 4.3.

Table 4.3 *Salmonella* species /25g Detected Meat samples

| **Week** | **Sampling point A (CFU/100)** | **Sampling point B (CFU/100)** |
|---|---|---|
| Week 1 | NIL | NIL |
| Week 3 | NIL | NIL |
| Week 5 | NIL | NIL |
| Week 7 | NIL | NIL |
| Week 9 | NIL | NIL |
| Week 11 | NIL | NIL |



From the result, it can be presumed that the meat products that are being purchased from the facility were generally free from contamination of *Salmonella* sp. Throughout the period of study, the samples analyzed did not reveal any contamination with *Salmonella* sp. This suggests to the researcher that, although visual observation of some of the sections and the practices were not the best as indicated in the literature review, it did not necessarily mean the products were contaminated with *Salmonella* sp.

### 4.4 Laboratory analysis of water (*Escherichia coli*).

Public and environmental health protection requires safe drinking water. This means that it must be free of any amount of pathogenic bacteria. The World Health Organization also prescribes the acceptable level of *E. coli* in drinking water to be Zero CFU per 100 ml (WHO, 1996). Since the water is used to clean food that is meant for consumption, it is also required to be free of any

levels of pathogenic bacteria. The results of the analysis of the water samples for the levels of *E. coli* are shown in Table 4.4.

### 4.4.1 Precautions and Limitations

- The samples that foamed during homogenization were avoided during the pipetting.
- The media used were autoclaved in batches so as to avoid overcrowding in the autoclave.
- The pipette tip was not made to extend more than 2.5cm below the level of the diluent during the dilutions.

Table 4.4: Results of analysis of water samples for *Escherichia coli* (CFU/100ml).

| **Week** | **Sampling point A (CFU/100ml)** | **Sampling point B (CFU/100ml)** |
|---|---|---|
| Week 1 | NIL | $8 \times 10^1$ |
| Week 3 | NIL | $8 \times 10^1$ |
| Week 5 | $2.8 \times 10^1$ | $2.8 \times 10^1$ |
| Week 7 | NIL | $8 \times 10^1$ |
| Week 9 | $8 \times 10^1$ | $2.8 \times 10^1$ |
| Week 11 | NIL | $8 \times 10^1$ |

The results indicated that, the water samples that were being used for most operations of the facility were generally positive with contamination with *E. coli*. Out of the twelve separate instances of sampling and testing of the products, eight tested positive for *E. coli* contamination. This represents 66.67% of the samples tested. It was also observed that the sampling point B

always tested positive for *E. coli*. This could be attributed to the contact and contamination introduced by the workers as they fetched and used the water from the containers consistently. It could also be attributed to the poor protection of the water sources, especially with the uncovered storage tank (sampling point B). The reservoir was close to the ground and uncovered thus offering easy access to sheep, cows and other animals that came to drink from it. This resulted in contaminating the water. Throughout the weeks of sampling and testing, positive results were always obtained for the presence of *E. coli* contamination.

This suggests that the surfaces that had contact with the meat products were likely to contaminate the meat products. This presented a health risk to consumers who obtained the meat.

### 4.5 Laboratory analysis of water (Feacal coliforms).

The results of the analysis of the water samples for the levels of *E. coli* are shown in Table 4.8.

#### 4.5.1 Precautions and Limitations

- The samples that foamed during homogenization were avoided during the pipetting.
- The media used were autoclaved in batches so as not avoid overcrowding in the autoclave.
- The pipette tip was not made to extend more than 2.5cm below the level of the diluent during the dilutions.
- All suspected colonies on selective agar were subjected to confirmed biochemical and serological reaction.

Table 4.8 Results of analysis of water samples for Feacal Coliform (CFU /100mL)

| **Sampling Period** | **Sampling point A (CFU/100ml)** | **Sampling point B (CFU/100ml)** |
|---|---|---|
| Week 1 | $2.8 \times 10^1$ | $8 \times 10^1$ |
| Week 3 | $8 \times 10^1$ | $8 \times 10^1$ |
| Week 5 | $2.8 \times 10^1$ | $8 \times 10^1$ |
| Week 7 | $2.8 \times 10^1$ | $2.8 \times 10^1$ |
| Week 9 | NIL | $2.8 \times 10^1$ |
| Week 11 | $2.8 \times 10^1$ | $8 \times 10^1$ |



The result indicated that the water samples that are being used for most operations of the facility were generally tested positive for Feacal coliform bacteria. Out of the twelve separate instances of sampling and testing of the products, eleven tested positive for Feacal coliform contamination. This represents 91.6% of the samples tested. The uncovered water reservoir allowed nearby animals to drink from it. This can lead to contamination of the water. The result showed that the water was unfit for the purposes that it was being used for.

# CHAPTER 5

# CONCLUSION AND RECOMMENDATIONS

## 5.1 Conclusion

Meat has over the years become a primary component of the food that is consumed by most people. Now more than ever, people are consuming more meat and this calls for global and national efforts towards ensuring that meat processing facilities are effective in ensuring that meat that leaves the slaughtering houses is wholesome, uncontaminated and fit for human consumption. Results revealed that the facility does not possess the good sanitary requirements that are essential for these facilities.

Concerning the infrastructure, it can be concluded that the observations made were below the requirements and that much was needed to be done to improve the system at the facility. It was also concluded that, the most acceptable observations at the facility were the ventilation and the illumination at the facility. With regards to these factors, the slaughter house was in a very good condition. The size and the location of the slaughter house was in a good condition although there was room for improvement.

With regards to water supply and sanitary facilities like toilets, the slaughter house was not up to standard and much had to be done to raise the standards of the slaughter house to meet approved standards. In terms of transportation of animals to the facility and the materials used for the construction of the facility, the slaughter house was barely satisfactory. The space for housing the animals prior to slaughter-the lairage, was however, satisfactory.

The other practices at the slaughter house were not effectively carried out. For example, the bleeding and splitting processes were not effectively carried out. Stunning was never practiced and this made the process of slaughtering very inhumane as the animals struggled with the butchers before slaughter. Pest control was not satisfactorily conducted and disinfection was also poorly done. The slaughtering and skinning processes needed an improvement. In general, although the workers were hardworking, they were not sensitive to health and sanitary concerns and they exposed themselves to health risks in their operations.

Concerning microbial analysis at the facility, the meat from the facility was not contaminated with S*almonella.* It was also observed that although the sanitary practices were not always acceptable, it did not mean that the meat would be contaminated with *Salmonella.* The microbial tests conducted on the water revealed that, it was contaminated with *E. coli* and Feacal coliforms and was therefore unsafe for use as food.

## 5.2 Recommendations

In line with the observations and conclusion, the following are recommended at the various sections of the facility.

### 5.2.1 Recommendations on Infrastructural provisions

1. Location:
    - The nearby residential facilities are to relocate to safer distances of at least 300m away from the slaughterhouse.
2. Constructional Materials
    - The facility should be renovated to provide smooth walls and roofs for easy cleaning.
    - The concrete working surfaces should be smoothened to allow for easy cleaning.
    - The floor should be tiled to prevent injuries and to facilitate cleaning processes.
3. Water Supply
    - The ground tanks should appropriately covered to protect the water from pests encroachment.
    - The polytanks and all water storage vessels should be cleaned regularly, preferable with food grade soap and records maintained on the cleaning activities.
4. Sanitary Facilities
    - The toilet facility should be equipped with hand washing soap, preferably a liquid soap and disposable tissue papers, or hand towels for workers to use after visiting the place of convenience.

- Warm water, or hand sanitizers may also be provided for workers to use to disinfect their hands during wok.
- A changing room should be provided for workers to change into their working gear before work.

### 5.2.2. Recommendations on Slaughtering Practices



1. Transportation to facility
    - The animals should not be overcrowded in the vehicles that bring them to the facility. Herdsmen should be warned to desist from this practice. The vehicles should also have sufficient cover to protect the animal from rain and sunshine, especially the cows brought from Burkina-Faso.
    - The herdsmen should desist from beating the animals whenever they have the opportunity and especially during deliver to the slaughterhouse.
2. Stunning
    - The animals should be stunned before they are slaughtered.
3. Slaughtering
    - The animals should be slaughtered above the floor since they can easily pick up germs from the floor. Also slaughtering in a hanged position will facilitate bleeding
4. Bleeding
    - The process should be appropriately separated from the rest of the activities at the facility. The ropes and bars used should be replaces with proper hanging pins and clips designed for that purpose.

5. Evisceration
    - The process should be carried out on an elevated position instead of the floor
    - Waste bins provided at the area to collect waste should be emptied frequently.
6. Splitting and trimming
    - The knives used for the process should be cleaned in warm water periodically
7. Personal hygiene
    - Workers should change into appropriate working clothes and not to use the same clothes that they brought home since this can introduce foreign material to the meat products. They should be encouraged or forced if necessary to wash their working clothes everyday after work and not to use the same clothe more than once.
    - Sanitizers or warm water should be made available to workers for frequent cleaning and sterilizing of hands and equipments
8. Pest Control
    - It is recommended that pest control activities must be carried out periodically at the facility and this must be done preferably by a person certified by the Environmental Protection Agency.
    - The cracks and crevices should be sealed to prevent the entry of pests into the area. The borders of the facility should be sealed effectively to shut out all pests from entry into the facility. Bait can be placed at vantage points to control pests. Other places accessible to the birds should be protected.

9. Waste Management

- The bins provided for waste disposal should be covered to prevent cross contamination.
- The dumpsite for the waste must be significantly distanced from the facility.
- The use of foot operated bins should be encouraged to reduce the occurrence of cross contamination.



5.2.3. Microbial Contamination

- It is recommended that further tests and other parameters can also be studied at the facility so as to determine the safety of the meat that is processed at the facility.

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# APPENDIX

## Appendix 1: Tables

Table 5: Rating of observations of infrastructure at various sections of the Tulaku slaughter House.

| **Observed Parameter** | **Observer 1** | **Observer 2** | **Observer 3** | **Average** | **SD** |
|---|---|---|---|---|---|
| Site/Location of Facility | 3 | 3 | 4 | 3.3 | 0.6 |
| Size | 4 | 3 | 4 | 3.7 | 0.6 |
| Constructional Materials, walls, Floors | 1 | 1 | 2 | 1.3 | 0.6 |
| Ventilation | 4 | 4 | 5 | 4.3 | 0.6 |
| Illumination | 4 | 5 | 5 | 4.7 | 0.6 |
| Water Supply | 2 | 1 | 2 | 1.7 | 0.6 |
| Sanitary Facilities | 2 | 1 | 2 | 1.7 | 0.6 |
| Lairage | 3 | 1 | 4 | 2.6 | 1.5 |

**Rating Key**

| | |
|---|---|
| Excellent | 5 |
| Very Good | 4 |
| Good | 3 |
| Satisfactory | 2 |
| Unsatisfactory | 1 |



Table 6: Rating of observations on practices of various sections of the Tulaku Slaughter house.

| **Observed Parameter** | **Observer 1** | **Observer 2** | **Observer 3** | **Average** | **SD** |
|---|---|---|---|---|---|
| Transport to and from the facility/ Liarage condition | 1 | 1 | 2 | 1.3 | 0.5 |
| Stunning | 1 | 1 | 1 | 1 | 0.0 |
| Slaughtering | 1 | 1 | 2 | 1.3 | 0.5 |
| Bleeding | 2 | 1 | 3 | 2 | 0.8 |
| Skinning /dehairing | 2 | 1 | 2 | 1.7 | 0.5 |
| Evisceration | 2 | 1 | 2 | 1.7 | 0.5 |
| Splitting and trimming | 2 | 2 | 2 | 2 | 0.0 |
| Disinfection on entering the premises | 1 | 1 | 1 | 1 | 0.0 |
| Pest Control | 1 | 1 | 1 | 1 | 0.0 |
| Waste Management | 1 | 1 | 1 | 1 | 0.0 |

**Rating Key**

| | |
|---|---|
| Excellent | 5 |
| Very Good | 4 |
| Good | 3 |
| Satisfactory | 2 |
| Unsatisfactory | 1 |



Table 7: WHO Guidelines for microbiological Parameters

| **PARAMETER** | **GUIDLINE** |
|---|---|
| E. coli | NIL |
| Faecal coliforms | NIL |
| Salmonella | NIL |

Source: WHO Guidelines for Drinking Water Quality.

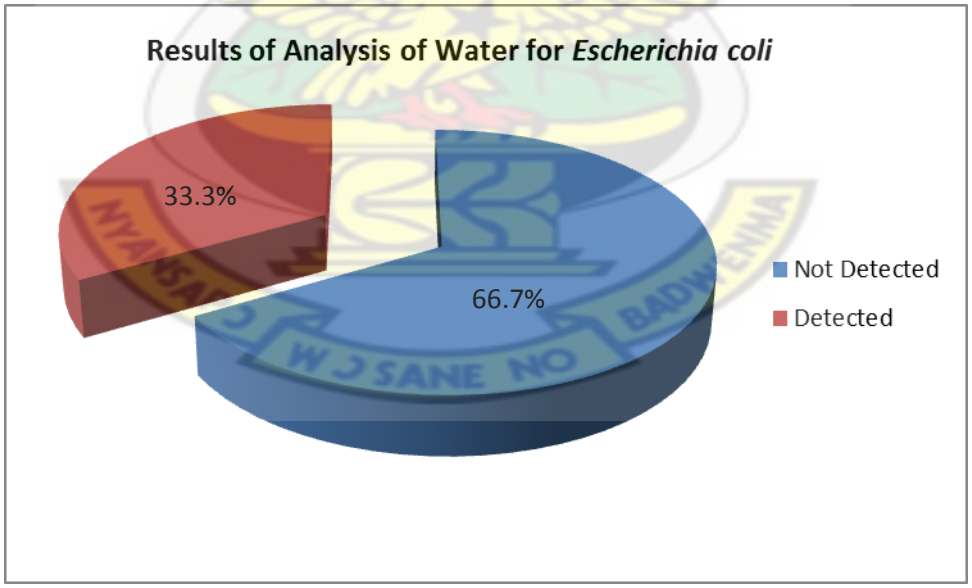


Fig 7: Results of analysis of Water for *E. coli*

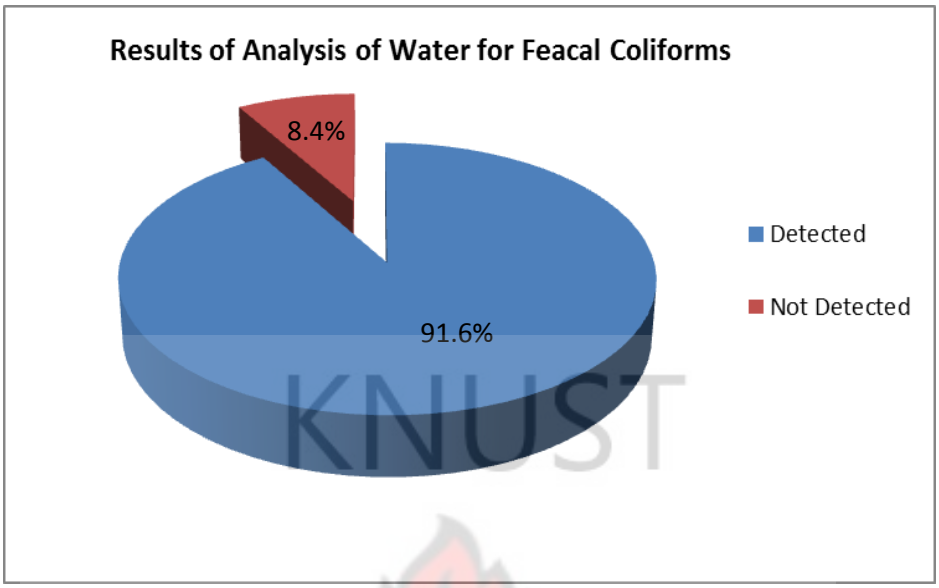

Fig 8: Results of analysis of Water for Feacal coliforms

**Appendix 2: Observations of Infrastructure at Various Sections of the Tulaku Slaughter - house.**

a. The working floor of the slaughterhouse of the slaughter house was not smooth and did not facilitate cleaning.

Fig 9: Rough surface of the working floor

b. Sources of water

The sources of water were mainly from an uncovered reservoir and covered barrels.

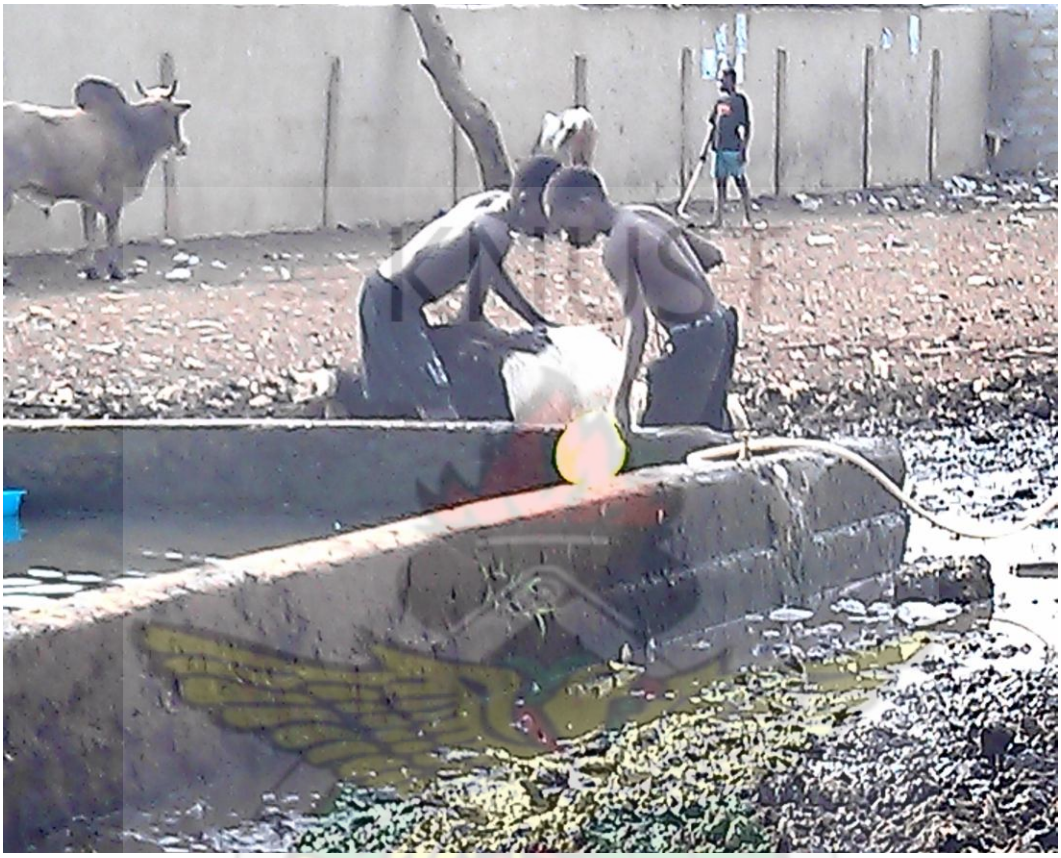

Fig 10: Uncovered reservoir for water storage.

Fig 11: Barrels for temporary water storage at the Tulaku slaughter house.

Fig 12: Barrels for temporary storage of water at the Tulaku slaughter house.

c. Sanitary Facilities:

The sanitary facilities available at the slaughter house includes a washroom and a toilet facility

Fig 13: Washroom facility at the Tulaku Slaughter House.

Fig 14: Toilet facility at the Tulaku Slaughter House.

d. Lairage

There was an adequate lairage facility provided by the slaughter house for temporary storage of the animals prior to slaughter.

Fig 15: Lairage facility at the Slaughter house.

**Appendix 3: Observations of practices at various sections of the Tulaku Slaughter house**

a. Transport to and from the facility/ Liarage condition

Fig 16: Uncovered vehicle transporting cattle from Burkina Faso to Ghana.

b. Slaughtering.

The animals are mostly slaughtered on the ground rather than being elevated

Fug 17: A cow about to be slaughtered on the ground

Fig 18: A slaughtered cow on the ground

c. Bleeding

The animals were tied on ropes and hung on wooden bars for the process and the process was not adequately separated from the other activities at the working area.

Fig 19: Bleeding of animals at the slaughter house

d. Skinning /dehairing

Although the process was carried at a convenient distance away from the main working area, it was not sufficiently shielded

Fig 20: Skinning at the slaughter house.

e. Waste Management

There was no foot operated or self-closing bins at the area. The waste bins were also uncovered The dumpsite was too close to the facility and not sufficiently shielded from the facility.

Fig 21: Uncovered bin at the Tulaku Slaughterhouse.

Fig 22: A Dumpsite of the Tulaku Slaughterhouse.