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ASSESSMENT OF CATTLE WELFARE FROM FARM TO SLAUGHTERHOUSE IN THE GHANAIAN CONTEXT

JOSHUA WUNTIMAH SALIFU MOGRE

OCTOBER, 2021

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FACULTY OF AGRICULTURE

DEPARTMENT OF ANIMAL SCIENCE

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BY

JOSHUA WUNTIMAH SALIFU MOGRE

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THESIS SUBMITTED TO THE DEPARTMENT OF ANIMAL SCIENCE, FACULTY

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DECLARATION

I declare that I composed this thesis; except as specifically mentioned otherwise in the text, the work contained below is my own, and it has not been submitted for any other degree or any other qualification save as specified.

Candidate's Signature ……. …….. Date ……

Joshua Wuntimah Salifu Mogre

Supervisors

I hereby declare that the preparation and presentation of this thesis was supervised in accordance with the guidelines on supervision of as laid down by the University for Development Studies

Principal Supervisor's signature …… Date ……

Professor Gabriel Ayum Teye

UDS

Co- Supervisor's signature ……Date ……

Professor Frederick Adzitey

UDS

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DEDICATION

This dissertation is dedicated to the memory of my Father Samuel Salifu. He was my inspiration to pursue my doctoral degree, although he was unable to see me graduate.

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ABSTRACT

The main objective of this study was to assess the current condition of cattle welfare from farm to slaughterhouse in Ghana. The study applied field and laboratory approaches to gather and analyze data. Data was collected from farms, slaughterhouses, and cattle transport centers in the Upper East, Northern, North East, Savanna, Bono East, Ashanti and Greater Accra regions.. A total of three hundred and eighteen (318) farmers, 78 transporters and 450 butchers were interviewed using semi-structured questionnaire, observations, and focus group discussion. Data collected were classified and summarized on the basis of the information provided. The body temperature and respiratory rates of the animals were measured at rest and point of slaughter (n=100). Cortisol levels in blood samples during the exsanguination were measured (n-10). Test for Pale Soft Exudative (PSE), Dark Firm and Dry (DFD) and pH levels were taken from meat samples (n-10). Behaviour of cattle at slaughter and carcass bruising were scored (n=50).

The first study assessed the indigenous knowledge of cattle farmers, transporters and butchers on animal welfare in Ghana. The second study continued to evaluate welfare conditions of Ghanaian farms. Both studies found evidence that most of the knowledge transfer from older farmers to apprentice farmers was carried out through oral methods. Farmers were concerned about their animal's welfare but did not place equal weight on the five freedoms of animal welfare. Farmers placed the most premium on freedom from hunger, malnutrition and thirst (95%), and freedom from pain, injury and disease (90%). Farmers placed less premium on their animals freedoms from fear and distress (50%), and freedom from physical and thermal discomfort (50%). The freedom to express

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normal patterns of behaviour (0%) was not considered. The third study showed that transporters paid little attention to the welfare of animals in transit. The average transit time is 18 hours in transit. Adherence to recommended rest stops, provision of feed and water and spacing were absent. The fourth study appraised welfare standards (conditions and procedures) of Ghanaian slaughterhouses Animal welfare standards were found to be poor. Structures in the facilities were obsolete and did little to safe guard the welfare of the animals and handlers. Animals are exposed to great levels of stress and pain before and during slaughter. The final study examined the effects of welfare conditions on meat quality. The mean body temperature (37.6 ºC), respiration rate (33.6 bpm), blood cortisol (43.4 ng/mL) and pH (6.5), indicates that cattle are exposed to extreme discomfort pre-slaughter leading to DFD meat products. Animal welfare from cattle farms to slaughterhouse were below acceptable standards and urgent interventions are needed to improve welfare in Ghana.

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LIST OF ABBREVIATIONS AND ACRONYMS

ALF: Animal Liberation Front

DFD: Dark Firm Dry

FAO: Food and Agriculture Organization

GSPCA: Ghana Society for Protection and Care of Animals

HAS: Humane Slaughter Association

HPA: Hypothalamic-Pituitary-Adrenal

IOE: World Organisation for Animal Health (Office International des Epizooties)

MoFA: Ministry of Food and Agriculture

PSE: Pale Soft Exudative

SHAC: Stop Huntingdon Animal Cruelty

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CHAPTER ONE

1.0 Introduction

Farmers, animal welfare experts and governments, especially in developed countries, are concerned about the importance of animal welfare (Miele *et al.*, 2013). As agriculture develops and becomes more efficient, actors in the agricultural sector are tackling animal welfare issues at all levels of the value chain (Schröder and McEachern, 2004). In recent years, consumers at the end of the value chain are becoming more sophisticated and aware of animal welfare standards (Olesen *et al.*, 2010); and are demanding products that are in compliance with these standards (Kehlbacher *et al.*, 2012).

Animal welfare is a term that generally speaks to how an animal deals with the conditions in the environment which it lives (Broom, 2011). An animal is believed to be experiencing good welfare if it is comfortable, healthy, well-nourished, protected, and capable of showing its innate behaviour (Veasey, 2017). Additionally, the animal should not be experience unpleasant states such as fear, pain, and distress. For animal welfare to be considered adequate, it requires appropriate shelter provision, disease prevention (and veterinary treatment), appropriate management, adequate nutrition, and importantly humane handling and slaughter (Hewson, 2003; Broom, 1991).

The "Terrestrial Code" for OIE (World Organization for Animal Health) states that: "animal welfare means the physical and mental state of an animal in relation to the conditions in which it lives and dies" (Grandin, 2018).

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The OIE's animal welfare standards include a reference to the widely recognized “Five Freedoms”, published in 1965 to describe the right to welfare of animals under human control (OIE, 2017).

According to this concept, an animal’s primary welfare needs are when it experiences freedom from:

I. hunger, malnutrition, and thirst;
II. fear and distress;
III. physical and thermal discomfort;
IV. pain, injury and disease; and
V. Freedom to express normal patterns of behaviour.

Animal Welfare Strategy in Africa (OIE) (2017) report reveals that livestock (cattle) on the continent make up on about 30% of the agricultural (GDP), and 10% of the national GDP. Also about 300 million people depend on livestock for their income and livelihood (Dessie and Mwai, 2019). In Ghana, the economic contribution from the livestock subsector has increased steadily with a recorded 5.7% growth in this sector in 2018 (Dessie and Mwai, 2019). Livestock play an important role in the life of many people on the continent. However, Most underdeveloped countries' laws and regulations make minimal provision for animal welfare (Moss, 1994).

Animal welfare has become a growing concern in various countries throughout the world, as well as those in Africa in recent years. Increasingly animal welfare requirements are being incorporated into trade agreements”.

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Animal welfare issues from farm to slaughter are very important and this requires disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling and slaughter. The benefits of implementing animal welfare strategies include:

1. Increased profits
2. Reduced incidence of diseases
3. Reduced deaths/losses in transit
4. Better meat quality
5. Increased customer satisfaction and acceptance of local meat products
6. Increased meat exports
7. Improved environmental impact and reduced CO_2 emissions (Sinclair *et al.* 2019).

In Ghana, although policy documents on animal welfare standards are available, they are hardly applied (Lalonde *et al*., 2017). Frimpong *et al*. (2014) reported that, the cruel ways of animal handling, occurrence of inability to walk and death of animals were common due to congestion, poor loading and offloading procedures, and falling in the truck, disease, hunger, and exposure to unfavorable weather during transport. They indicated that, inappropriate animal management resulted in a loss of more than 16% of planned revenue. The unsanitary conditions of the slaughtering procedures and meat distribution to butcheries using unclean vehicles confirmed that the safety and quality of meat produced was impaired (Frimpong *et al*., 2012). Adzitey (2011) also observed that the mode by which animals are handled on the farm, during transportation, at the market, and in the lairage expose them to various stresses.

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Studies on animal welfare are extremely important for a developing country such as Ghana. When farmers give attention to the welfare of their animals, they will obtain many benefits. Animals raised in a good environment are less susceptible to diseases, reach their genetic potential faster and are more productive. This leads to lower cost of production, and positive profit margins (Manyi-Loh *et al*., 2018).

Middlemen who transport animals from farms to major cities and towns also need to consider animal welfare. Adhering to recommended loading numbers, stopping for the animals to rest, and providing adequate feed and water are key. This will result in fewer mortalities in transit, less loss of animal condition and reduced incidence of impaired perambulation (Frimpong *et al*., 2014). If this happens middlemen will be able to obtain higher prices for their animals with increased profits.

Prior to slaughter, animal handling procedures have a substantial impact on the stress level and welfare of the animals. this also affects the final meat quality (Álvarez *et al*., 2009). When animals are manhandled before slaughter their carcasses can be damaged due to bruises and injuries. Additionally, the meat shows signs of dark cutting (DFD) and pale soft exudative (PSE) meat. (Gregory, 2010). Poor animal welfare also poses a risk to farmers and handlers, through zoonoses, and accidents during handling (Kimman *et al*., 2013). Pale soft and exudative (PSE) and Dry firm and dark DFD meat conditions are described in relation to the characteristics of normal meat. They are defined in connection with the pH of meat at a specific time after slaughter. PSE is said to have occurred when the pH of meat is < 6 at 45 minutes after slaughter. DFD (also known as dark cutting in beef) is when the ultimate pH post mortem measured after 12 – 48 hours is ≥ 6 (Adzitey and Nurul, 2011).

Animal welfare brings vital gains for humans in terms of increased income, nutrition and food security, thereby contributing to gross domestic product and improved livelihoods through higher productivity and quality.

Objectives of the study

The main objective of the study was to assess the current condition of cattle welfare from farm to slaughterhouse in Ghana.

Specific objectives were to:

- Assess indigenous knowledge in animal welfare in Ghana
- Evaluate farm welfare conditions
- Evaluate the welfare conditions under which cattle are transported from various farms to market and slaughter centers
- Appraise welfare standards (conditions and procedures) of Ghanaian slaughterhouses
- Examine the influence of welfare conditions on meat quality.

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CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 History of animal welfare

Animals have had a long-term relationship with humans. From the evolution of man into hunter-gatherers, centuries ago, animals have been integral to human lives, where our ancestors must have followed their prey (animals) around in a nomadic lifestyle (Leach, 2003). When our early ancestors began to domesticate animals in 4800/4600 BC (Crombé *et al.*, 2020), they inadvertently committed themselves to the welfare of animals.

The early farmers had need for increased productivity as populations increased. They began to provide food, shelter, and the health needs of their animals. These improved management conditions also improved the welfare conditions of the animals they domesticated.

Source: (Wild and Adviser, 2015)

Figure 2.1: Evolution in the status of animals from prehistory to 19th century

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In animal welfare there are three overlapping ethical concerns expressed regarding the quality of life of animals:

1. They should lead natural lives through the development and use of their natural adaptations and capabilities
2. They should feel well, by being free from prolonged and intense fear, pain, and other negative states, and by experiencing normal pleasures
3. Finally, they should function well, in the sense of satisfactory health, growth and normal functioning of physiological and behavioural systems

(Fraser, 1997).

The Western world began to consider legislature and formal protocols for animal welfare as far back as 1635 when the Ireland Parliament (Thomas Wentworth) passed "An Act against lowing by the tail, and pulling the wool off living sheep". In 1824 the Society for the Prevention of Cruelty to Animals which was the world's first animal protection association was founded (Mench and Bekoff, 1998).

When commercial farming began to take root in the early 1900, more attention was focused on the welfare standards by which animals were managed (Winders and Nibert, 2004).

From the mid 1900's to early 2000's branches of animal welfare became more militant with the with the birth of Animal Liberation Front (ALF), Animal Rights Militia (ARM), and Stop Huntingdon Animal Cruelty (SHAC). They started strings of bombings, attacks on research centers and vandalizing of meat shops and slaughter houses. Since 2008 "animal extremists' activities have begun to rapidly decline (Wlach, 2012). Other branches of animal welfare have begun to explore the production of meat

invitro to address many concerns with humane treatment of animals in the production of meat for consumption (Bhat *et al*., 2019).

2.2 Animal welfare in Africa

2.2 1 Indigenous knowledge of animal welfare.

Cattle are intertwined with the history, culture, and daily lives of Africans all over the continent. In Africa, cattle are treasured possessions for close to a billion livestock keepers across the continent. Cattle are important daily source of food and nutrition, income, and manure for replenishing soils fertility. They also fulfil a wide variety of socio-cultural roles (Dessie and Mwai, 2019).

Animal welfare perceptions in Africa vary by region, culture, and customs (Qekwana *et al.*, 2020). Due to their ubiquitous distribution across the continent, pastoral systems have accommodated and safe guarded the welfare of cattle for centuries. Although these welfare practices are not formalized like the OIE guiding principles, they are none the less potent and have guarded the genetic diversity of cattle in Africa, with well over a hundred distinct breeds (Dessie and Mwai, 2019).

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Over time, African farmers and all actors in the livestock industry have sought to safeguard their animal's welfare. Their motivation for doing so includes economic, cultural, religious and emotional reasons (Devereux, 2014). For instance, farmers prioritizing finding fodder for their animals on a daily bases, is a clear example of welfare protection. Many authors including Lumu *et al.* (2013) and Komwihangilo *et al.* (2001) discussed the trouble farmers go through to ensure that their animals are fed and have water to drink on a daily basis.

Several pastoral tribes including the Fulani are known to carry out seasonal migration in their quest to protect their cattle's freedom from hunger, malnutrition and thirst (Motta *et al,*. 2018).

The Fulani, Dagari, Lobi and Mossi tribes reportedly use medicinal plants to treat foot and mouth disease and animal trypanosomiasis (Traoré *et al*., 2020). This indigenous practice protects freedom five of animal welfare standards, which is the freedom from pain, injury and disease.

However according to Njisane *et al.* (2020a), the concept of animal welfare has not been entirely espoused in African communities. While international animal welfare standards exist in the industrialized world, there are intrinsic barriers to implementation in most developing nations, particularly among communal farmers. some of these hurdles are: cultural norms and behaviours, social ranking, socioeconomic level, resource availability, information distribution, and monitoring technologies. As a result, there is a need to synchronize what is required internationally with what is practical in order to account for global diversity.

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Although animal welfare is safe-guarded to an extent by farmer on their farmsteads, the standards of welfare in the times of draught, transportation and slaughter are of a much lower standard than on farms (Fisher *et al*., 2009). According to Reix *et al.* (2014) most draught animals are found in low income countries. The high prevalence of lameness, discomfort, and numerous limb and spinal abnormalities in working animals is a red flag when considering animal welfare, and this underlines how difficult it is to solve this issue.

Additionally, once they have finished their working lives, draught animals are forced to trek, or transported in congested vehicles, over hundreds of miles, and finally slaughtered using crude and cruel methods. There is practically no effort to prevent such cruelty (Ramaswamy, 1998).

2.2.2 Present state of animal welfare in Africa

Animal welfare policy in Africa has a unique challenge. There are differences in animal welfare practices between locations, tribes, and even between practitioners, because of the wide range of cultural practices and animal species involved. The existing animal welfare regulations are incompatible with the realities of Africa (Qekwana *et al.*, 2019).

In Ghana, the situation is similar to other parts of the continent, with a few fledgling organizations promoting awareness on animal welfare and seeking to lobby legislation on animal rights. Organizations such as Sancore Animal Rescue and Shelter, based in the Greater Accra Region of Ghana, attend to abused, injured, hungry and stray animals (Sancore 2020). The Ghana Society for Protection and Care of Animals (GSPCA) teaches *Humane Education* to thousands of students in Accra, Volta Region, and Upper East Region (GSPCA, 2020). One of the most difficult aspects of animal welfare in Ghana is that, there is scarce data on animal handling and linked complications that can be used as basis to develop animal welfare policies (Frimpong *et al*., 2012).

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2.3 Overview of cattle rearing in Ghana

Animal production is an integral part of Ghana's agricultural and a key source of livelihood for countless rural households. Nearly 95% of livestock keepers in Ghana are in the rural sector with rural livestock providing the bulk of Ghana's locally

produced meat (Ministry of Food and Agriculture, 2004). In northern zone, farming is the prime occupation of the population. Most farmers regard food crop cultivation as their major occupation for subsistence. Livestock are kept as a minor occupation for diverse purposes (Karbo and Agyare, 1997).

There are three main systems of animal production in Ghana. These are: 1. the extensive, 2. semi-intensive and 3. the intensive. However, the extensive system is the most use particularly in rural communities (Adzitey, 2013).

In many rustic communities in the Northern Regions of Ghana, livestock production is a major source of source of revenue especially during the rainless season. The Northern Regions of Ghana account for about 75% of all cattle produced in Ghana. while the rest (mainly ruminants) are imported from neighboring countries (Adzitey, 2013).

Cattle are raised in every region in Ghana, but have a higher concentration in the Northern zone as compared to the forest zone. The major breeds of cattle found in Ghana are N'Dama, West African Short Horn, Gudali and White Fulani (Dessie and Mwai, 2019). There are also several cross breeds. In Ghana, nomadic Fulani herds men play a major role in the farming of cattle. Indigenous cattle owners often hire the services of these herdsmen to take care of their cattle (Tonah, 2002a; Dary *et al*., 2017). The major challenges facing the cattle industry in Ghana are: access to feed all year round, incidence of diseases and pest infestations (Konlan *et al*., 2015).

Despite attempts to improve animal breeds by establishing animal breeding stations, the majority of local animal breeds have low feed conversion efficiency and reproductive efficiency. Local livestock producers have a small herd size and are unable to access

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veterinary services due to access and relatively high costs when their animals are ill. The domino effect is that fewer animals are contributed to the animal and meat industry of Ghana coupled with their susceptibility to high animal mortality (Adzitey, 2013).

A survey carried out by Okantah *et al*. (1997) in Ghana on cattle rearing revealed:

- A good number of the farms we visited had employed herd managers who were paid in milk in exchange for their services. The Fulani ethnic group accounted for 58.2% of the herders engaged. The educational level of household heads was generally low.
- Modern utility services, were absent.
- Because there was little or no farm machinery, most farmers used acaricide by hand dipping. There were no private grazing pastures under their collective tenancy.

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2.4 Farm welfare

Since the farm is the first-place animals are bred, and managed, the foundation of animal welfare starts there. There is the expectation that animals should be reared, bred, sheltered and cared for in housing or structures which are specially built for that purpose.

It is a farmer's responsibility to ensure that their animal's welfare is protected on the farm. The concern about welfare is a concern about the quality of life of individual animals. There are three scientific approaches to understanding farm animal welfare.

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According to Future (2009a), the first emphasizes the importance of how an animal feels, i.e. emotions such as discomfort, boredom and pleasure. The second focuses on biological function in which an animal's fitness is assessed by output indices, such as milk yield, reproduction, growth, as well as disease and injury. The final approach is a concern for naturalness, that is, an animal should be kept in a setting within which its species has evolved and with respect for its nature. All these three welfare issues are relevant to an animal's quality of life and linked in various ways to ensure the Five Freedoms.

2.5 Indicators of animal welfare

The structures to evaluate animal welfare as mentioned by (Barbari *et al.*, 2007) they are sectioned into the following groupings:

1. Systems that rely on working farm equipment and infrastructure to verify performance and link it to animal wellbeing.
2. Diagnostic mechanisms based on welfare "indicators" for individual animals.
3. On-farm index systems that assess the ability of farming practices and structures to provide a given level of animal wellbeing.

Diagnostic indicators of welfare on farms can be generally measured in three ways:

1. There is the observation of stereotypic behaviour: this refers to a group of phenotypic behaviours that are repetitive, morphologically identical and which possess no obvious goal or function (Mason *et al.*, 2007).

2. The study of meeting the physical, environmental, nutritional, behavioural and social requirements of the animal or groups of animals under the supervision, care, or influence of stockmen (Scipioni *et al*., 2009).
3. The use of various blood and fluid parameters and hair to determine stress and health conditions. This gives clear insights into the welfare state of the animals in question, as stated by Tarantola *et al*. (2020).

These indicators are measured through human observation, automated recording and by laboratory analysis. Each of these methods come with inherent challenges of cost, replication and amount of time needed to record the data (Rushen *et al*., 2012).

2.6 Attitudes of farmers and consumers towards animal welfare issues

The adoption of animal welfare standards hinges on the attitudes and acceptance by farmers and customers demanding better standards at the sources of the products they consume.

For instance, FoodPrint (2019), stated that 58 percent of USA consumers are becoming increasingly more concerned about how farm animals are being raised, slaughtered and treated with antibiotics. Food industry executives have responded by taking some steps to improve animal welfare in their supply chains to address customer concerns.

Driven by several socio-economic evolutions, animal welfare has gradually become a topical in recent societal debates. Despite the fact that animal welfare is subject to an increasing amount of research, theoretical development and empirical evidence related to the topic within sociology and consumer science research is very limited (Vanhonacker *et al*., 2007).

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Consumers' demand for welfare standards are influenced by demographic backgrounds, experiential involvement with food animals and knowledge of food animal production practices (Spooner *et al.*, 2014). Mostly in western countries, consumers perceived industrial efficiency negatively and invariably preferred more traditional, smaller and lower intensity farms (Clark *et al*., 2016).

Farmers readiness to implement sterner animal welfare protocols and their belief in animal-friendly production differ according to their perceptions and understanding of animal welfare and the value they attach to it (Bock and Van Huik, 2007). According to Kielland *et al.* (2010), farmers have empathy for animals in pain and try to alleviate their discomfort. Farmers concerns towards welfare manifest in some or all of the following areas:

a. Providing the animals with a satisfactory living environment and healthcare were the most often stated ways to advance animal welfare.
b. Farmers were of the opinion that, taking care of their own well-being was an important group of actions: they perceived that animal welfare and their own welfare were codependent.
c. The humane treatment of their animals (Kauppinen *et al.*, 2010).

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2.7 Farm animal welfare in Ghana

Developing countries are frequently confronted with issues such as limited resources and technology, rising living costs, different political interests and food insecurity

(Mwaniki, 2016). Such factors greatly limit focusing on animal welfare concerns. In Africa and Asia, where agriculture and animal farming contribute significantly to the economy, animals are often viewed mainly in relation to their benefit to human well-being (Mugenda and Croney, 2019). This mindset may stifle progress in animal welfare, unless these improvements also increase economic benefits to people (Fraser, 2008).

There is little published literature on farm animal welfare in Ghana. It can be hypothesized that, developing countries like Ghana prioritize production to meet their populations needs over strict adherence to welfare standards. Fuseini and Sulemana (2018) stated that people who were concerned about the welfare standards of the meat they consume belong to the highly educated echelons of the Ghanaian society. This may account for the minimal interest of policy makers in the area of animal welfare. Frimpong *et al*. (2014) recorded the use of whips, sticks and aggressive handling by farmers as they load cattle onto trucks for slaughter. This shows that aspects of animal welfare are lacking on the Ghanaian farm level.

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2.8 Stress indicators in cattle

Cattle are subjected to two main types of stress (West, 2003). These are physical stressors and psychological stressors (O'Brien *et al*., 2010). Physical stressors include:

1. Thermal stress
2. Transportation
3. Feed deprivation
4. Noise

Psychological stressors include;

1. Weaning
2. Restraining
3. Social isolation or inclusion (Faturi *et al*., 2010).

Stress is known to adversely affect the growth, production, reproduction, and disease susceptibility of cattle. Biological responses to a stressor have been used most frequently as indicators of stress. It is usually more informative to combine multiple indicators of stress to assess animal welfare. Behavioural and immunological responses also serve as indicators of stress and welfare of animals (Kumar, 2012).

Figure 2.2 Stressors in animals

Source: Humane Slaughter Association (2011)

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2.8.1 Physical stress indicators

Some of the physical stressors that cattle experience are:

- Thermal stressors

This includes heat and cold stress, which are regularly encountered by livestock in a natural setting. Heat stress in dairy cows has been examined, and a number of results observed, include unfavorable health and production repercussions. Heat stress was

linked to a decrease in both milk supply and milk yield. (West, 2003) and body weight loss (O'Brien *et al*., 2010). The most severe outcome of heat stress is mortality. Heat stress for one to three weeks during late term pregnancy can also affect newborn calves (West, 2003).

- Transport stress

This is one of the most common stresses for cattle. Transportation has been implicated in epidemiological research as a factor contributing to increased disease. (Honkavaara *et al*., 2003). Chulayo *et al*. (2016) observation following transportation of cattle showed a temporary increase in blood cortisol concentration which indicates stress. A wide range of physiological reactions have been linked to the complex combination of stresses associated with transportation, including altered immunological function, behavioural responses, and alterations in muscle physiology (Earley *et al*., 2012). These diverse responses highlight the potential for multifaceted interactions among many stressors with each combination of stressors resulting in a dissimilar physiological response (Sejian *et al*., 2012).

- Feed deprivation

Feed deprivation can take several forms, including an absence of certain micronutrients or an absence of protein or calories. (Hogan *et al.*, 2007). Several controlled feed deprivation tests show that malnutrition can have serious consequences to cows with high metabolic demands. (Bourguet *et al*., 2011). Studies have also shown that even short periods of feed denial have a significant impact on the gut microbiome, resulting in animals being highly stressed when they are transported (Clarke *et al*., 2014).

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2.8.2 Psychological stress indicators

• Separation from the mothers and weaning

Maternal separation has been found as a significant stressor in newborns and young animals, with long-term psychological and physical consequences (Faturi *et al*., 2010). In cattle husbandry, abrupt weaning or separation of suckling calves from their dams is widespread. When 5 to 6-month-old beef calves are abruptly separated from their mothers, they experience both psychological stress and nutritional alterations as a result of the dietary changes (Haley *et al.*, 2005). This separation causes behavioural abnormalities in both calves and dams that can last many days, indicating a more severe form of stress. (Meagher *et al*., 2019). Increased vocalization and ambulation are common behavioural changes in calves, and this activity lasts for days after separation (Haley *et al.*, 2005).

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- Isolation and mixing

Cattle are herd animals that create social hierarchies within each group, with dominant and subordinate individuals (Sołtysiak and Nogalski, 2010). As a result, social seclusion or introduction to a new social group can be stressful for an individual animal, resulting in a variety of behavioural and physical responses. (Bøe and Færevik, 2003). Friesian cows were isolated for 4 or 8 weeks to determine the effect of prolonged social isolation on them. Socially isolated cows demonstrated behavioural alterations such as greater self-grooming and leaning, but no alterations in serum cortisol concentrations (Munksgaard and Simonsen, 1996). Both young and older cattle are commonly socially mixed or regrouped as a result of current management procedures. A number of studies

have looked at the behavioural and biological responses that occur when a single animal is introduced to an established group (Chen *et al*., 2015).

- Restraint stress

Restraint is a common procedure used when handling cattle and may have negative effects on productivity (Andrade *et al*., 2001). Plasma cortisol concentrations are significantly elevated after cattle are restrained. However, when restraints are used on cattle multiple times over a period, the cattle adopt to them and restraining no longer has an effect on their stress levels (Szenci *et al.*, 2011; Andrade *et al.*, 2001). The stress reaction to restriction could start even before confinement. The cellular signaling pathways that mediate physiological changes in reaction to confinement, as well as the persistence of responses after release from restriction, are poorly understood (Buynitsky and Mostofsky, 2009).

- Stress and disease

The impact of stress on disease susceptibility has been difficult to assess. Using a model of a mixed viral and bacterial respiratory infection in an experimental respiratory illness model, Hodgson *et al.*(2012a) were able to show that weaning and transportation increased mortality in Angus x Hereford calves aged 5 to 6 months. A considerably heightened innate immune response to both viral and bacterial infection was linked to increased mortality. This improved innate immune responsiveness was also associated with a shorter time between infection and death, implying that greater immunity led to immunological pathology rather than immune protection. However, unless animals are treated to controlled stressors and subsequently challenged with a specific pathogen or monitored for specific metabolic changes, it is impossible to validate these findings that

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greater immunity led to immunological pathology rather than immune protection (Chen *et al*., 2015).

- Cortisol as an indicator of physiological stress

There are several physiological stress indicator tests that can be done. Each testing type has varying effectiveness based on cost, time to analyze results, and ease of taking samples. Some of the common test include:

- The use of respiratory and heart rates to measure stress (Andrade *et al*., 2001).
- Gauging of rectal temperature (Hulbert *et al*., 2013).
- Plasma albumin and urea concentrations tests (Earley *et al.*, 2013).
- Change in gene expression by testing peripheral blood leukocytes (Kolli *et al.*, 2014).
- Serum glucose tests (McCorkell *et al*., 2013).

The use of cortisol to determine stress levels in cattle is an ubiquitous method. The activation of the hypothalamic-pituitary-adrenal axis (HPA axis) is routinely evaluated by measuring cortisol levels in plasma or serum. (Minton, 1994), However, the adrenal cortex's fast and pulsatile release of corticosteroids makes this a particularly dynamic response. Blood samples are usually taken within minutes of an animal being exposed to the stressor to gauge the fast release of cortisol into the blood. (Mormède *et al*., 2007). When animals are responding to a prolonged stress, cortisol levels may remain elevated for days (Hodgson *et al*., 2012).

A Cattle's basal cortisol concentration is 15–25 nmol/L, but it can quickly rise to 60–200 nmol/L depending on the stressor and individual animal reactions. (Mormède *et al*.,

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2007). In addition, endogenous cortisol has a diurnal pattern, with peak levels often occurring in the morning. (Mormède *et al*., 2007). When developing stress tests and interpreting results, it is crucial to consider both the method of sample collection and the timing of sample collection.

Cortisol levels in cattle's urine, saliva, hair, feaces, and milk have all been measured. (De Clercq *et al.*, 2013; Fukasawa and Tsukada, 2010; Loberg *et al.*, 2008; Gupta *et al.*, 2004; Möstl *et al.*, 2002). The collection of these bodily fluids may be less invasive than venipuncture, reducing sample collecting effects. Cortisol levels in hair have been studied as a way to track stress responses over a longer period of time and reduce the impact of oscillations caused by the circadian rhythm, seasonal changes, and animal handling. (Macbeth *et al*., 2010).

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2.9 Cattle transportation

Transportation is a critical component of modern cattle production and marketing (Schwartzkopf-Genswein *et al*., 2016). Cattle are transported from farms to markets or slaughterhouses by various vehicles and over different terrains. Herding, trucking, railroad and water transport are the various ways cattle are moved around. Transportation is generally regarded as stressful to cattle. There was reported high mortality during the early days of transport leading to concerns for the welfare of cattle that still persist today (Swanson and Morrow-Tesch, 2001). In their lives, most cattle will be transported at least once. Each of these loads of transported cattle comes with concerns about animal care, biosecurity, and potential performance and carcass quality loss (Tarrant, 1990).

The amount of space available for animals during transportation is a key driver of humane transportation, and establishing guidelines for cattle is a must in the development of policies and regulation (Njisane and Muchenje, 2017; Whiting, 2000).

Other aspects of animal welfare during transportation include the design of loading and unloading ramps for cattle. The height and width of ramps, as well as the side sheeting, flooring, and the ramp apron, are all important considerations for animal welfare in transit.

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2.10 Standards for cattle transport.

Space allowance for animals in transit is a consistent concern, with many countries developing codes of practice and regulations to assure humane treatment of food producing animals. Describing minimum space allowance requirements for cattle in transit has proven to be difficult, as the space required increases as the animal grows (Whiting, 2000). When transporting livestock, it is essential that they are managed in a way that reduces stress and minimizes any risks to animal welfare. Livestock should be adequately prepared for a journey (Costa, 2016). Farmers need to comply with the Animal Welfare Standards and Guidelines for the land transport of livestock and relevant state and territory legislation (Manning *et al.,* 2021). According to Schwartzkopf-Genswein *et al*. (2016), transport involves several potential stressors that can affect animal welfare negatively. The new and unfamiliar environment, movement restrictions due to confinement, vibrations, sudden and unusual noises, animal fitness, mixing with other animals, temperature and humidity variations together with inadequate ventilation and often feed and water restrictions all have an impact on the

animals' state. Long journeys have been identified as being potentially more detrimental to the general welfare status of the animals than short journeys (Schwartzkopf-Genswein *et al*., 2016).

Guidelines for cattle transport:

- Facilities, carriers, crates, and containers should provide a suitable environment to reduce the danger of severe temperatures, weather, and humidity affecting animal wellbeing.
- The materials utilized to manufacture trucks, boxes, and containers should be easy to clean and effective. Between voyages, there should be a cleaning program for cattle crates and containers.
- Internal sheeting should be smooth to avoid pressure points and bruising, and vehicle gates and facilities should be broad enough to allow simple movement of livestock while minimizing injuries.
- To avoid respiratory distress, vehicle exhaust gases should not pollute the cattle crate substantially.

  The livestock box shall be built so that livestock, excluding poultry, can rise normally from reclining without colliding with overhead deck structures. The livestock's limbs should not protrude from the crate. Limbs should be contained within the cattle box utilizing proper crate design, sound side paneling, and loading densities.

  Surfaces and flooring should be designed to increase grip while reducing slipping and falling. Slats or grooves in the surface are two strategies for

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improving grip. If livestock are sliding and falling, the floor surface and livestock management should be investigated, and suitable measures implemented to prevent the problem.

- The floor of multi-deck vehicles, with the exception of poultry vehicles, should be built and maintained in such a way that animal soiling on lower decks is avoided.
- For particular types of animals, appropriate bedding should be given.
- When traveling in mountainous or high-traffic regions, or when transporting small quantities of animals, fixed walls should be present in the livestock box to protect livestock from being thrown around or wounded. When necessary, partitions should also be employed for segregation.
- To reduce wind chill and cold stress in livestock that are susceptible to cold (such as young cattle), transport vehicles should have fully enclosed fronts or the option to cover the vehicle front, roof, or canopy.
- Solid yard extensions should be utilized to fill in any gaps between the loading ramp floor and the vehicle's floor where an animal or part of an animal could fall.
- Railings on ramps and raceways should be of an appropriate height, with gaps at the bottom sufficiently narrow to prevent livestock from being caught, slipping through, or becoming injured.
- Ramps should be wide enough to allow easy movement and sloped appropriately for the species and class of livestock.

Source : Land Transport 0f Livestock (2012).

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2.11 Effects of transport on cattle

The welfare of animals during transport should be assessed using a range of behavioural, physiological and carcass quality measures. In addition, health is an important part of welfare so the extent of any disease, injury or mortality resulting from or exacerbated by transport should be measured (Broom, 2003). The use of an improper vehicle, calves tied to one another in a recumbent position, overloading, lack of rest, and water deprivation to cattle in transit, and animals being beaten and kicked during loading and unloading are all sources of stress (Adeyemi *et al*., 2010).

Transportation is known to cause several injuries to animals as reported by Minka and Ayo, (2007) and in some cases death during transport or shortly after delivery to slaughterhouses (Malena *et al*., 2006). Fazio *et al.* (2005) suggested that transport stress induces an increase in the activity of thyroid and adrenal function in cattle that is evident after even a short-distance road transport and continues to increase after long-distance transport.

The loading density, trailer microclimate, transport duration, animal size and condition; impacts the welfare (stress, health, injury, fatigue, dehydration, core body temperature, mortality and morbidity) of the animal. Transportation also affects carcass and meat quality by causing to varying degrees of: shrinkage, bruising, pH changes, color defects, water losses (Schwartzkopf-Genswein *et al*., 2012).

2.12 Slaughterhouse welfare

Animal slaughter in the broad sense refers to the killing of an animal for food. The origin of animal slaughter can be traced back to the inception of animal domestication. Some

ancient text such as the Bible, Torrah and Quran mentioned animal slaughter and prescribed regulations for animal slaughter. Both the Muslim and Jewish faiths have specific requirements for the slaughter of religiously acceptable animals. The major difference from the general practices in most countries is that the animals are not stunned prior to slaughter (Farouk *et al*., 2014; Regenstein and Grandin, 1994; Grandin, 2013).

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The unnecessary brutal slaughter of animal contributed to the development of specialized stunning and slaughter methods in several countries (Lerner and Rabello, 2006). A physician who spent most of his latter working life striving to discover and adapt chemicals capable of causing general or local anesthetic to relieve pain in people, was one of the first activists on the issue of slaughterhouse welfare (Hill, 1935). In 1882, the "Model Slaughterhouse Society" whose responsibility was to research and promote humane slaughtering procedures, and at the Royal Polytechnic Institution, where the use of electric current experimented with (Scott, 2018).

According to the Humane Slaughter Association (2011), the first part of the twentieth century was dominated by the emergence of stunning technologies. To enhance cattle slaughter, the Council of Justice to Animals (later the Humane Slaughter Association, or HSA) was founded in England in 1911. The HSA introduced and displayed a mechanical stunner in the early 1920s, which led to the acceptance of compassionate stunning by several local governments. After that, the HSA was instrumental in the enactment of the Slaughter of Animals Act of 1933. With the exception of Jewish and Muslim meat, this made mechanical and electrical stunning of cows and pigs mandatory. Modern technologies, such as the captive bolt gun and electric tongs, were necessary,

and the poleaxe was expressly prohibited by the Act's wording. Various advances in slaughterhouse technologies emerged during this time, albeit not all of them were particularly long-lasting. (Slaughter, 2011). In modern times animal slaughter is viewed in 3 main areas: pre-slaughter, slaughter and post-slaughter.

2.12.1 Pre-Slaughter:

All of the activities and processes that animals go through prior to being slaughtered are referred to as pre-slaughter handling. This includes activities on the farm, during transportation, marketing, and at the slaughterhouse (Adzitey, 2011). Some of these activities include: driving the animals from farm to the vehicle, loading the animals onto the truck on the farm, transport from farm to slaughterhouse, unloading, driving from the unloading ramp to the lairage facility, inspecting the live animals at the lairage and driving to stunning.

Protecting animal welfare at slaughter is about minimizing the pain, distress or suffering of farmed animals at the time of killing (Browning and Veit, 2020). To ensure humane slaughter of animals the following are suggested:

- Use of humane handling techniques.
- Stunning which stops animals from feeling pain.
- Correct use of stunning and restraining equipment.
- Handling pigs in groups to reduce stress on individual animals.
- Installation of blue lamps to calm animals.
- Use of non-slip floors and low-angle ramps to stop animals falling and getting injured (Humane slaughter, 2020).

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2.12.2 Animal welfare safe guards for slaughtering cattle

The OIE welfare requirements for disease control, transportation, and slaughter, of animals are the basic minimum standards that every country should adhere to (Vapnek and Chapman, 2010). Both private sector and some governments use numerical scoring to assess animal care at slaughter operations.

There are five variables that are measured which are as follows:

1. Percentage of animals stunned successfully on the first try
2. Percentage made insensible
3. Percentage that vocalize during handling and stunning
4. Percentage that fall during handling
5. Percentage moved with an electric goad (Grandin, 2010).

Each of these crucial control points assesses the outcome of a variety of issues. During slaughter, cattle may be exposed to many potentially stress-inducing factors, of emotional and physical nature (Terlouw *et al*., 2012). Prior to loss of consciousness, the main goal of humane slaughter should be to minimize or eliminate fear, pain, and misery. As a result, both inducing unconsciousness and handling prior to slaughter must be taken into account. (Leary *et al*., 2016).

According to the FAO guidelines for slaughter (2020), slaughtering equipment, particularly for smaller-scale operations, need not be elaborate and expensive. If possible, all equipment should be made of stainless steel or plastic, be rust resistant and easily cleaned and sanitized.

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Leary *et al*. (2016) stated that the basic mechanisms by which humane slaughter occurs are:

1. Physical disruption of brain activity (e.g., blunt cranial trauma, penetrating captive bolt, gunshot),
2. Hypoxia (e.g. controlled low atmospheric pressure for poultry, N_2, Ar, exsanguination),
3. Direct depression of neurons necessary for life function (e.g., inhalation of CO_2)
4. Epileptiform brain activity (e.g. electric stunning).

Because loss of consciousness resulting from these mechanisms can occur at different rates, the suitability of a particular agent or method will depend on the species and whether an animal experiences pain or distress prior to loss of consciousness (Leary *et al.*, 2016).

For a humane slaughtering process that ensures the welfare of animals, the following should be observed:

- Animals must be herded without agitation.
- Driving aids may only be used in a manner that spares the animals.
- The use of electrical driving aids are to be avoided and only used for full-grown cattle.
- Animals should be stunned in a manner that leads quickly and without pain or suffering to a condition of unconsciousness until the death of the animal.
- During sticking, it must be ensured that by opening one carotid artery or the corresponding main blood vessel strong bleeding occurs rapidly and leads to the extraction of blood from the animal.

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- Sticking must be performed while the animal is still incapable of sensation and perception.
- Following sticking, further slaughtering tasks may only be performed on the animal when no movement of the animal is registered (Guidelines for Slaughter and Debobing (GSD), 2020).

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2.13 Conditions of Ghanaian slaughterhouses

The conditions of most Ghanaian slaughterhouses do not meet the basic animal welfare and environmental hygiene standards. During rearing, loading, transporting, marketing, unloading, lairaging, and stunning of animals, there is incorrect and unsatisfactory pre-slaughter management (Adzitey, 2011).

Improper methods of off-loading and herding of cattle have been observed in several slaughterhouses. According to Frimpong *et al*. (2014), whipping is the most common technique of cattle handling, followed by tail pulling, stamping on the cattle's tails, stoning, slapping the animals with bare hands, forcing the animals to fall down, leg, and horn pulling. All state slaughter facilities in Ghana have qualified veterinary and public health personnel who perform both ante- and postmortem examinations before meat is transported to the market for sale, with some slaughter houses having facilities for holding animals prior to slaughter. However, these places are observed to have sub-standard facilities such as absence of potable water and hoists, with meat being conveyed mainly in pickup trucks, taxis and even on motor bikes (Asuming-Bediako *et al.*, 2018).

Butchers in Ghana have a low level of education, which makes modern slaughtering procedures and adherence to strict hygienic and standard slaughtering practices difficult to accept (Adzitey *et al., 2*011).

Ghanaian slaughterhouses have poor waste disposal systems. Adonu *et al*. (2017) observed that the operations of the slaughterhouse had detrimental effects on the health of the residents of the community because waste water was disposed into the streams and rivers which served as a source of drinking water for humans.

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2.14 Effects of animal handling on carcass quality

2.14 .1 Influence on structure and appearance

Meat production is influenced by a variety of environmental conditions as well as management. Meat composition varies due to genes, age, and sex of the animal, as well as nutritional and environmental factors. (Uhlíová *et al*., 2018). With respect to carcass weight, fat, muscle, and bone percentages, the carcass composition of distinct species varies greatly. The proportion of fat in an animal grows as it becomes older and heavier, while the proportion of muscles and bones decreases (Bureš and Bartoň, 2018). Uncastrated male animals produce carcasses with more muscle than do castrated males (Morgan *et al.*, 1993; Nian *et al.*, 2018). The muscle-to-bone ratio influences the value of a carcass at a given fat level. A higher ratio is obviously preferable because it translates to more saleable lean meat and better carcass shape. Complete males have a higher ratio than castrates, while beef breeds have a higher ratio than dairy breeds. Several parameters under livestock producers' control can be modified to generate desired carcass effects (Gurunathan *et al*., 2013).

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Several factors also contribute to beef carcass quality. Some of these factors are : species, breed, individual genetic traits, gender, age and weight at slaughter, freezing and storage (Guerrero *et al*., 2013). However, Arik and Karaca (2017) concluded that the effect of breed on meat quality traits was limited except for water holding capacity. Transport time, waiting of animals restrained or unrestrained, and age had a significant effect on pH levels, cooking loss and percentage of DFD. Animals, carcasses, and meat quality have all been known to suffer as a result of poor livestock management. This results in poor processing qualities, functional quality, and eating quality, as well as a higher likelihood of consumer rejection. (Adzitey, 2011). DFD carcasses can be caused by animals being subjected to chronic or long-term stress, such as lengthy hours of transit, food and water restriction, and overcrowding in the lairage. PSE and DFD meats are unappealing to consumers and are more likely to be rejected (Adzitey, 2011). And, if the stunning is not done properly, the meat may develop blood spots, resulting in lower acceptance and quality (Guerrero *et al*., 2013).

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CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 General materials and methods

3.1.1 Target and study population

Ghana is situated on the west coast of Africa with a total area of 238 540 Km^2 (Claude, 2009). The country has a north-south extent of approximately 670 km and a maximum east-west extent of about 560 km (Ghana Physical Setting, 2020). It shares borders with Côte d'Ivoire to the west, Burkina Faso to the north, and Togo to the east. To the south are the Gulf of Guinea and the Atlantic Ocean. Ghana is found approximately between Latitude and Longitude 8^o 00' and 2^0 00'(Kumi-Boateng and Ziggah, 2020). The country is divided into 16 administrative regions and has a population of 3.8 million (GSS, 2021). The study was conducted in seven administrative regions (Figure 3.1). These were Upper East, North East, Northern, Savanna, Bono East, Ashanti and Greater Accra. These regions were purposefully selected to cover the Savannah, Transitional, Forest and Coastal Savannah zones of Ghana.

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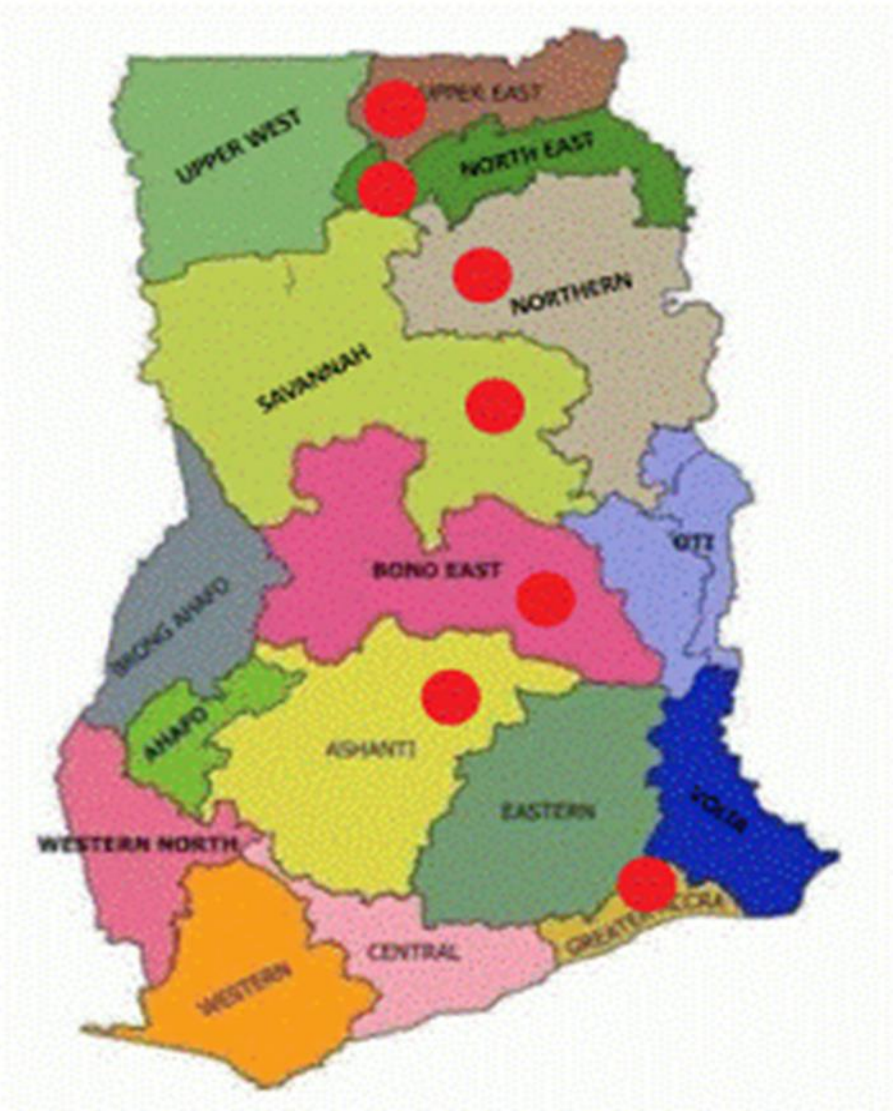

Figure 3.0-1: Map of Ghana showing the study.

3.2 Study design

The study applied field and laboratory approaches to gather and analyze data. It employed a mixed design, which used aspects of correlational, causal comparative, experimental, narrative and grounded theory designs. This design allowed for an understanding of the context and other factors that affect and influence animal welfare from the farm to slaughterhouse.

3.3 Sources of data

A two-pronged approach was used to collect data. The primary source comprised interviews, personal observations, sampling and laboratory analysis. The secondary source comprised data from dissertations, articles, encyclopedias, journals as well as website information.

3.4 Primary data collection

Primary data was collected through one-on-one interviews, focus group discussions, observations, and laboratory analysis.

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3.5 Sampling procedure

- Three hundred and eighteen (318) farmers in eleven (11) districts, municipalities and metropolitan assemblies in the northern zone were interviewed. Farmers were sampled only in the northern zone because this zone has a greater density of cattle farmers as the main zone for cattle rearing in Ghana (MoFA, 2016). This region also allowed for interviews of rural, peri-Urban and urban cattle farmers using simple random sampling.
- The largest slaughterhouse in each region was assessed. A total of five (5) slaughterhouses were assessed, and the veterinary officers in each was interviewed. The number of butchers interviewed were as follows; Upper East Region (85), Northern Region (111), Bono East (63), Ashanti Region (92) and Greater Accra Region (99). A total of four hundred and fifty (450) butchers were interviewed.
- By simple random sampling in each of the five regions, the following number of transporters were interviewed: Upper East Region (5), Northern Region (20), Bono East (8), Ashanti Region (25), and Greater Accra Region (20). Transporters were interviewed at the main cattle markets and slaughterhouses in each region.
- Tests for plasma cortisol levels in blood samples during the exsanguination phase was carried out for 10 cattle. Cattle were chosen as random at the point of slaughter.

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- Test for Pale Soft Exudative (PSE) and Dark Firm and Dry (DFD) was done on 10 meat samples using their pH and temperature. Each of 10 cattle had samples taken from the left longissimus muscle between the 11th and 12th ribs postmortem. Each sample was packed in an airtight bag and sent to the UDS Nyankpala Campus for testing under temperature-controlled conditions. Fifty carcasses were chosen at random and evaluated. These fifty carcasses were categorized as "none," which indicated a clean, unbruised surface; "slight," which indicated a reddish area with surface damage; and "severe," which indicated reddish, deep, and bleeding injury on the surface (Strappini, 2012).
- The temperature and respiratory rate of 100 cattle was randomly taken. Fifty when they were resting in the lairage and fifty taken just before slaughter.

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3.6 Data analysis

Data collected from respondents were classified and summarized on the basis of the information provided by the respondents. Responses were summarized into frequencies and percentages; Cramer's V was used to test the null hypothesis that there is no association between years of experience and each of the variables under:

I. Freedom from hunger and malnutrition and thirst

II. Freedom from fear and distress

III. Freedom from physical and thermal discomfort

IV. Freedom from pain, injury and disease

V. Freedom to express normal patterns of behaviour

VI. Indigenous knowledge of animal welfare.

The Cramer's V analysis was done using the Cross tab sub command under the descriptive statistics in Statistical Package for Social Sciences (SPSS 2013).

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CHAPTER FOUR

THE INDIGENOUS KNOWLEDGE OF FARMERS, TRANSPORTERS AND BUTCHERS ON ANIMAL WELFARE IN GHANA

4.1 Introduction

Local knowledge or Indigenous Knowledge (IK), may be defined as tacit knowledge of a community which is either generated locally or imported and transformed to be incorporated in the life of the community (Gorjestani, 2012).

Indigenous knowledge is a body of knowledge which has survived for generations. It dictates the progress and the well-being of the knowledge community. However, globalization has negatively influenced the recognition of indigenous knowledge and its utilization (Naamwintome and Millar, 2015). The advent of modern western education has resulted in the dearth of the importance of indigenous forms of knowledge in Africa. Certain modern philosophies of education have alienated and affected some of Africa's indigenous agricultural education systems (Mutekwe, 2015). In Africa, the interaction between cattle and their owners is usually deep and complex. Cattle are frequently given names and may be kept for longer than is economically justified because their owners see them as family members (Qekwana *et al.*, 2020).

While international animal welfare standards exist in the industrialized world, there are intrinsic barriers to implementation in most developing nations, particularly among communal farmers. Cultural norms and practices, social ranking, socioeconomic standing, system constraints, information distribution, and monitoring technologies are

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examples of issues that constrain the adoption of modern animal welfare standards (Njisane *et al*., 2020a).

To accurately assess animal welfare standards in Ghana, it is important to understand the indigenous welfare knowledge and practices that already exist. It is also imperative to recognize how such knowledge has been passed down from generations. With such information acquired, lessons can be learnt as to how indigenous knowledge is juxtaposed with international animal welfare standards. The objective is to assess the indigenous knowledge of farmers, transporters and butcher in animal welfare in Ghana

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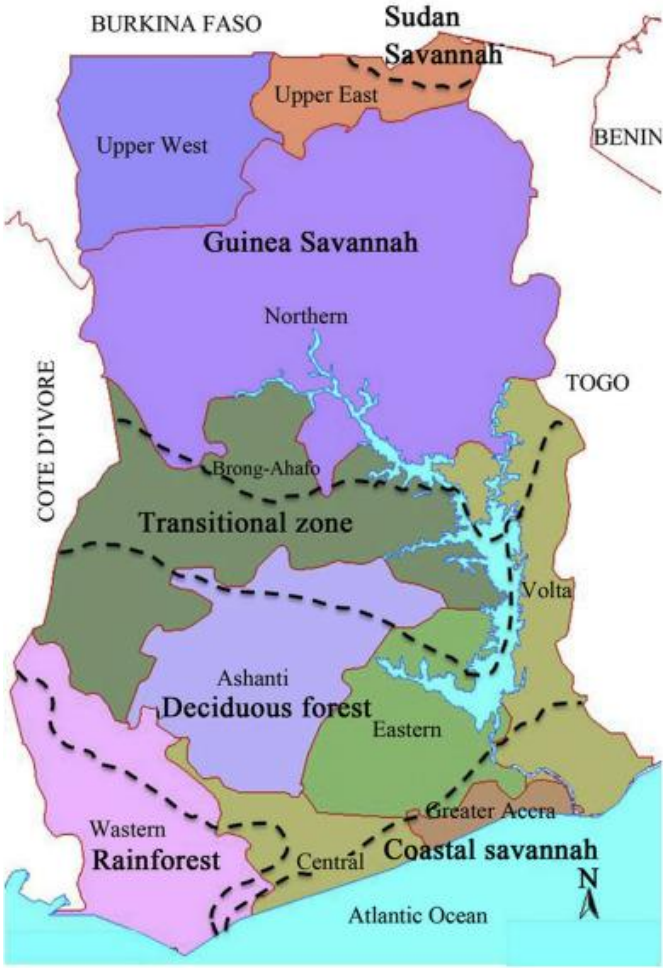
4.3 Study area

The study was carried out in the following regions: Upper East, North East, Northern, Savanna, Bono East, Ashanti, and Greater Accra (Table 4.1). regions were selected to reflect the various ecological zones in Ghana.

4.3.1 Vegetation, climate, and population

The physical terrain of the study areas were composed primarily of Sudan Savanna ecoregion in the Upper East Region and Guinea Savanna for the North East, Northern and Savanna Regions (Adanu *et al*., 2013). These four areas are characterized by relatively dry northern climate with its single rainy season, open tree savannas, and scattered rainfed croplands. The Bono East region is in the transitional zone and the Ashanti region is in the Forest zone which is the largest ecoregion, with deciduous tropical forests scattered among a number of biological reserves (Kadyampakeni *et al*., 2017). The Greater Accra region is in the coastal Savanna zone which is distinguished by its relatively low rainfall in two seasons, high population density, grassland savanna

vegetation, and coastal geomorphology that includes tidal flats and lagoons (Armah *et al*., 2011). Figure 4.1 shows the vegetational zones of Ghana.



Source: Vegetation Zones Ghana (2021)

Figure 4.0-1: Vegetational zones of Ghana.

Seasonal variations in temperature in Ghana are greatest in the northern zone, with highest temperatures in the hot dry season (April to June) at 27-30°C, and lowest in rainy season (July- September) at 25-27°C. In the transitional and southern zone,

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temperatures reach 25-27°C in the warmest season (January to March) and 22-25C at their lowest in the rainy season (July to September) (UNDP Ghana, 2021) . Table 4.1 shows the human population of the regions of study.

Table 4.1 Study regions population

Region	Population
Greater Accra	5,055,883
Ashanti	5,924,498
Bono East	594,712
Savannah	1,133,768
Northern	1,948,913
North East	588,800
Upper East	1,302,718

Source: Ghana Statistical Services (2021)

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4.4 Materials and methods

4.4.1 Data collection

The indigenous knowledge was assessed using a variety of methods. It was assumed that local farmers, middlemen/transporters and butchers had existing knowledge and experience in caring for the needs of animals they managed. This knowledge was investigated using the following approaches:

- Observation and checklist
- Focus group discussions
- Key Persons interviews
- Questionnaires

4.4.2 Interactions with Farmers

Three hundred and eighteen (318) farmers in eleven (11) district/metropolitan assemblies in the Northern Region were interviewed. Districts and communities were chosen by simple random sampling and respondents were identified and interviewed using the snowball approach.

The assemblies chosen were: Saboba, Kumbungu, Tolon, Mion, Nanton and Central Gonja districts; the West Mamprusi, Yendi, Sanarigu, Savelugu municipalities and the Tamale metropolis.

The northern zone was chosen to sample farmers for the ensuing reasons:

- This zone has a higher density of cattle farmers and is the main cattle rearing zone in Ghana (MoFA, 2016).
- The zone gave the researchers access to rural, peri-urban and urban cattle farmers. This gave a better picture of the state of cattle farming in Ghana.

4.4.3 Interactions with butchers

Butcher were interviewed in the largest slaughterhouse in each region. The slaughter houses were chosen to reflect ecological zones as mentioned earlier. Five (5) slaughterhouses were assessed. In each slaughterhouse the veterinary officers were

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interviewed. Depending on the number of respondents, the number of butchers interviewed were as follows; Upper East Region (85), Northern Region (111), Bono East (63), Ashanti Region (92) and Greater Accra Region (99). A total of four hundred and fifty (450) butchers.

4.4.4 Interactions with transporters

By simple random sampling in each of the five regions, and number of respondents the following transporters were interviewed Upper East Region (5), Northern Region (20), Bono East (8), Ashanti Region (25), and Greater Accra Region (20).

Where respondents did not understand English, local dialect interpreters were used. The local dialects used were: Gruni, Hausa, Dagbani, Twi, Ga and Mampruli.

Samples of questionnaires and observation checklist attached as appendix 1 (titled: transporters questionnaires).

4.5 Pitfalls and alternative strategies

4.5.1 Farmers

It was observed that most farmers left very early for grazing their cattle, and returned after 4:00 pm, this posed a challenge and required that the data collecting schedule be reorganized. Finally, data collectors had to switch to meeting most of the farmers in the evenings or went with them to the field.

Additionally, there was a challenge with the language barrier and interpreters had to be used to facilitate collection of data.

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4.5.2 Transporters

Transporters were initially concerned that data collected would be used for taxation purposes. After the rational of the study was carefully explained, willing transporters were interviewed. Transporters found certain questions to be sensitive that is the age of the car and the size. this was solved by gathering such data by observation.

4.5.3 Butchers

Butchers in the Greater Accra Region had a rather peculiar time of work. Unlike other regions that started butchering at about 6am, they start their activities in the night starting from about 10:00 pm and working till dawn. Data collection had to be rearranged to ensure that they could be interviewed at night.

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4.6 Results

4.6.1 Demographic of respondents

The demographic details of the respondents showing age, educational level and years of experience are in Table 4.2.

Table 4.2 Demographic details of respondents

Demographic			
Indicator	Farmers	Transporters	Butchers
Age (%)			
Below 18	3.8	0	0
18-40	57.2	56.5	53.8
41-60	37.7	43.5	41.7
61-Above	1.3	0	4.5
	100	100	100
Education (%)			
None	51	29.7	30
Primary	21.4	14.9	36.2
Secondary	15.7	45.9	23.9
Tertiary	11.9	9.5	9.9
	100	100	100
Years of Experience (%)			
0-5	23.3	37.2	10.7
6--10	27	19.2	17.1
11--15	21.4	12.8	19.8
15- Above	28.3	30.8	52.4
	100	100	100

The maximum and minimum herd size was 120 and 2 respectively, the average herd size was 25 animals. Butchers slaughtered a maximum of 5 animals and a minimum of 1 animal daily with the average number of animals slaughtered being 1.3.

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4.6.3 Gender and age of farmers

All farmers interviewed were male. Majority of the farmers were above the age of thirty (30) years with the median age range being 36-40 years of age forming 18.2% of the total sampled; 13.8% of the farmers were between the ages of fifteen to twenty, being the youngest age range. The oldest farmers were between the ages of fifty-five to sixty (Table 4.2).

4.6.4 Educational background of farmers

Over 50% of the farmers had no formal education, 21.4% had primary school education. Almost sixteen percent (15.7%) had secondary school education 11.9% had a form of tertiary education (this ranged from diplomas to a first degree). A very small proportion (0.1%) had post graduate education, (Table 4.2).

4.6.5 Farm hands/ apprentices demographic data

Most farmers had male farm hands assisting them on their. The average number of farm hands was two (2), with the maximum number of hands recorded being six (6). Most farm hands/ apprentices (57.9%) ages ranged between 15-20 years. A few farm hands (3.8%) were above the ages of 40 years. About fifty-one percent (50.9%) of farmers had been running their farms for five (5) years, and 34% for six to ten years the rest of the details are seen in Table 4.2.

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Table 4.3: Distribution of farmers according to location

District/Municipal/Metropolitan	Number of farmers	Percentage (%)
Saboba	46	14.5
West Mamprusi	12	3.8
Tamale Metro	78	24.5
Kumbungu	14	4.4
Tolon	66	20.8
Yendi	12	3.8
Sanarigu	50	15.7
Savelugu	30	9.4
Mion	2	0.6
Nanton	6	1.9
Central Gonja	2	0.6
TOTAL	**318**	**100**

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4.6 6 Location of farmers

Data was collected from farmers in eleven (11) districts, municipalities and metros. Majority of the farmers (24.5%) were interviewed in the Tamale metropolis. The least districts sampled were the Mion and Central Gonja districts (Table 4.3).

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4.7 Demographic data of transporters

4.7.1 Location of transporters

Transporters were found to constantly move between regions and hardly had a static place of operation. For this reason, interviews had to be conducted on availability basis. Interviews were conducted at the cattle markets on designated market days. Each region has a designated day each week where cattle are brought to the market.

By simple random sampling in each of the five regions, and availability of respondents the following transporters were interviewed Upper East Region (5), Northern Region (20), Bono East (8), Ashanti Region (25), and Greater Accra Region (20) percentages are shown in Figure 4.2.

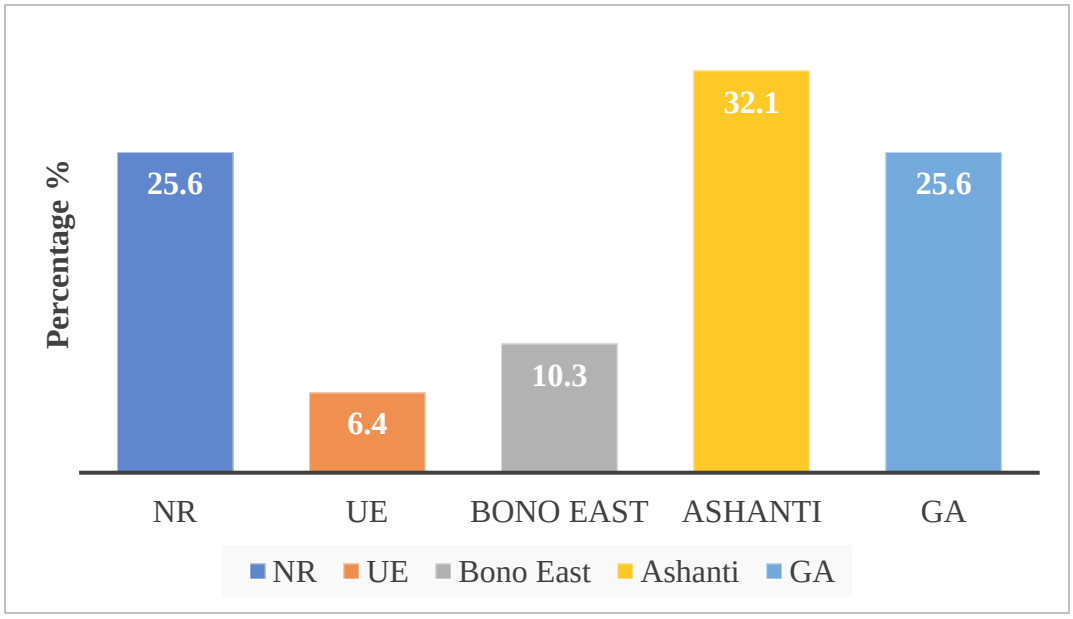

Figure 4.0-2: Location of transporters

The main destination of transporters in this study was the Ashanti region (Kumasi), followed by Greater Accra region (Accra), then Northern region (Tamale). The rest stated they did not have specific destinations (4.3).

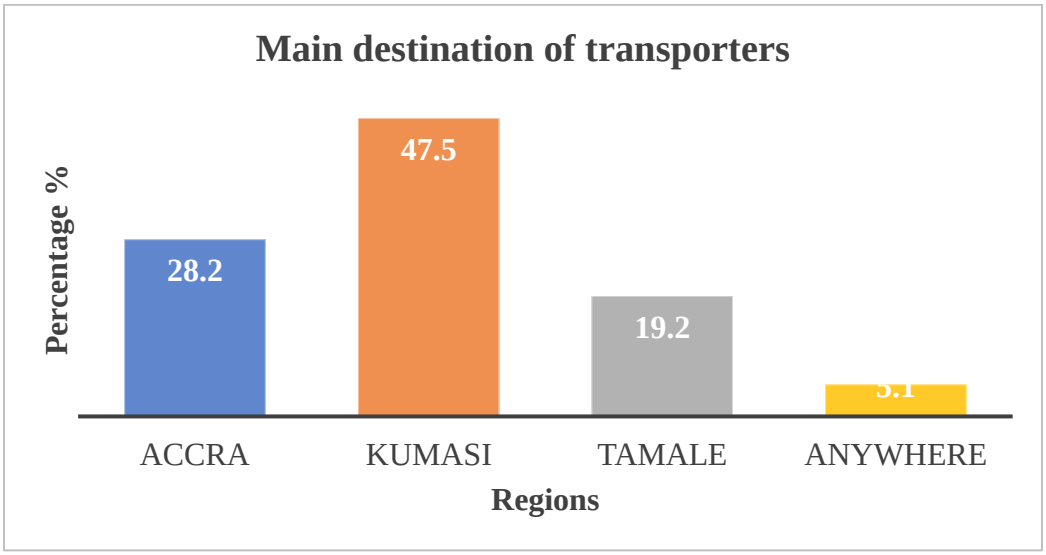

Figure 4.0-3: Destinations of transporters

4.7.2 Types of vehicle and stocking density

The vehicles used by transporters to convey cattle were: cargo trucks (56.4%), KIA trucks (12.8%), pick-up trucks (5.1%) motor tricycles (19.2%), and not indicated (6.4%). “Not indicated” refers to transporters who used any available vehicle which includes passenger vehicles The average number of cattle carried in a vehicle was 27, the maximum number was 150 and the minimum was 2. Out of all the vehicles inspected only 39.5 % of them were fit for the purpose of transporting cattle. 60.5 % of the vehicles when not fit for purpose. Each vehicle had at least one attendant in addition to the driver. In the larger cargo trucks, some had up to 8 attendants.

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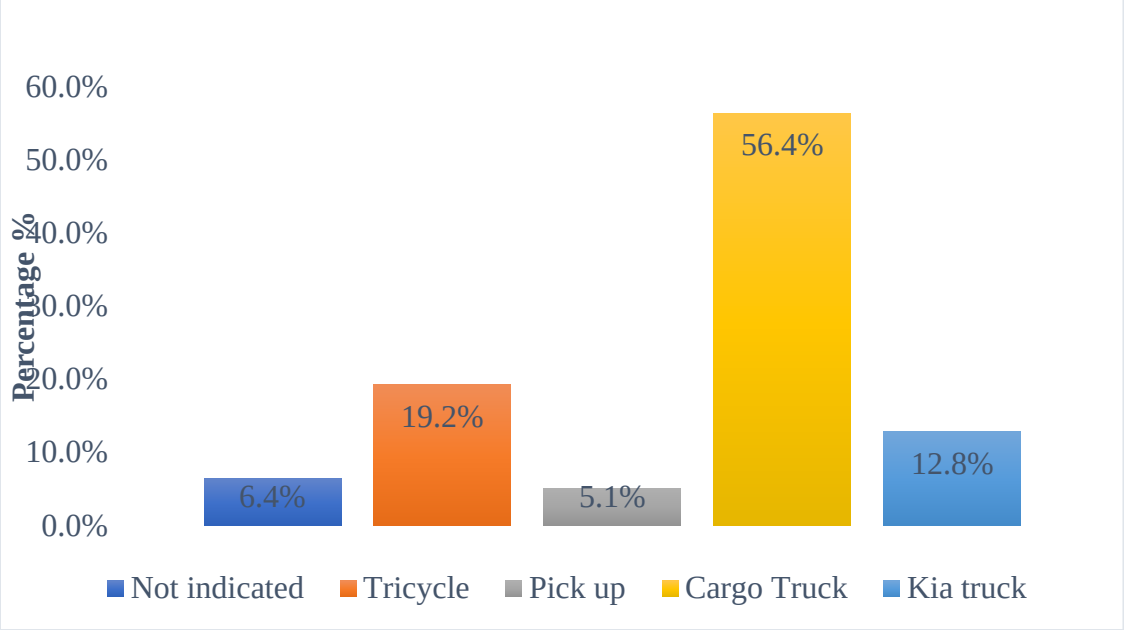

Figure 4.0-4: Types of vehicles used by transporters

4.7.3 Gender and age of transporters

All transporters were male. Majority of the transporters were above the age of thirty (30) years with the median age range being 41-45 years (28.2%).

4.7.4 Educational background of transporters

Out of all transporters interviewed, 29.5% had no formal education, 15.4% had primary school education, 44.9% had a secondary school education with 10.3% having tertiary education (Table 4.2).

4.7.5 Experience of transporters

The average years of experience as a transporter was 10.7 years and the maximum years of was 27 years.

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4.7.6 Demographic data of butchers

All though butchers operate in different parts of their towns and cities, they congregate daily at the regional slaughterhouse to slaughter animals they have purchased. The main slaughterhouses in each region were identified. A total of five (5) slaughterhouses were assessed, and the veterinary officer in each was interviewed.

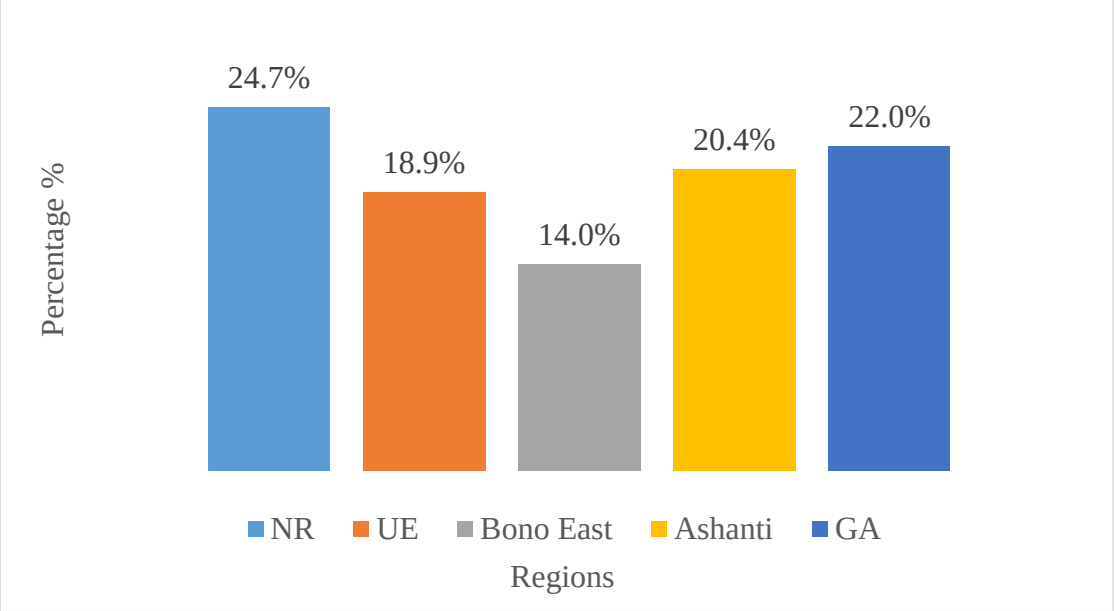

Figure 4.0-5: Regional distribution of butchers

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4.7.7 Gender and age of butchers

The youngest butcher was 17 years old and the oldest was 70 years old. The average age of butchers was 41 years. Age distribution of butchers is shown in Table 4.2. All butchers were male, 78.9% of them were Muslims, 17.3% were Christians, and 3.8% were traditionalists (Figure 4.7).

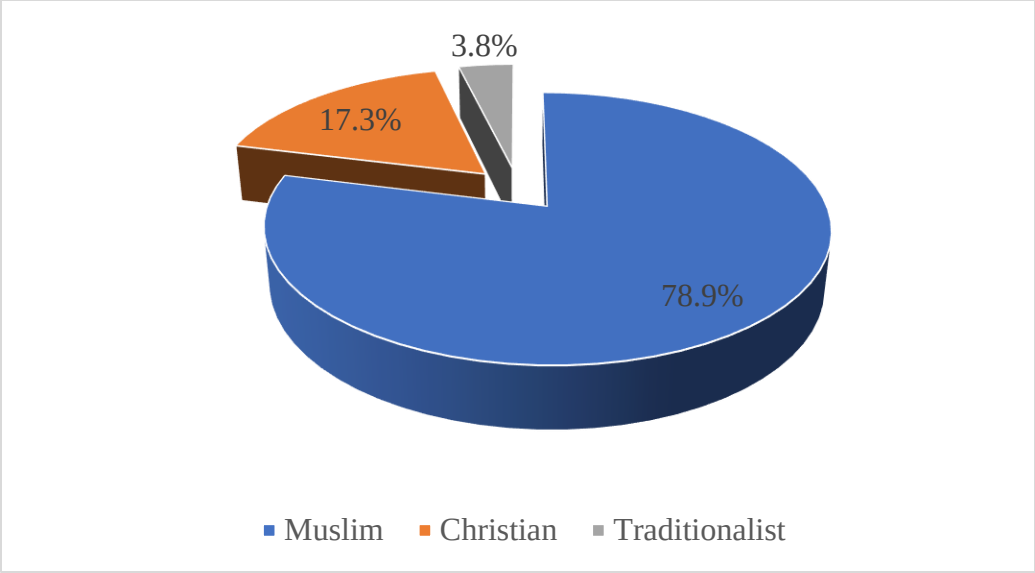

Figure 4.0-6: Religions of butchers

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4.7.8 Educational background of butchers

Majority of the butchers had a primary school education (36.7%), 30.7% of the butchers had no formal education. A total of 23.1 % of the butchers had secondary school education, 6% had tertiary education and 3.6% had vocational education.

4.7.9 Experience of butchers

The average years of experience as a butcher was 19 years, the maximum years of experience was 50 years with the minimum being 1 year. None of the butchers had any kind of formal training in butchering. Some (45.3%) of them received training from their fathers, 1.6% by their grandfathers 20% received training as an apprentice while detailed to an older butcher, 15% were trained by an uncle, 9.3% learnt the trade from friends 5.3% were trained by their clan or someone within the extended family and 1.8% of learned the trade on their own (Figure 4.8).

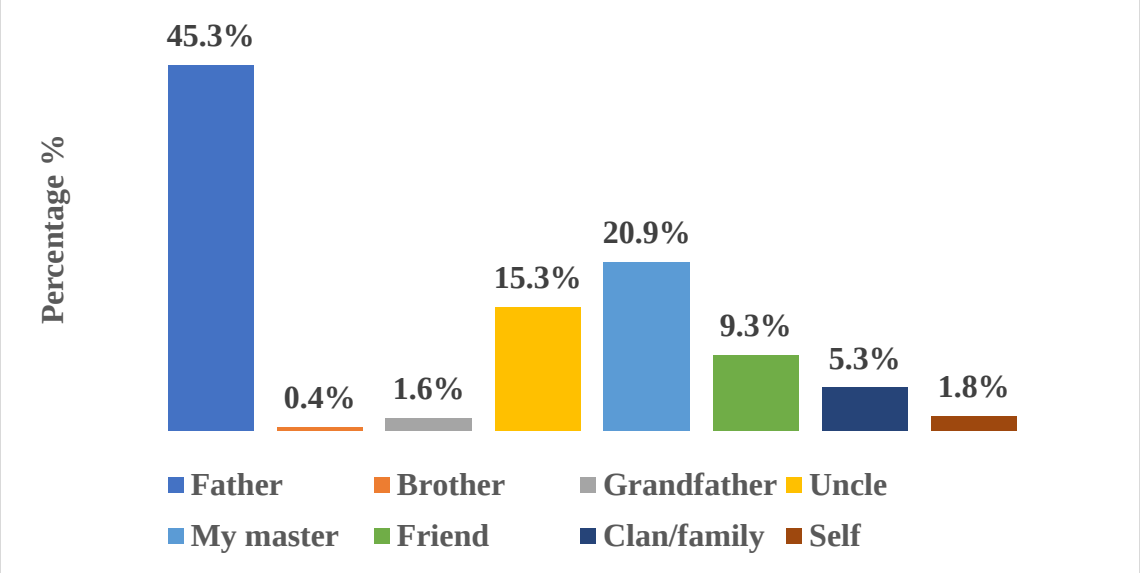

Figure 4.0-7: Trainers of butchers

4.8 Indigenous knowledge (IK) and experience of farmers, transporters and butchers

4.8.1 Freedom from hunger and thirst from IK

On how they learned about animal welfare, 91.8% had no formal training in cattle rearing or animal welfare. Only 8.2% had some form of formal training in cattle welfare. Out of all farmers 51.7% had an idea of what animal welfare meant with 48.3% having no knowledge on the formal concept of animal welfare. Only 8.8% of farmers stated that general farm work mainly focused on feeding as they learnt from older farmers through indigenous knowledge transfer.

Majority of the farmers did not have any formal training. According to the farmers they learnt the skill of welfare for cattle through apprenticeship. The feeding methods these farmers learnt by apprentiship were generally traditional methods with 90.6% employing grazing as a means of feeding animals with no major regard to the type of

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grass available. Only 9.4% practiced zero grazing and these were found in the urban area (Figure 4.9).

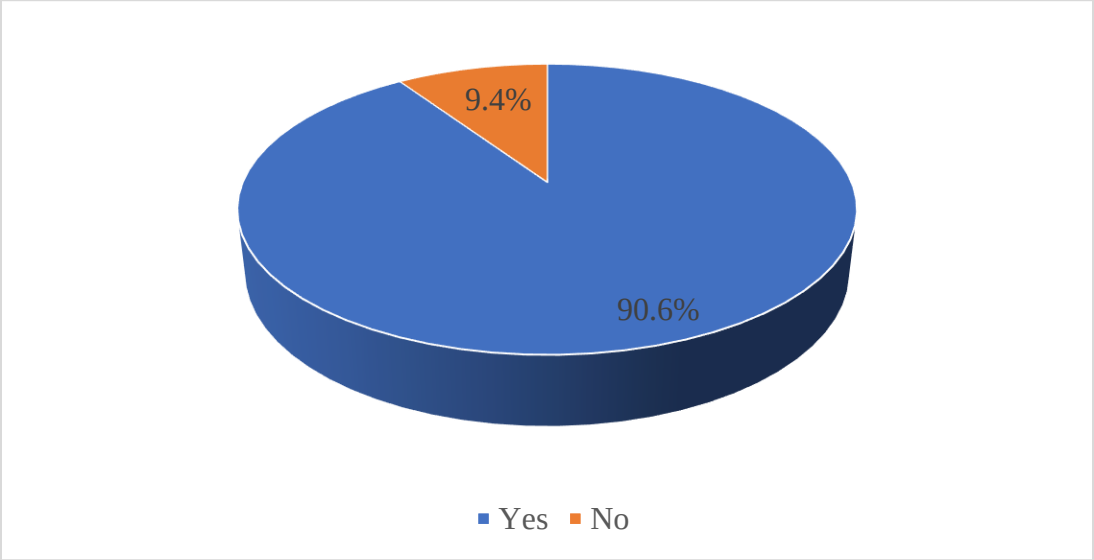

Figure 4.0-8: Do animals graze on free range?.

Most transporters (84.7%) on the other hand had no knowledge of the concept of animal welfare. Only 15.3 % were able to give a rudimentary definition of what they considered as animal welfare. For this group that had an idea about animal welfare 91% defined animal welfare as provision of food and medical attention to animals. Transporters were generally trained by older transporters after several years of acting as an attendant locally referred to as “drivers’ mate”.

Majority (69.6%) of the butchers were able to define animal welfare, with 42.9% having attended some form of formal training in animal welfare (Table 4.4). Ninety Percent of

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these trainings were facilitated by veterinary officers, the remaining 10% was facilitated by leaders of the association and agricultural extension officers.

Table4.4: Percentage of butchers with knowledge of animal welfare

Response	Number of butchers	Percentage
Yes	313	69.6%
No	137	30.4%
Total	**450**	**100.0%**

Table 4.5: Percentage of butchers who have ever participated in welfare training

Response	Number of butchers	Percentage
Yes	193	42.9%
No	257	57.1%
Total	**450**	**100.0%**

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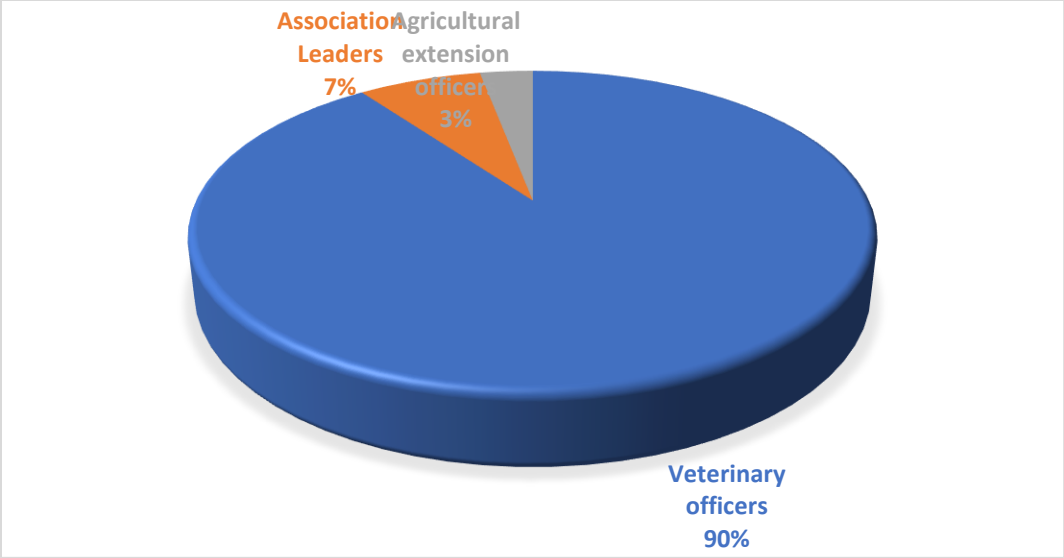

Figure 4.0-9: Facilitators of welfare trainings

4.8.2 Freedom to express normal patterns of behaviour and freedom from fear and distress from IK

With regards to farmers understanding of animal behaviour, farmers expressed their understanding of why their animals behaved the way they did as explained to them by older farmers (Table 4.6). Only 2.5% of farmers stated that they were trained in the use of paranormal to detect causes of agitation within the herd, and the rituals to stop the agitation.

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Table 4.6: Causes of agitation in cattle

Causes of agitation	Number of Farmers	Per (%)
Loud noise	18	5.7
Paranormal reasons.	76	23.9
People who stone them	36	11.3
Reptiles (Snakes)	76	23.9
Intruders	34	10.7
Nothing	44	13.8
Dogs/Wild animals	14	4.4
Insects (Bees, Tsetse flies)	8	2.5
Do not know	22	3.8
Total	**318**	**100**

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According to the farmers, the older ones taught them the following as ways to calm agitated animals on their farms: 32.5% used vocal commands (i.e., whistling/use of specific words) and hand movements to calm the animals. Others sought out the source of stress and remove it (32.5%), 28.6% allowed their animals to rest; 2.6% admitted they beat them with sticks to control them and 3.9% said they did nothing at all.

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Table 4.7: Methods of controlling/directing cattle.

Drive and control methods	Number of farmers	Per (%)
Use of lead cow	6	1.9
Use of commands	220	69.2
Use of sticks/rods	52	16.4
Commands and rods	40	12.6
Total	**318**	**100.0**

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Table 4.7 showed the various means by which farmers controlled and directed animals. A few transporters (9%) considered animal welfare to concern only the handling of animals in loading and offloading.

4.8.3 Freedom from physical and thermal distress and freedom from injury, pain and disease from IK

Through apprentiship, 39% of farmers mainly learnt disease detection and herbal treatments for cattle, while 49.7% learnt labour detection and how to assist with calving. With regards to thermal stress, 87.7% did not provide any kind of housing or protection from the weather. According to the farmers they had been taught that their animals were impervious to varying weather conditions. Some farmers (56.6%) had been taught

various methods of protecting their herds from theft by the use of dogs and kraaling very close to the household.

Out of all the 78 transporters 77.3 % of them stated they had no training in animal welfare from the older transporters. The remaining 22.7% who had received some kind of animal welfare training from older transporters, stated that they were taught how to: Purchase healthy animals, carry outs basic health checks and the proper techniques of restraining animals.

According to the butchers. 77.1% reported that their indigenous training focused on knife handling and how to slaughter and butcher in a way that caused less pain. Only 10.9% of the butchers stated that their training focused on identifying and purchasing healthy animals. Customer care at point of sale was indicated by 12% as the focus of their training (Figure 4.11).

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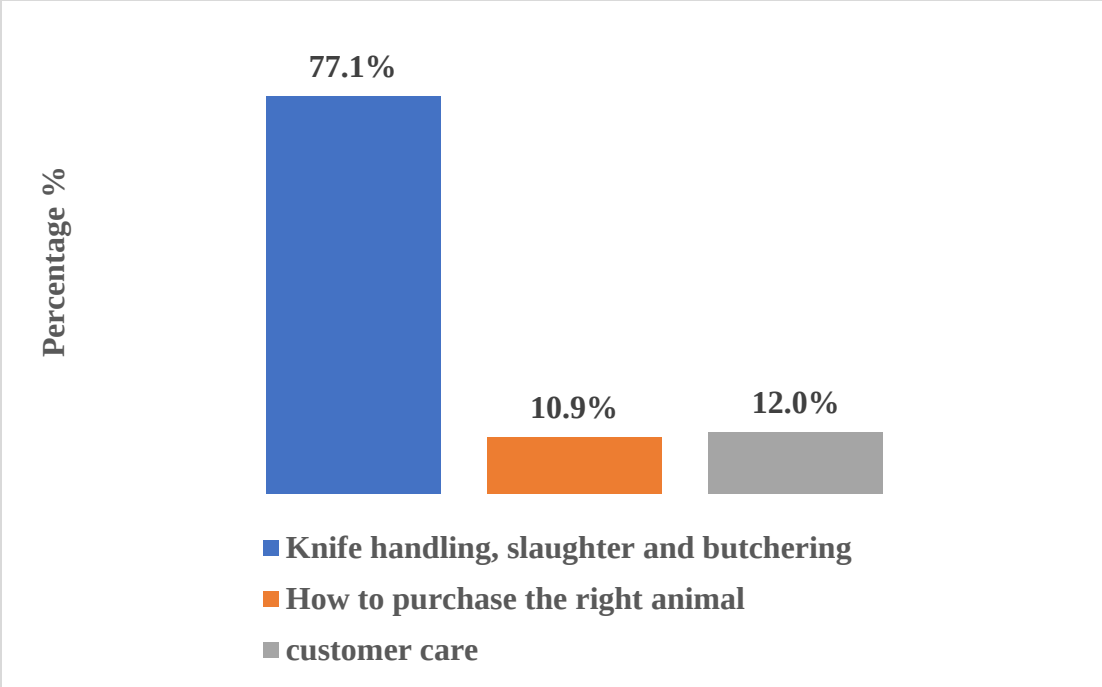

Figure 4.0-10: Methods of traditional training of butchers

Butchers gave details on how they were taught to avoid injuries (Figure 4.12).

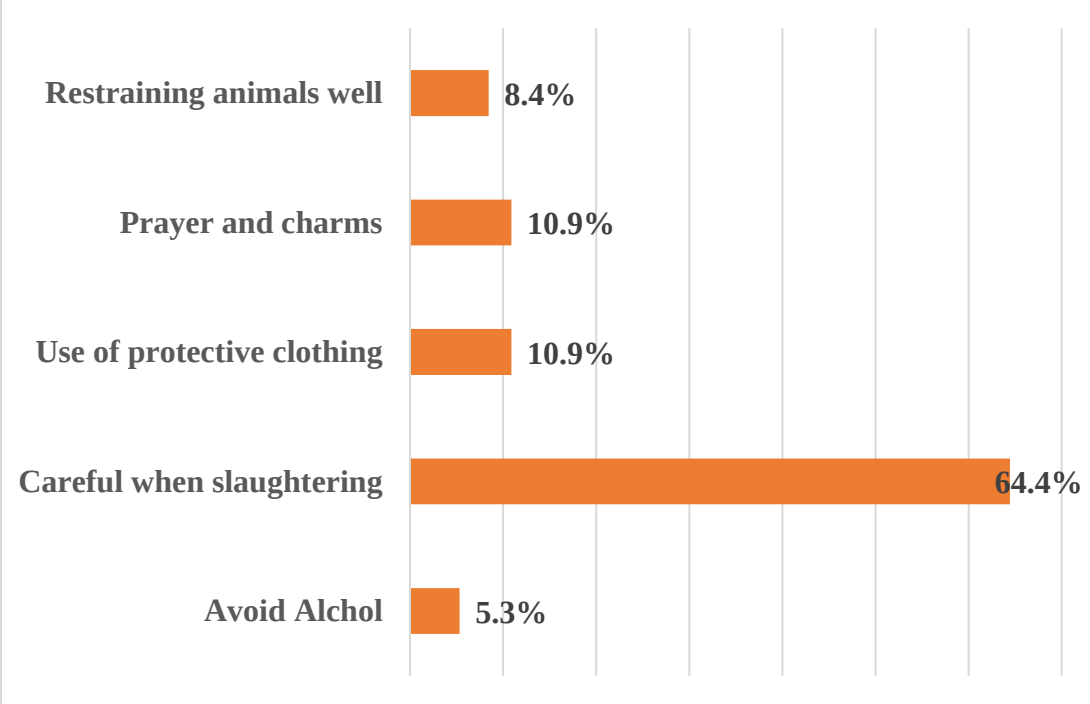

Figure 4.0-11: Injury prevention

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4.9 Discussion

The urgent need for a comprehensive animal welfare assessment, of the Ghanaian livestock value chain triggered this study. This study was carried out to document the current state of animal welfare in Ghana. The main objective of this study was to assess the current condition of cattle welfare from the farm to the slaughterhouse in Ghana.

The farms can be classified as small herd sizes, the range of herd size falls within that reported for sub–Saharan Africa by Otte and Chilonda, (2002) who reported1 4.6 to 157.3 mean herd size. Most farmers were middle aged with no education. This agrees with findings by Nuvey *et al*. (2020) who found the mean age of the cattle farmers to be 46.9 ± 11.7 years and almost all the respondents were male (93%) and had some basic education (46%). Although 7% of their respondents were female, in this study none of the respondents were female. The low level of participation of women in the cattle industry has also been widely reported by Zakaria *et al*. (2015), Quisumbing *et al*. (2015) and Hovorka (2012), who proposed that cattle rearing is considered a male profession.

Transporters were the most educated players in the cattle value chain when compared with farmers and butchers. This may be attributed to their ability to read and write as a requirement for acquiring a driving license in Ghana.

The average age of butchers was 41 years with almost a third of them being above 40 years. This was in agreement with Adzitey *et al*. (2011) who reported that majority (45%) of the butchers they encountered were within the ages of 41-50 years.

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The average years of experience by butchers was 19 years. Most of the butchers (70%) had some form of formal education, which was contrary to the findings of Adzitey *et al*. (2011) who stated that 64% of the butchers had no formal education. However, it agrees with Asuming-Bediako *et al*. (2018) who stated that 70% of butchers had an education, with 49.1% having a basic level education.

Majority of the butchers were Muslims which supports existing evidence reported by Adzitey *et al*. (2011) and Asuming-Bediako *et al*. (2018) who observed the dominance of Muslims in the slaughtering, butchering and meat business. Most of the butchers are from the northern regions which contributes to Muslim dominance in the industry, since Islam is the dominant religion in northern Ghana as stated by Abdul-Hamid (2010) and Tonah (2006). Additionally, a Muslim bleeding an animal gives it wider acceptability due to it being halal.

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4.9.1 Indigenous knowledge and experience of farmers, transporters and butchers

The average age range for farm hands ranged between 15-20 years of age. Nuvey *et al*. (2020) reported that the majority of farmers (70%) had experience with cattle rearing and raising livestock in general since their childhood. This study agrees, and found that farm hand apprentices form the next generation of farmers. It therefore supports the assumption that indigenous knowledge on animal welfare is passed down transgenerational in an informal training system.

Very few farmers had any form of formal training in cattle rearing, the majority learnt the skill from older farmers through apprenticeship. With regards to the concept of animal welfare, most farmers had a little understanding of the concept. The animal

welfare they learnt from older farmers were in the areas of: stockmanship, health and a minority focused on the paranormal aspects of cattle rearing. Although farmers did not hold an academic definition or model of animal welfare protection, it was obvious that various aspects of animal welfare had been handed down to farmers through indigenous knowledge transfer, thus farmers had a significant concern for animal welfare. This assertion on the existence of indigenous knowledge is noted by FAO (2012) which state that indigenous knowledge systems of livestock care and health care are asset in the hands of the small holder farmers to mitigate the challenges livestock production.

Farmers were generally able to determine sources of behavioural changes in their herds, however nearly a third (23.9%) still attributed some behavioural changes to paranormal reasons. Most methods of calming agitated cows were learnt from older farmers and proved effective as farmers in this study showed good stockmanship skill. This disagrees with the assertions made by Ndou *et al*. (2011) which stated that " in the developing world, where food insecurity and poverty are prevalent, the welfare of animals receives low priority due to factors such as traditional customs and beliefs, lack of knowledge in animal handling and substandard handling facilities".

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Most farmers used a series of commands and cues to direct and control their cattle. The use of projectiles and whips were employed (29%) some of the time. This indicates that farmers and farm hands spend considerable amounts of time interacting with the cattle on the farm. Record keeping was not done by majority of famers, most of the records kept were on births, deaths and sales. Poor record keeping is a common challenge to the livestock industry of Sub-Saharan Africa (Kuteesa and Kyotalimye, 2019, and Msalya

et al., 2020). Poor record keeping in this study can be linked to high illiteracy rate of farmers.

The main destination of transporters in this study was Kumasi in the Ashanti Region. Kumasi is the capital of the Ashanti region, and has the second largest population in Ghana (Kumasi, 2021); consequently, a high demand for meat products. Most of the vehicles observed in the study were overloaded with little or no space for cattle to move while in transit. Frimpong *et al*. (2014) also reported cases of overcrowding of cattle during cattle transport in Ghana.

Majority of the cars observed were not fit for the purpose of transporting cattle, none of the vehicles encountered had any form of partitioning. This agrees with studies by Shaibu *et al*. (2017) who noted that inappropriate vehicles were used to transport animals to slaughterhouses in Ghana.

Most (84.7%) had no knowledge of the generally accepted concept of animal welfare, transporters view of animal welfare were limited to provision of food, medical attention to animals and loading and offloading of animals. None of the transporters had received any form of formal education on the transportation of livestock, most of them had been assistants on other trucks until they finally started driving vehicles of their own.

the training butchers received while in apprentiship focused on knife handling, slaughtering /butchering, purchasing of animals and customer care. The lack of formal training for butchers was also reported by Asuming-Bediako *et al*. (2018) who stated that formal training opportunities for actors in the meat value chain was observed to be low.

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Butchers were trained to avoid personal injury through proper restraining of animals before sticking, use of protective gear, being careful in process and few (10%) relied on prayers and charms as a source of protection.

Majority of butchers were able to give a fair definition of animal welfare, with 42.9% having attended some form of formal training in animal welfare. This Figure is higher than 28% reported by Asuming-Bediako *et al*. (2018).

4.9.2 Conclusion

The broad objective of assessing the conditions of livestock welfare from the farm to slaughterhouse was achieved in this study. The study has established that most of the knowledge transfer from older to younger farmers was carried out through oral means and apprenticeship. The absence of formal training in cattle stockmanship and welfare clearly indicate that the training regiments for most Ghanaian cattle farmers is through the transfer of indigenous knowledge.

Based on their conclusions it is recommend that that a repository for indigenous welfare knowledge be set up to preserve the important information that is fast being lost with the advent of formal learning systems.

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CHAPTER FIVE

5.0 WELFARE CONDITIONS OF GHANAIAN CATTLE FARMS

5.1 Introduction

The bedrock of evaluation of animal welfare begins with the farm conditions and stockmanship. In this study the objective was to evaluate farm welfare conditions. The study sought to take a critical look at how cattle are treated from birth till they are sent off to slaughter houses. The study took a critical look at these conditions of Ghanaian farms from the viewpoint of the five welfare freedoms.

Animals are raised for a variety of reasons, and provision should be made for their needs. The quality of life of farm animals is determined by legislation, husbandry, stockmen, and market demand by the consumer (Future, 2009a).

Animals are raised in Ghana using the extensive, semi-intensive, or intensive systems. The extensive system, is the most widely used method, especially in rural areas (Adzitey, 2013).

In developed countries, evaluating a farm for welfare purposes should include:

1. Food and water availability.
2. Environment: building, thermal environments, space allowance, pasture section, handling facilities, fencing, waste disposal.
3. Management: managers, storekeepers, handling, and identification equipment, inspection, other farm work animals, protection from other animals, sourcing of livestock.

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4. Health: health and welfare monitoring, body condition scoring, husbandry procedures, breeding/calving, medication /vaccination, casualty slaughter /emergency slaughter.

5. Transport

Transport of animals out of the farm (McKenna, 2018).

While international animal welfare standards exist in the industrialized world, there are intrinsic barriers to implementation in most developing nations, particularly among communal farmers. These include cultural rules and practices, social ranking, socioeconomic status, accessible resources, information distribution and monitoring tools. As a result, there is a need to synchronize what is required internationally with what is practical in order to account for global diversity (Njisane *et al*., 2020b). Farm conditions are the foundation of all animal welfare assessments. Exploring and documenting the farm conditions, equipment use for handling of animals and the health conditions of flock; were important in meeting this objective.

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5.2 Study area

Study area has been described in chapter 4

5.3 Materials and methods

Materials and methods carried out as outlined in chapter 4

5.3.1 Data collection

Data collection was carried out as outlined in chapter 4

5.4 Results

5.4 .1 Farm observation

Results of the observation checklist are presented in Table 5.1.

Table 5.1: Farm assessment by observation

Animal handling	Yes		No		Chi Square	
	Number of farms	%	Number of farms	%	Stat	P Value
Housing	82	25.8	236	74.2	74.6	<0.001
Alternative housing for rainy season	60	18.9	258	81.1	118.2	<0.001
Exposure of animals to harsh weather conditions	279	87.7	39	12.3	182.3	<0.001
Separate quarters for different animals (age and/sex)	44	13.8	272	86.2	166.4	<0.001
Demarcation of farm	122	38.4	196	61.6	17.2	<0.001
Animals protected from theft	180	56.6	138	43.4	5.5	0.019
Adequate feeding troughs	100	31.4	218	68.6	42.6	<0.001
Adequate drinking troughs	191	60.1	127	39.9	13.0	<0.001
Presence of prophylactic medication	122	38.4	196	61.6	18.3	<0.001
Isolation Area	42	13.2	276	86.8	172.2	<0.001
Presence of record books	60	18.9	258	81.1	121.6	<0.001
Animals seem stressed	10	3.1	308	96.9	277.3	<0.001
Overcrowding	88	27.7	230	72.3	67.9	<0.001
Was farmer calm around animals	296	93	22	7	284.2	<0.001
Presence of farm equipment	100	31.4	218	68.6	44.9	<0.001

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Table 5.2: Evaluation of association of years of experience of farmers with five freedom parameters

Freedoms	Variable	Stat	P Value
Hunger malnutrition and thirst	Farming system	0.15	0.285
	Feeding practices	0.18	0.016
	Use of mineral supplements	0.24	0.005
Fear and distress	Threat of herd to wild animals	0.45	<0.001
	Ability of farmers to detect stress in animals	0.21	0.027
	Knowledge of the sources of stress in their herds	0.40	<0.001
Physical and thermal discomfort	Housing provided	0.24	<0.001
	Housing practices in the rainy season	0.26	<0.001
Pain, injury and disease	Persons who treat sick animals	0.29	<0.001
	Their understanding of signs of disease	0.18	0.043
	How often animals are inspected for disease conditions	0.38	<0.001
Express normal patterns of behaviour	Knowledge of behaviour of animals' exhibit	0.49	<0.001
	Animals' response to commands	0.34	<0.001
	Their ability to notice change in behaviour	0.14	0.361

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5.4.2 Farm evaluation of freedom from hunger, malnutrition, and thirst

With regards to feeding, 38% of the farmers fed animals ad libitum, 1% fed once a day with 61% feeding their animals twice a day. Farmers fed animals in the morning and evening with 90.6% grazing their animals on free range (Figure 5.1).

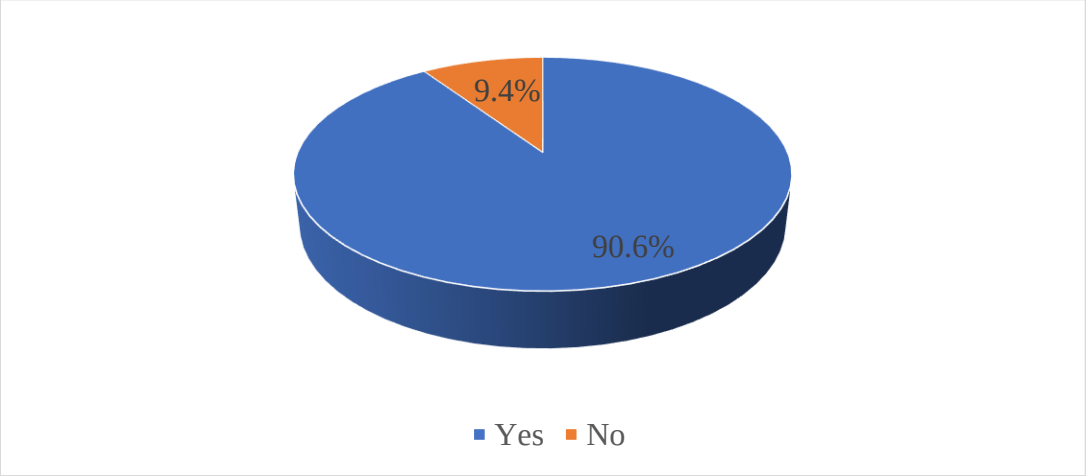

Figure 5.0-1: Animals grazed on free range

Most farmers (60.4 %) used some form of mineral supplements on their farm (Figure 5.2), the supplements given are shown in Table 5.3.

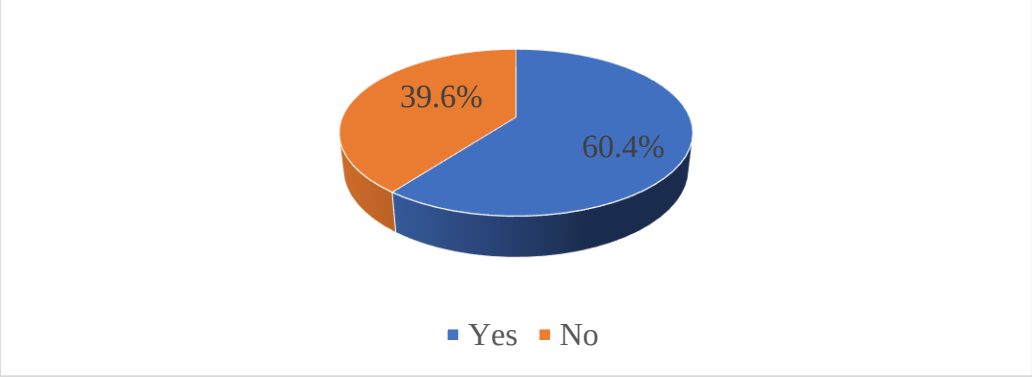

Figure 5.0-2: Use of supplements.

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Table 5.3: Type of supplements given

Type of Supplement	Number of farmers	Per (%)
Saltlick	104	54.2
Vitamins	66	34.4
Injection and salt lick	4	2.1
Salt solution	4	2.1
Unknown medication from veterinary officers	12	6.3
Food seasoning	2	1.0
Total	**192**	**100.**

In the rainy/wet season the main method of feeding is to allow animals to graze grass (82.4%). However, in the dry season although animals were still grazed, many more supplementary feeds were employed (Table 5.4).

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Table 5.4: Comparing feeding methods in the rainy and dry seasons

Rainy Season			Dry Season		
Feeding	**Number of farms**	**Per (%)**	**Feeding**	**Number of farms**	**Per (%)**
Grazing	262	82.4	Grazing	240	75.5
Cutgrass	28	8.8	Cutgrass	20	6.3
Cut tree branches	4	1.3	Grinding mill waste	30	9.4
Grinding mill waste	10	3.1	Formulated feed	16	5.0
Formulated feed	14	4.4	Grazing and grinding mill waste.	2	.6
			Grazing and cassava peels	2	.6
			Grazing and cutgrass	2	.6
			Kitchen waste	6	1.9
Total	**318**	**100.0**	**Total**	**318**	**100.0**

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In both the dry and rainy seasons farmers allowed animals to graze freely for 10-12 hours during the day. Majority of the farmers (79%) had a feeding plan for the year with 21% having no plan for feeding.

5.4.3 Farm evaluation of freedom from fear and distress

To determine farmers' appreciation of fear and distress within their herds farmers were asked the common sources of fear within the herd. A quarter (25 %) attributed fear to the presence of reptiles (snakes), 23% believed fear in the herd was caused by

paranormal sources, 18% did not know the source of fear, other reasons are given in Table 5.5.

Table 5.5: Causes of fear/ distress in heard

Triggers of fear	Number of farmers	Per (%)
Loud noise	18	6
Paranormal	73	23
People throw projectiles (e.g. stones)	36	11
Reptiles (Snakes)	79	25
Intruders	34	11
Not sure	56	18
Dogs/Wild animals	14	4
Insects (Bees, Tsetse flies)	8	3
Total	**318**	**100**

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Some farmers indicated that their herds (48.4%) had experience attacks by wild animals and snakes on their farm, 51.6% had never experience attacks from wild animals and snakes.

Farmers identified signs of fear and distress in their animals by raised tails, bellowing, huddling, agitated movement, refusal to move, running and jumping, lying down and change in normal routine. A few (4.4%) of farmers stated that they could not identify signs of fear in their animals (Figure 5.3).

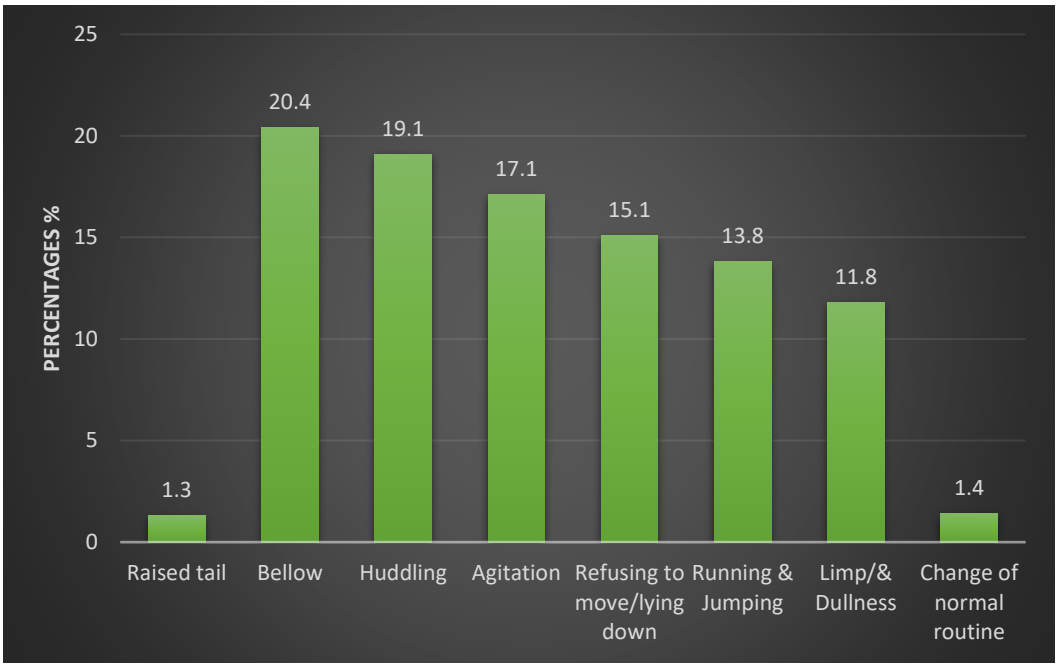

Figure 5.0-3:Signs animals show when in distress

Farmers adopted the following means to calm an agitated herd of cattle; 32.9% used vocal commands and movement, 32.9% removed the source of distress, 28.9% would allow animals to rest, 2.6% beat animals with sticks in an attempt to stop the agitation and 2.6% did nothing at all (Figure 5.4).

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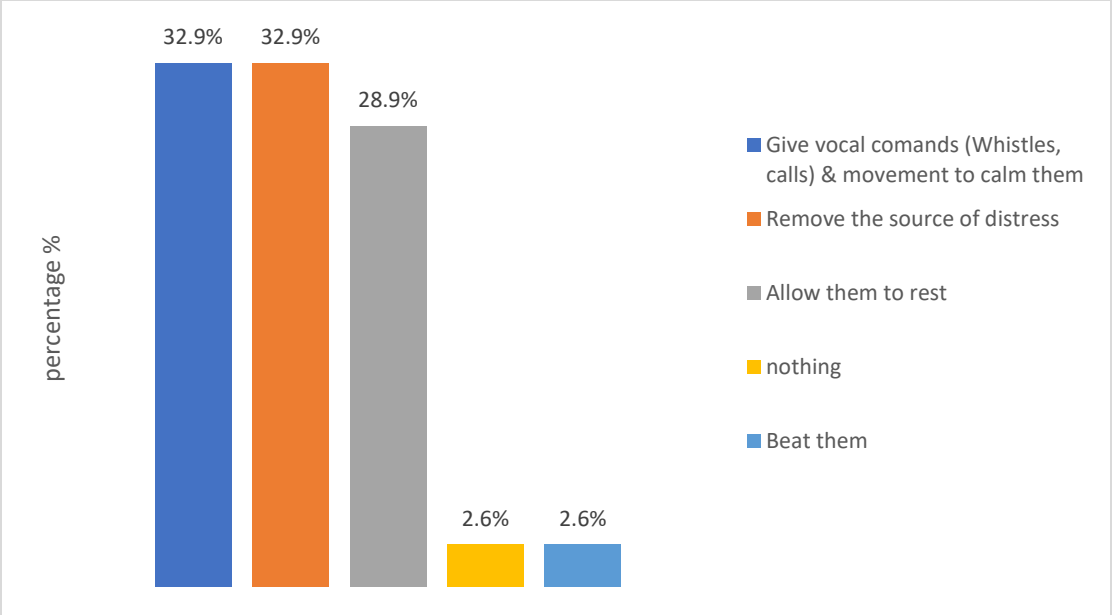

Figure 5.0-4: how farmers calm agitated animals

5.4.4 Farm evaluation of freedom from pain, injury and disease

Most (67.9%) farms had never been inspected, and remaining 32.1% had been inspected (Figure 5.5). The farms were inspected by veterinary and agricultural extension officers.

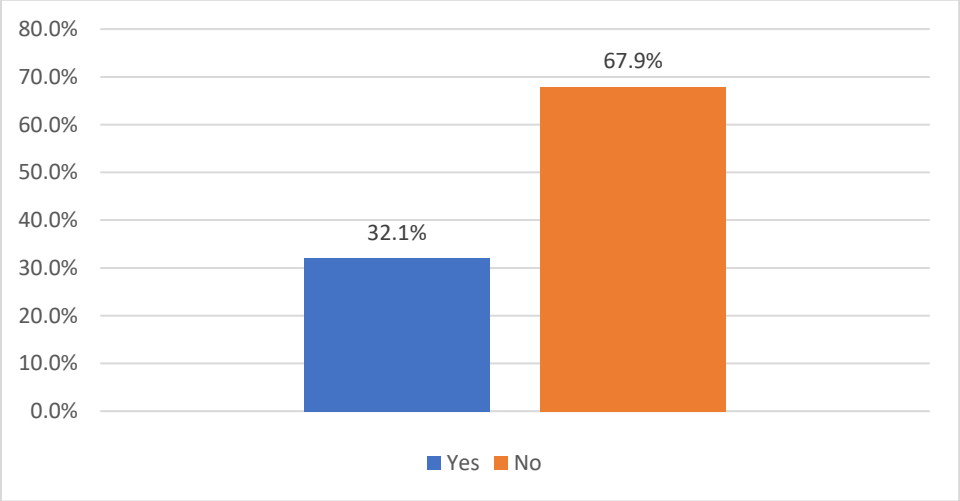

Figure 5.0-5:Inspection of farm

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The signs farmers observed for disease were loss of appetite (57.2%), physical dullness (39%) and physical changes of the skin, hooves and orifices (3.8%) (Figure 5.6). Sick animals were treated by Veterinary officers (57.2%), farmers (27.7%) and by other farmers (15.1%) (Figure 5.7).

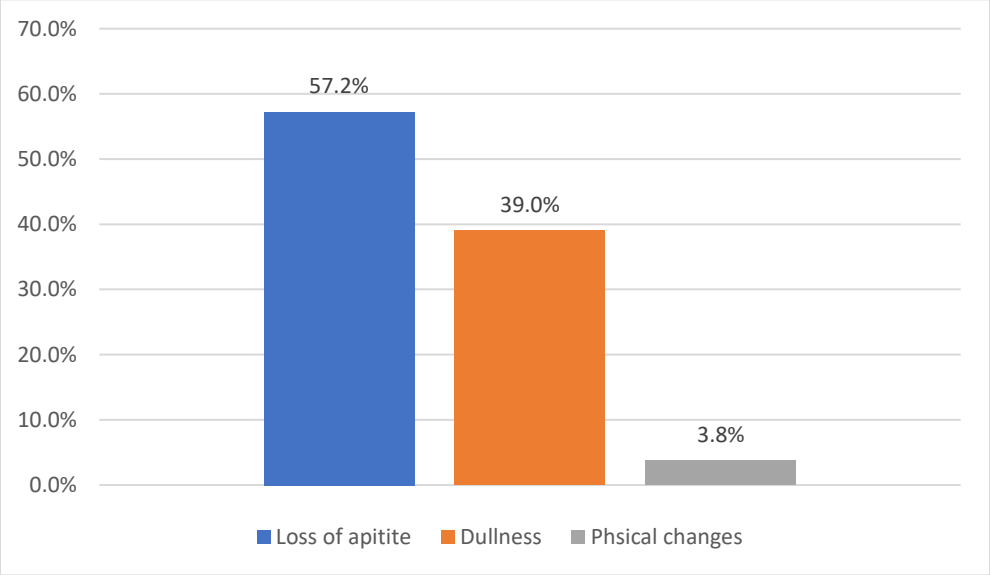

Figure 5.0-6: Signs of disease

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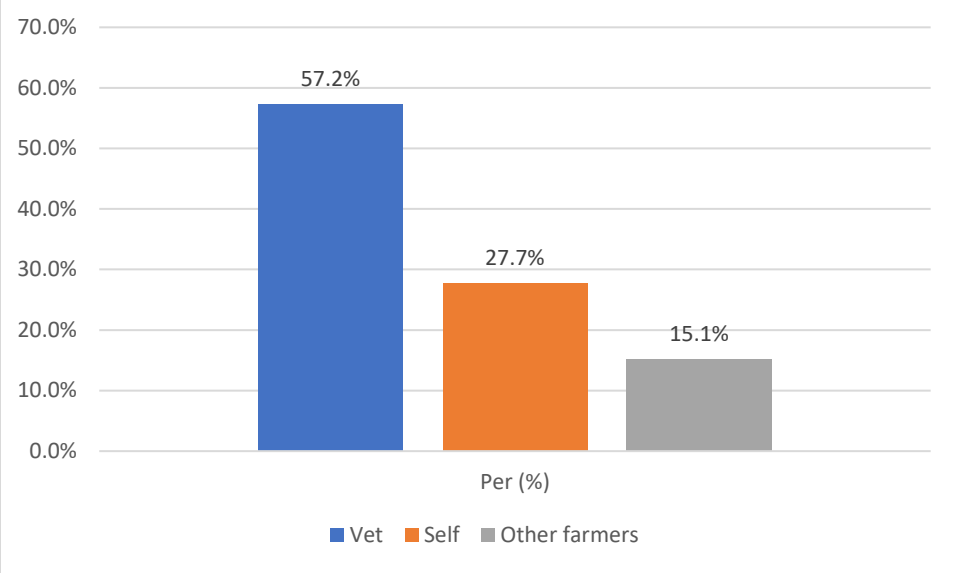

Figure 5.0-7: Persons who treat sick animals

Cattle were inspected for disease daily by almost half (48.8%) of the farmers, weekly by 18.7% of the farmers, at least monthly by 20.6% of farmers, 9.4% only when animals looked sick and 2.5% at random. Majority of the farmers (69.2%) had no treatment plan while 30.8% had rudimentary treatment plans. Treatments were carried out at regular intervals by 42.7% of farmers, 18.7% carried out treatment at the beginning of the rainy season only, 1.3% carried out treatment on when new animals arrived and 37.3% treated animals only when signs of sickness were identified. Farmers stored their medication as shown in Figure 5.8.

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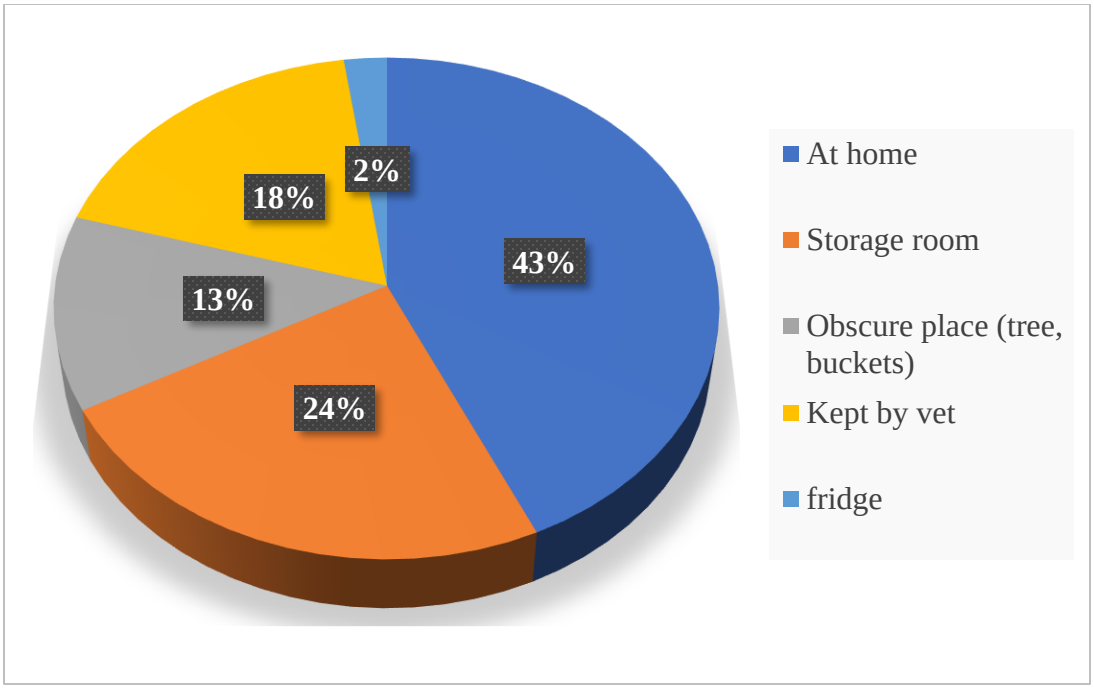

Figure 5.0-8: Where medication is stored

Farmers carried out various veterinary activities on their farms, some (32.7%) of farmers assisted their cows in calving, 23.3% castration, 30.8 % dehorning, 70.4% carried out parasite control, and 24.1% trimmed overgrown hooves.

5.4.5 Farm evaluation of freedom to express normal patterns of behaviour

Farmers generally found their animals to be calm and playful (89.4%) and a minority (10.6%) reported aggressive animals. Nearly all farmers (99.4%) were able to detect changes in behaviour of their animals. Majority (93%) of the animals responded to vocal commands and hand gestures (Figure 5.9), the purpose of commands used is show in Figure 5.10.

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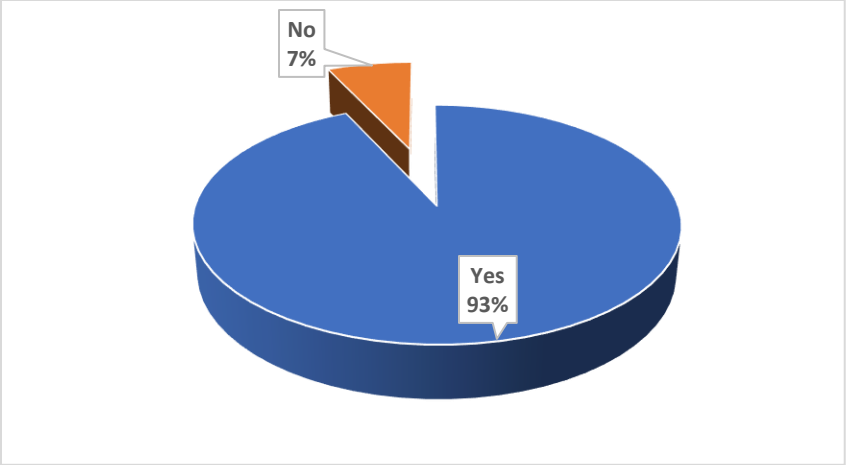

Figure 5.0-9: Animals respond to commands

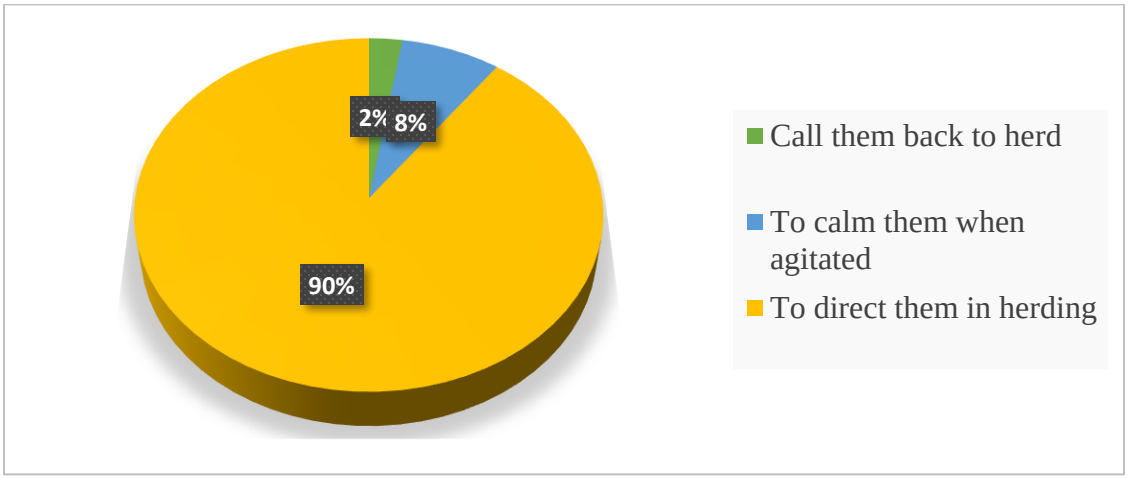

Figure 5.0-10: Purpose of commands.

Farmers herd their cattle by the following means: Use of lead cow (1.9%), commands (69.2%) and use of sticks/rods (16.4%). Many farmers (82.4%) admitted they had emotional attachment to their animals and were not always keen on selling them. However, 17.6% considered their farming a commercial venture and had no emotional attachment to their animals.

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5.4.5 Farm evaluation of freedom from physical and thermal discomfort

Out of all the farms visited, 78% of farms had animals in an open space, 14% had a kraal and 8% had stalls/sheds. There was no change in housing system during the rainy season. In the hot season animals are left in the heat and could be seen congregating under trees where available. In the rainy season animals were left in the rain in most occasions. Only 13.2% of farms had housing/ demarcated area for sick animals. All farms kraaled animals together with no separation according to age or sex. On the average farmers were cleaned twice in a month.

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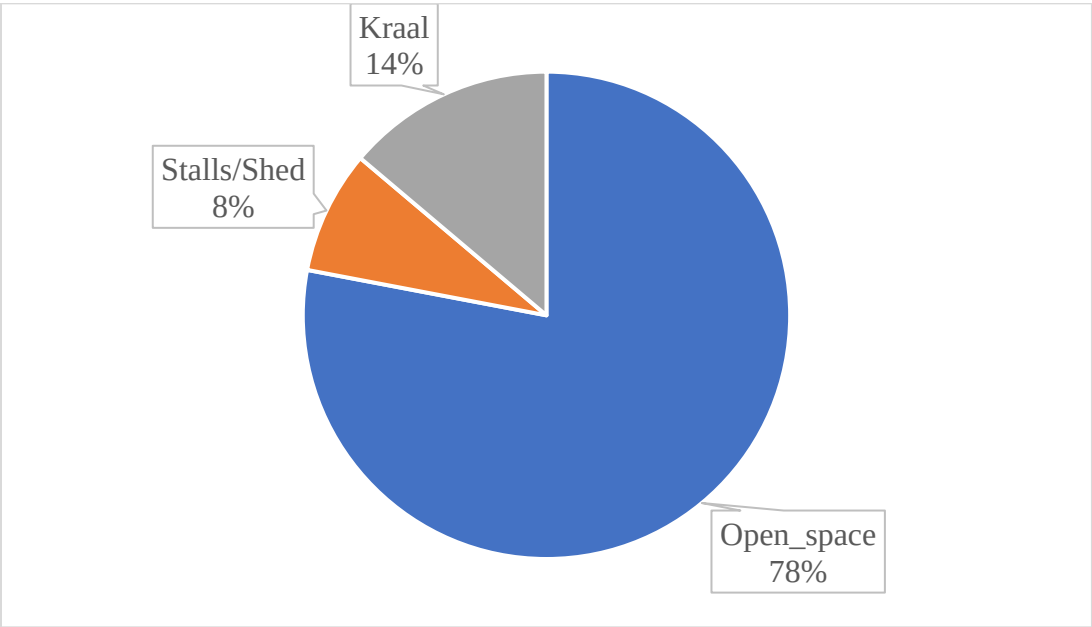

Figure 5.0-11: Types of housing.

Most (63.5%) farmers transported their animals to markets for sale in motor tricycles, 20.1% sold their animals at the farm gate while 16.4% used trucks when sending cattle to the markets/congregation points (Figure 5.12).

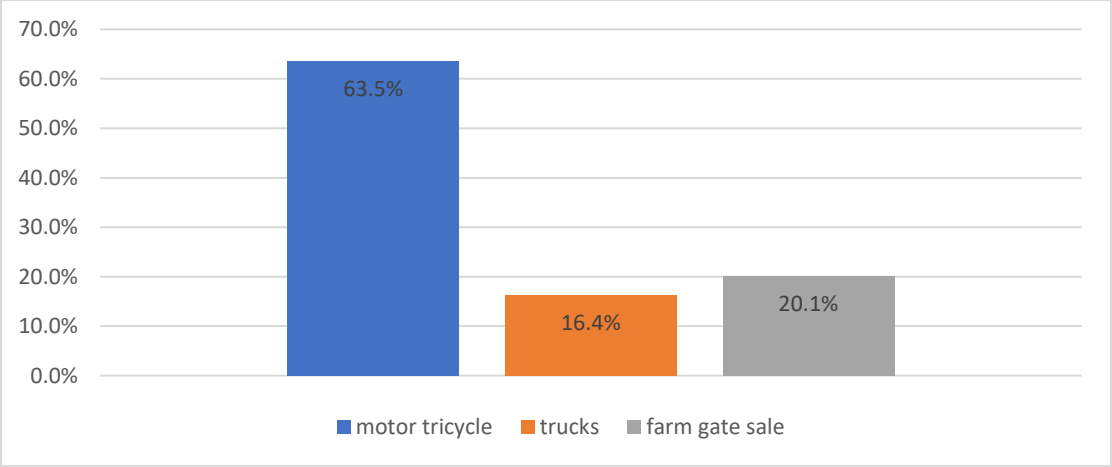

Figure 5.0-12: Transport to sales point.

From focus group discussions, farmers placed the most premium on freedom from hunger, malnutrition and thirst (95%), and freedom from pain, injury and disease (90%). Farmers took less proactive steps to guard their animals from freedoms of fear and distress (50%), and freedom from physical and thermal discomfort (50%). The freedom to express normal patterns of behavior (0%) was not one that they actively considered or proactively took steps to safeguard.

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5.5 Discussion

The objective of this study was to evaluate farm welfare conditions in Ghana. Majority (75%) of farms visited had no form of housing, and animals were exposed to the weather all year round. There was no change in housing system during the rainy season. In the hot season animals are left in the heat and may be congregated under trees where available. In the rainy season animals were left in the rain in most occasions. This situation exposed cattle of all ages to thermal discomfort. Shading seeking behaviour observed in this study was a sign that in the dry season, cattle are exposed to extreme heat which could lead to thermal discomfort. According to Van Laer *et al*. (2015), in tropical regions, heat stress (behavioural and physiological effects of hot ambient conditions) has been thoroughly documented to negatively impact the health, welfare and productivity of unsheltered cattle.

None of the farmers listed thermal discomfort as a welfare challenge to their herds, it can be inferred that even though these animals are exposed to high thermal stresses their inherent genetic adaptation to heat stress has mitigated the dire effects of the heat conditions they are exposed to as stated by Li *et al*., 2020; Kim *et al*., 2017; Katiyatiya *et al*., 2014.

The farming systems identified, were peri-urban livestock-production systems and non-nomadic pastoralism or extensive system. These results corroborate similar finding by Roessler *et al*., (2016), Scholtz *et al*. (2011) and Smith *et al*. (1998). The non-nomadic pastoralism system of farming required few inputs from farmers (mainly labour), and the constant movement of cattle for grazing exposes the cattle to many stressors and potential injuries through insect and reptile bites. Further, cattle activities can have a

detrimental effect on the environment through over grazing which causes erosion and soil degradation. Even though the peri-urban farmers encountered did graze their animals, there was a greater emphasis on supplementary feeding. They make great efforts to gather human food byproducts that they feed to their animals.

The use of mineral supplements was recorded in more than half of farms. In the dry season when the vegetation dries up, farmers augment grazing with the provision of supplementary feeds. Majority of the farmers (79%) had a feeding plan for the year with 21% having no plan for feeding. The absence of feeding troughs on most farms indicates that supplementary feeds were poured onto the ground as observed in many farms. It also indicates the high reliance of farmers on grazing. About 40% of animals on the farm only had access to drinking water when they trekked to open water bodies such as dams. The competition for water between humans and livestock observed in both rural and urban farms is similar to that of Naiga *et al*. (2015) who stated that animal farming contributes to contamination and water scarcity, as both humans and animals compete for the same water source. On the same observation, Water Resources and Livestock (2021) stated that humans, animals, and plants compete for water and it is by far the most important limiting factor in livestock production.

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This reliance on grazing and limitations of water, challenges the animal's freedom from hunger, malnutrition, and thirst, since the availability of food and water is seriously hampered by seasonal rainfall. This caused wide fluctuations in the body conditions of cattle. It was observed in the rainy season that cattle were in better physical condition as compared to the dry season for the non-nomadic pastoral farmers. The cattle of peri-urban farmers had smaller fluctuations in their conditions between seasons. The

challenge of hunger, malnutrition and thirst is a situation imposed on the farmers and not generated out of neglect or intentional harm to the animals as suggested by Woods (2012) and Taylor and Fraser (2019).

Most farmers had no prophylactic medications on the farms and there was no isolation structure in majority of the farms. The absence of a treatment unit or area and prophylactic drugs on most farms indicate that most farmers did not have a commercial farming approach to their farming module. Farmers were found to use medicinal plants to treat some cattle health conditions which is in agreement with observations by Mushtaq *et al*. (2018), Parthiban *et al*. (2016), and Sher and Alyemeni (2011).

Nearly all animals encountered on the farms were in a calm state, animals were not crowded farmers were calm around their animals which shows good stockmanship in their handling. Farmers showed a great degree of astute stockmanship, while some farmers named their animals and spoke directly to the animals while engaging them. Good stockmanship is known to have many benefits to the farmer and the animals as well. Rushen and Passillé (2017) stated that animal welfare and productivity will benefit from skilled stockmanship. Dairy cows and other animals which are afraid of humans gain less weight, produce less milk, and have decreased reproductive productivity. It is possible that farms with animals that are willing to approach people will be more productive (Rushen and Passillé, 2017). A very important component of farming that affects both animal welfare and animal productivity is the people who care for the animals. Rushen and Passillé, (2017) stated that, the knowledge or technical competence of the stockperson can play a major role if it leads to improper choice of housing, poor feeding methods, or lack of appropriate treatment of illness, and the

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quality and diligence with which routine tasks are done can be also be important. Zulkifli (2013) has shown that the way that animals are handled by people can have a major effect on their welfare.

Farmers were generally conversant with the sources of distress within the herd. The presence of reptiles (snakes), paranormal sources, pedestrians (mostly in urban and peri urban locations) who threw projectiles, intruders onto the farm, wild animals and insects (e.g. bees) are sources of distress reported by Wallach *et al*. (2017), Allen (2014) and Denning *et al*. (2014). Sources of stress such as cold, heat, handling, transporting, temperament, introduction to a new flock, diseases and parasites reported by Gebregeziabhear and Ameha (2015) and Chebel *et al*. (2016) were not considered by farmers in this study to be major causes of stress. This implies that farmers appreciation of stressors to animals is limited and had implications for the animal welfare on their farms. The belief in paranormal triggers is an indicator that cattle farming in some areas is still very traditional and steeped in elements of mysticism. These results are similar to that of Komwihangilo *et al*. (2007) , Wanzala *et al*. (2005), Misra and Kumar (2004), and Parkes (1987) who identified the belief in the supernatural as part of the animal rearing traditions.

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Farmers used behavioural signs such as raised tails, bellowing, huddling, agitated movement, refusal to move, running and jumping, lying down and change in normal routine to identify signs of fear and distress in their animals. These signs of fear are widely accepted as reported by Lindahl *et al*. (2016), Grandin and Shivley (2015), and Forkman *et al*. (2007).

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Generally, in this study farmers were observed to have good animal handling skills. Which is known to enhance the welfare of farm animals. These observations are in agreement with Ceballos *et al*. (2018) who stated that, good stockmanship shown by farmers can be an effective and practical strategy to promote positive human-animal interactions on cattle farms, improving the quality of life of both animals and workers. Additionally Hovi and Bouilhol (2000) stated that in majority of the observed cases, the bulls reacted calmly to the stockman when he was described as self-confident, calm and well balanced.

With regards to freedom from pain, injury and disease, farmers regularly inspect animals for disease, and had rudimentary treatment plans. Most of the farmers kept medication in locations that could affect the efficacy of the drugs since the drugs were exposed to heat and direct sunlight. Farmers carried out various health activities on their farms such as assisting cows in calving, castrations, dehorning parasite control, and trimming of overgrown hooves.

The limited access of farmers to veterinary and extension services has resulted in some farmers carrying out self-treatment or depending on other farmers to treat their animals. This was also reported by Mockshell *et al*. (2014), who stated that access to high-quality animal health services is still a major issue for Ghana's livestock-dependent communities. Farmers in places where there are few or no government para-vets have resorted to self-treatment or selling sick animals for consumption, both of which have negative health consequences. Fulani and Lobi farmers have indigenous knowledge of the use of medicinal plants for the treatment of cattle disease such as foot and mouth

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disease, and animal trypanosomiasis, which they use instead of the use of veterinary services as documented by Traoré *et al*. (2020).

Farmers (82.4%) admitted they had emotional attachment to their animals and were not always keen on selling them. Ghanaian farmers emotional attachment to their cattle was also reported by Nuvey *et al*. (2020). However, 17.6% considered their farming a commercial venture and had no emotional attachment to their cattle. From table 5.2, results showed that years of experience was significantly associated with nearly all parameters with regards to the five freedoms. Only two indicators namely "farming systems" and "ability to notice changes in behaviour" were not significantly associated ($P>0.05$) with years of experience of farmers. This indicates that the year of experience of farmers played an important role in their understanding and adoption of welfare issues or methods. Farmer's years of experience among other factors has been reported to affect their attention to animal welfare issues (Coleman *et al*., 2003; Dockes and Kling-Eveillard, 2006; Kauppinen *et al*., 2012).

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5.7 Conclusion and recommendations

The findings show that farmers were aware of their animal's welfare needs and attempted to address them. Ghanaian cattle farmers were concerned about their animal's welfare but did not place equal weight on the five freedoms of animal welfare. Farmers placed the most premium on freedom from hunger, malnutrition, and thirst, and freedom pain, injury and disease. Farmers took less proactive steps to enhance the freedoms from fear and distress and freedom from physical and thermal discomfort. The freedom to express normal patterns of behaviour was not one that they actively considered or proactively took steps to safeguard.

This study successfully evaluated the animal welfare conditions of cattle farms. The information gather in this research has unearthed previously undocumented information about Ghanaian cattle farmers perceptions and actions in safeguarding the welfare of the animals.

A detailed comparison of the urban, peri-urban and rural farms with regards to animal welfare would be a logical progression to this study. This would give added information for policy implementation in the future.

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CHAPTER SIX

6.0 WELFARE CONDITIONS UNDER WHICH CATTLE ARE TRANSPORTED FROM VARIOUS FARMS TO MARKET AND SLAUGHTER CENTERS

6.1 Introduction

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Transporters are a vital link in the livestock value chain. Their activities link farms to marketing centers and or meat processing units. Most livestock are transported at least once during their lifetime (Randall, 1993). The transportation of live animals is known to be stressful and therefore can have a direct impact on animal welfare and on food safety and quality (Schwartzkopf-Genswein *et al*., 2008).

Transporters are required to play several roles from the moment they pick animals till they are handed over to the butchers. A number of the responsibilities performed by livestock transporters include the basics of stockmanship and animal husbandry (Rushen and Passillé, 2017).

The areas of great concern during transportation include: (1) microclimate, (2) loading density, (3) duration of transport, (4) quality of transport, and (5) animal behaviour. All of these factors play a role in animal welfare and have been shown to influence post-transport animal health and carcass quality (Schuetze *et al.*, 2017).

To ensure that animal welfare is enhanced during transportation, it is critical that all parties involved are well-informed about the animals and how to assess and preserve their welfare. Planning of journeys, suitability of vehicles, and space allowances for satisfactory movement of animals are of great importance. The importance of inspecting

each animal on the truck is a requirement during road transport (Broom, 2008). The vital role these transporters play necessitated an evaluation of the welfare standard by which cattle are transported in Ghana.

The objective was to evaluate the welfare conditions under which cattle are transported from various farms to market and slaughter centers.

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6.2 Materials and methods

Materials and methods carried out as shown in chapter 4

6.2.1 Data collection

Data collection was carried out as shown in chapter 4

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6.3 Results

6.3.1 General assessment

The minimum distance travelled with cattle was 150 Km and the maximum distance was 720 Km, and the average distance was 528 Km. On the average, transporters spent 18 hours in transit. The minimum hours spent was 12 hours and the maximum hours spent on a trip was 30 hours. It was observed that animals were tied and physically lifted into vehicles, 51.3% of the time and a loading ramp was used 48.7% of the time. Some (52%) of transporters reported that they paid levies to regulatory bodies such as: customs, police, revenue authority, district/municipal /metropolitan assemblies, and veterinary officers.

The main problems transporters faced are shown in Figure 6.1. The paramount problem was access to water and feed in transit and the least problems were cost of vehicle repair and maintenance and access to fit for purpose vehicles.

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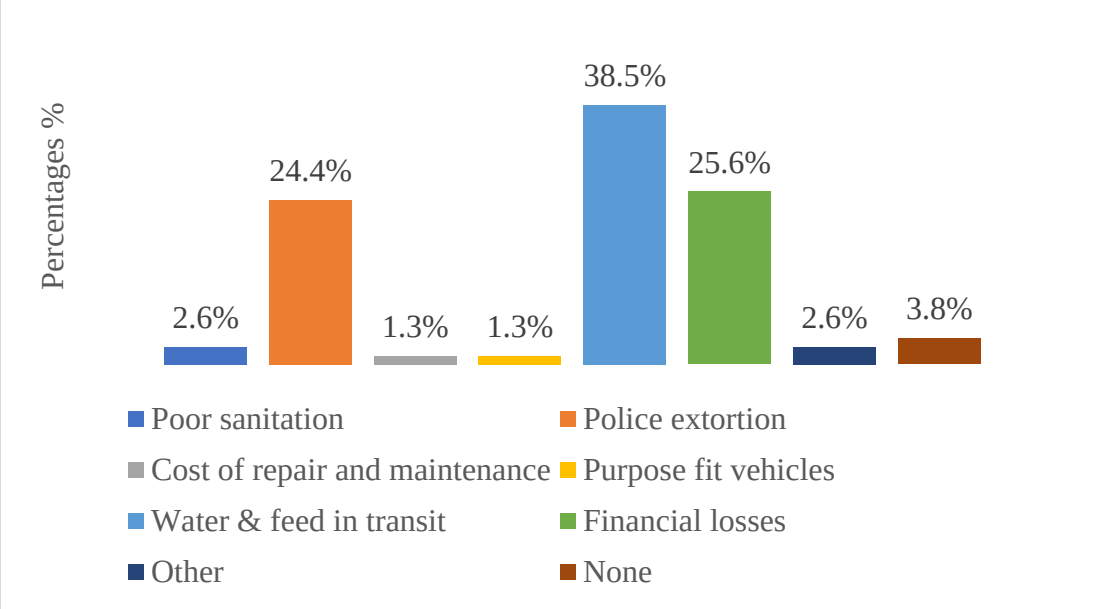

Figure 6.0-1: Major problems of transporters.

With regards to seasonal problems, feed and water shortage for animals (6.2) is the main problem in the dry season. and disease and mortality in the rainy season (Figure 6.3).

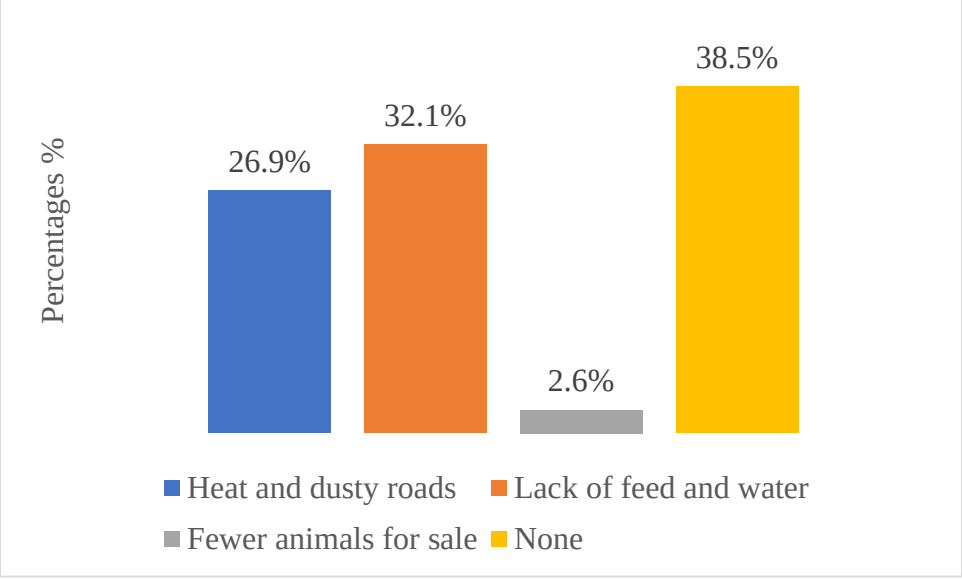

Figure 6.0-2: Main problems in dry season

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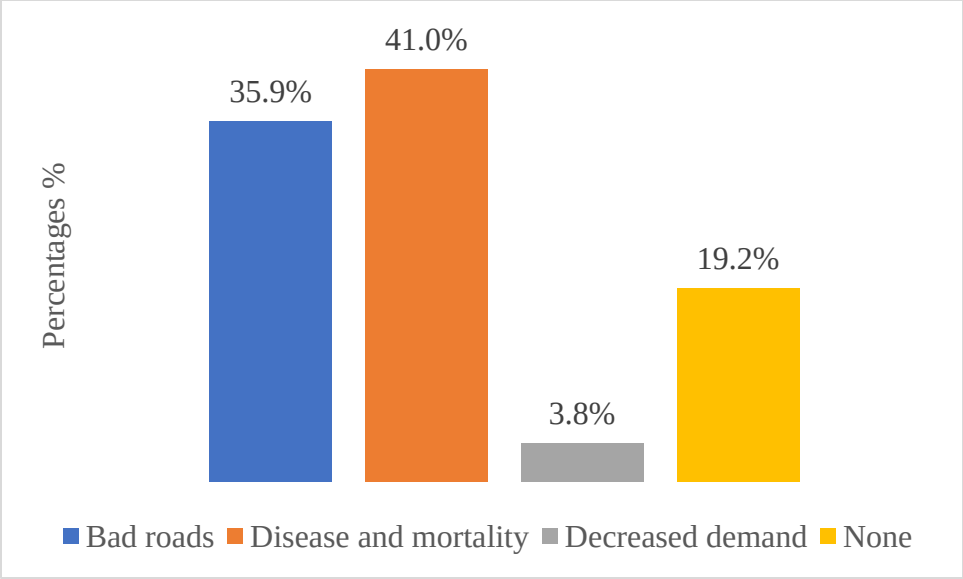

Figure 6.0-3: Main problems in rainy season

On maintenance of vehicles, 21% serviced their vehicles quarterly, 19% serviced their vehicles after every long journey, 36% serviced their vehicles twice annually and 24% serviced their vehicles once annually. Most transporters (72%) carried only cattle, while 28% transported cattle with sheep and goats. With regards to sizes of cattle, 79.5% of transporters mixed cattle of different sizes when transporting, while 20.5% transported cattle of similar size.

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Table 6.1 Evaluation of animal transport (observation)

Assessment of vehicles and animal handling	Yes		No		Chi Square	
	Number of Vehicles	%	Number of Vehicles	%	Stat	P Value
Vehicle fit for purpose of transporting cattle	31	39.70	47	60.30	2.92	0.087
Anti-Slip on vehicle floor	47	60.30	31	39.70	3.28	0.07
Adequate vehicle ventilation	75	96.20	3	3.80	66.46	<0.001
Drainage holes on floor	49	62.80	29	37.20	5.13	0.024
Carrier partitioned	13	16.70	65	83.30	35.58	<0.001
Loading ramp	47	60.30	31	39.70	3.37	0.066
Animals stressed during loading	43	55.10	35	44.90	0.82	0.365
Animals comfortable after loading	17	21.80	61	78.20	24.82	<0.001
Animals visibly sick/diseased	41	52.60	37	47.40	0.21	0.651
Transporters use handling equipment	55	70.50	23	29.50	13.13	<0.001

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Table 6.2: Evaluation of association of years of experience of transporters with five freedom parameters

Freedom From:	Variable	Stat	P Value
Hunger malnutrition and thirst	Feeding in transit	0.762	0.017
	Quantity of feed given	0.906	0.017
	Type of feed given in transit	0.516	0.699
Fear and distress	Animals show signs of fear in transit	0.747	0.029
	Signs of fear observed	0.74	0.011
	Transporter's estimation of how comfortable animals are in transit	0.708	0.068
Physical and thermal discomfort	Vehicles fit for transporting cattle	0.708	0.068
	Contingency plans for vehicle breakdowns	0.505	0.884
Pain, injury and disease	Ability of transporters to detect sick animals	0.895	<0.001
	Symptoms of disease transporters looked out for in animals they transported	0.64	0.021
To express normal patterns of behaviour.	Handling of aggressive animals	0.827	0.003
	Response to fatigued animals during transit	0.708	0.012
	If transporters observed fighting in transit	0.737	0.031

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6.3.2 Evaluating freedom from hunger, and thirst

Most transporters (65.4 %) fed their cattle in transit while, 34.6% did not feed the animals (Table 6.2); Majority (89%) feed the animals cut grass, while the rest (11%) fed them with rice or corn chaff. Majority of (61.5%) transporters provided water to animals in transit, out of the respondents who gave animals water in transit; 58.3% carried water for the animals while 41.7% stopped to fetch from water bodies along the route (Figure 6.4). Animals are fed and watered once while in transit. Upon arrival at the destinations most animals observed showed signs of dehydration and hunger; some animals could be seen nibling at wooden posts. The signs of dehydration observed were lethargy, tightening of the skin, drying of mucous membranes and eyes and sunken eyes.

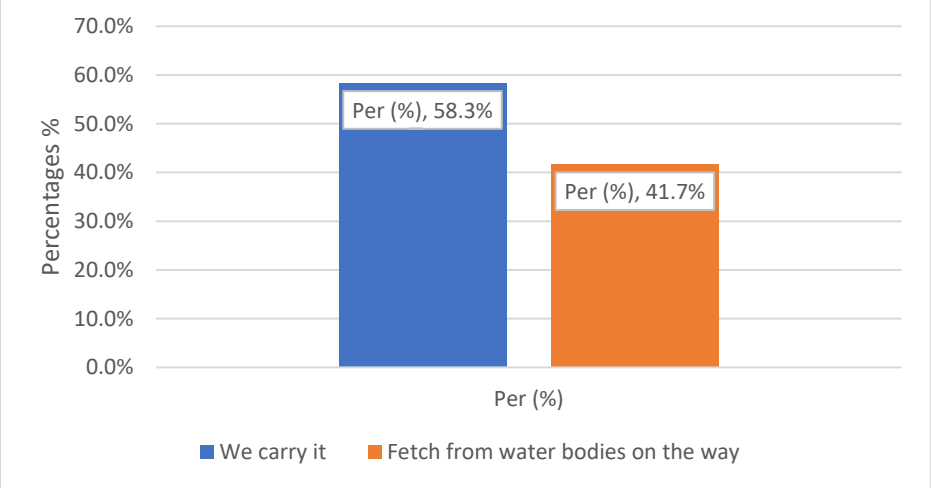

Figure 6.0-4:Source of water during transit

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6.3.3 Freedom from fear and distress

Transporters reported that animals mostly showed signs of fear and distress when in transit. The signs of fear shown are seen in Figure 6.5. Transporters judged the comfort of the animals based on calmness (89.6%) and by visual assessment of space (10.4%).

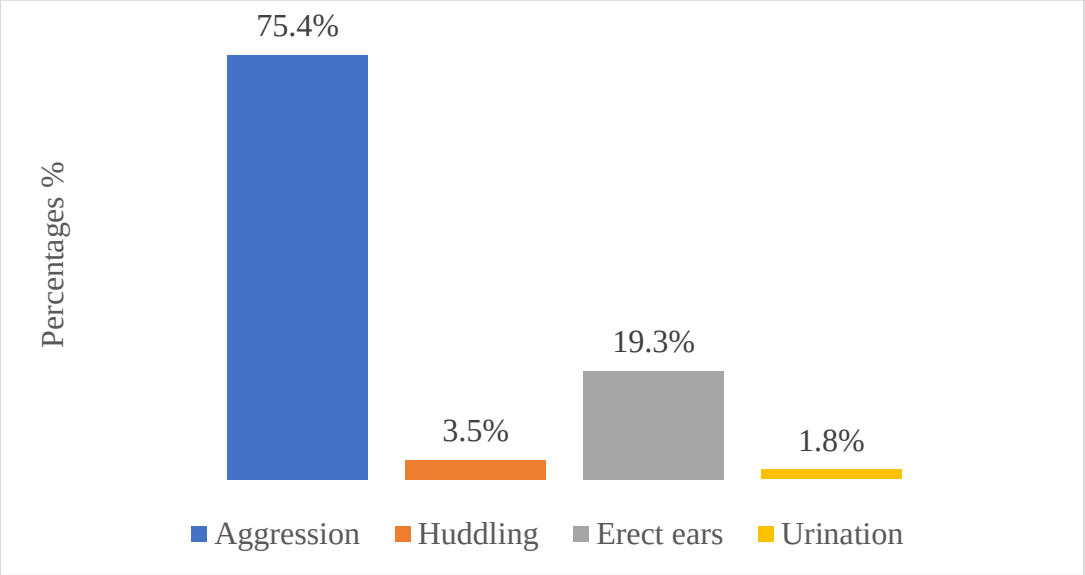

Figure 6.0-5: Signs of fear shown.

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6.3.4 Freedom from physical and thermal discomfort

Out of all the vehicles inspected 39.7% were fit for the purpose of transporting cattle, and 60.3% not fit for purpose. On the average each vehicle had 3 additional attendants to the driver. At least 2 of the attendants travelled in the carriage area in order to attend to animals while moving. The maximum number of attendants recorded was 8 and minimum was 1. Most (88.5%) of transporters reported incidents of vehicle breakdown while transporting cattle. Transporters contingency plans for vehicle breakdown as seen

in Table 6.3, most vehicles (81%) that broke down were fixed within 24 hours as seen in Table 6.4, and only 26.3% of vehicles provided bedding for animals.

Table 6.3: Contingency plans for vehicle breakdown

Contingency	No. of Transporter	%
Send for a replacement vehicle	1	1.3
Wait for vehicle to be fixed.	1	1.3
Call a mechanic from point of origin, if car cannot be fixed then another vehicle is arranged.	75	97.4
Total	77	100

Table 6.4: Number of hours to fix vehicle.

Number of hours to fix vehicle	**No. of Transporter**	**%**
24	63	81
48	3	4
72	3	4
120	3	4
144	6	8
Total	78	100

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6.3.5 Freedom from pain, injury and disease

Most transporters (94.7%) were able to identify sick animals before loading them onto their vehicles. The signs and symptoms transporters look out for are seen below in Figure 6.6.

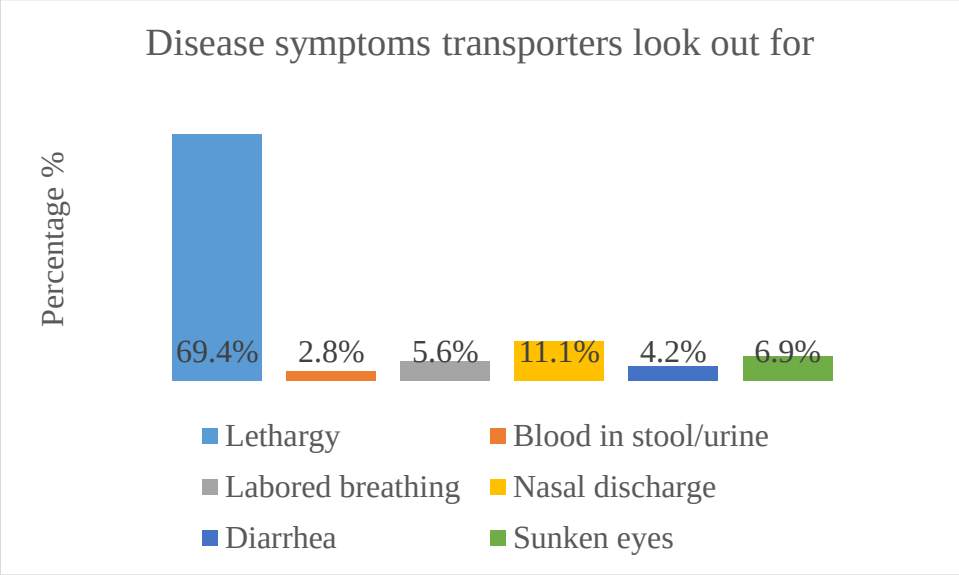

Figure 6.0-6: Disease symptoms transporters look out for.

As shown in Figure 6.7, 67% of transporters lost between 0-5 cattle out of every ten trips, 17.5% lost 6-10 animals out of every ten trips. However, 16% of respondents could not give an estimated number of deaths. 74% of transporters had recorded animals dying in transit.

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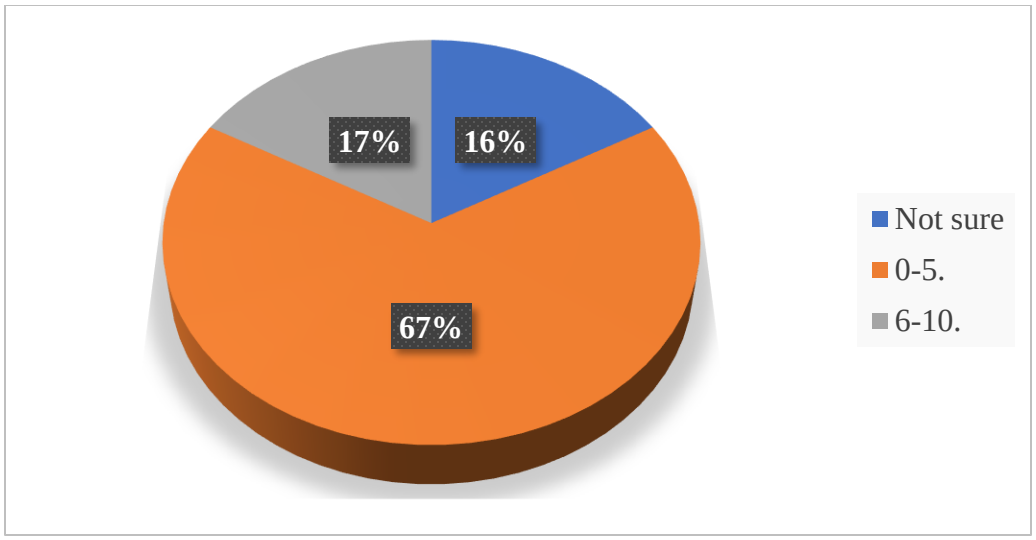

Figure 6.0-7: Number of dead animals in ten trips

Most transporters (80.3%) transported visibly pregnant animals, while 19.7% did not. Animals which were sick or injured during transit were treated as follows:

- 79.2% did nothing for the animals.
- 6.5% loosened restraints to make animals more comfortable.
- 9.1% tried to isolate the animal as much as possible.
- 1.3% would speed up to arrive faster.
- 9.1 % would slaughter animal if they suspected it may die.

Most transporters (74.4%) carried animals with broken leges. Injuries to animals during transit was reported by 89.7% of transporters. The causes of injury were: Aggression/fighting (75%), try to escape from moving vehicle (2.5%), loading and off-loading (5%), trampling weak/sick due to overcrowding (15%) and bad roads (2.5%).

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6.3.6 Freedom to express normal patterns of behaviour.

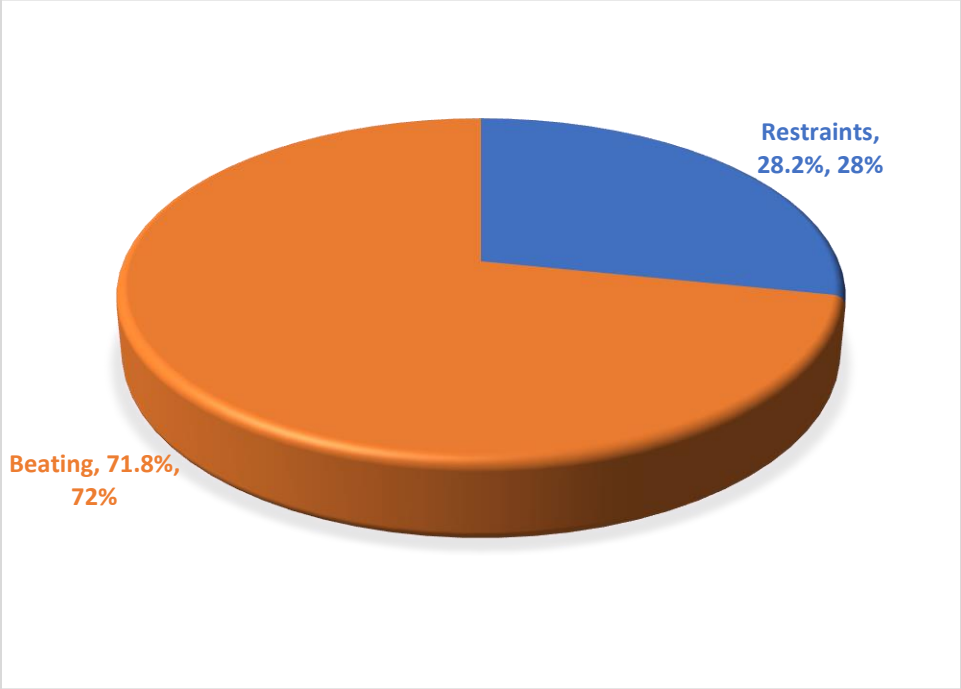

Figure 6.0-8:Methods of handling aggressive animals.

Transporters reported that their main means of handling aggressive animals was by beating (71.8%) (Figure 6.8). According to the transporters, the easiest breed to handle was the White Fulani (Figure 6.9).

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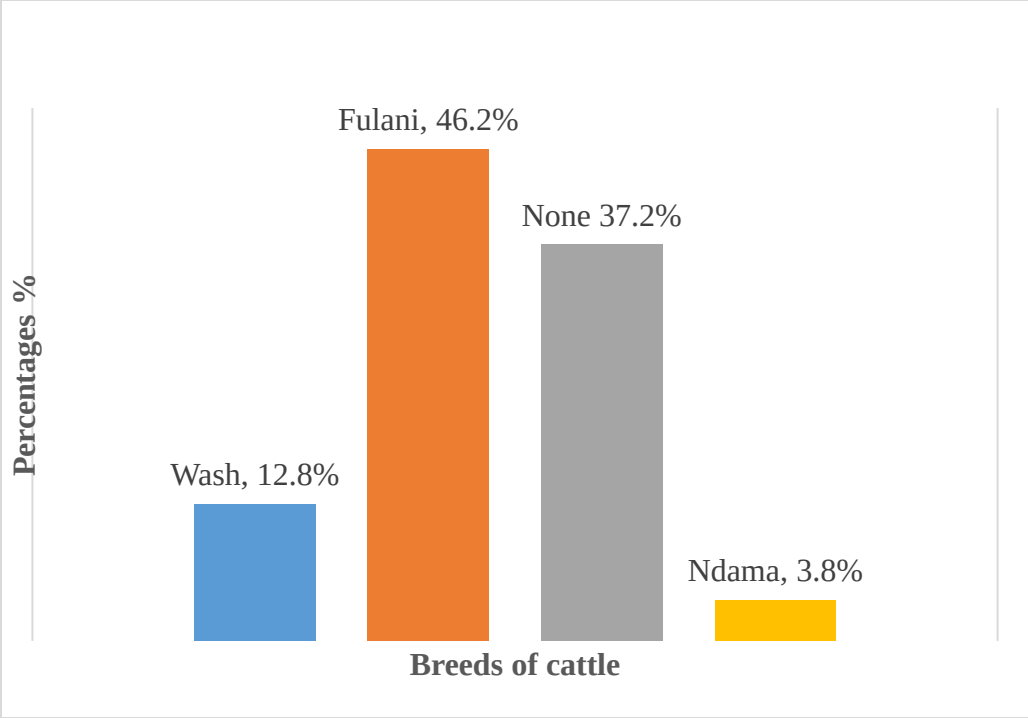

Figure 6.0-9: Temperament of cattle breeds during transport (ease of handling).

During transportation when animals showed signs of stress and fatigue, transporters took actions as shown in Figure 6.10.

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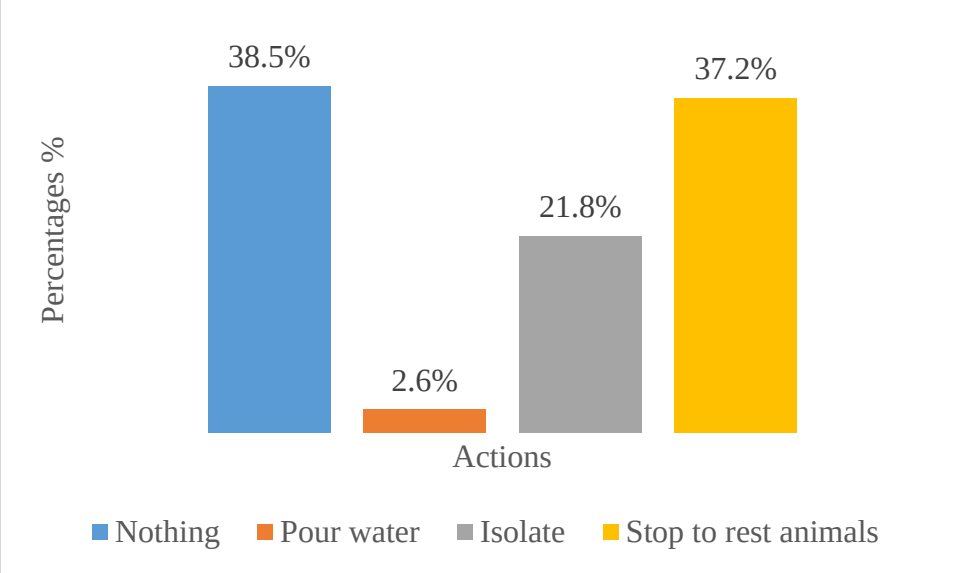

Figure 6.0-10: Actions taken when animals are fatigued or in distress.

Fighting among animals was common with 82.1% observing these actions; 70.5 % also reported that male animals attempted to mate females while in transit.

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6.7 Discussion

6.7.1 General assessment

The minimum and maximum distance travelled (150 Km and 720 Km) the average distance (528 KM) average (18) hours spent in transit. The minimum and miximum hours spent (12 and 30 hours), differed from a report by Flint *et al*. (2013) where truck loads surveyed journeyed for, 28.2 ± 5.0 hours before stopping, and cattle were rested for 11.2 ± 2.8 hours. The distance and duration of transit for cattle found in this study was above the recommended 8 hours for the European Union, but within the 24 hours for North America as reported by Schwartzkopf-Genswein *et al*. (2012).

Proper loading ramps were absent at most cattle markets, therefore the animals were tied and physically lifted into vehicles. This caused significant stress to the animals and handlers, since it took substantial effort and several workers to accomplish loading. A similar situation was observed by Frimpong *et al*. (2012). According to Schwartzkopf-Genswein *et al*. (2016) the process of loading and offloading animals is known to cause significant stress. The absence of loading and offloading ramps, which are a basic requirement for transporting cattle in this study aggravated the stress that already existed from the process of handling. Majority of transporters paid levies to regulators, which they complained that these charges were exorbitant and bureaucratic. This challenge of bureaucracy and extortion was also reported by Frimpong *et al*. (2012) stated that merchants have complained about unwarranted delays by security employees at security check points, as well as high fees charged by veterinary or quarantine officials for certifying animals as healthy or not. Filani (2005) in study in Nigeria also stated that

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transporters paid the police who collect both legal and illegal fees at various check points enroute.

The mortality rates recorded in this study were significantly higher than those reported for cattle by Simova *et al*. (2017) and Malena *et al*. (2007). The top ranked problem faced by transporters was access to water and feed in transit and the lowest ranked were cost of vehicle repair or maintenance and access to fit for purpose vehicles.

Generally, transporters took servicing of their vehicles seriously since this had a direct effect on their ability to earn money. Several authors Marufu *et al*. (2011), Chatikobo *et al*. (2004), Catley *et al*. (2002) and Waruiru *et al*. (2000) confirmed that the incidence of parasites and diseases are significantly higher in the rainy or wet season as compared to the dry season. Thus overall, animals are more diseased in the rainy season. The knock-on effect of higher numbers of sick animals leads to transporters carting more sick animals in the rainy season. Sick animals are already under stress due to disease and the added stress of transport increases their chances of mortality in transit or right after offloading.

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Seasonal availability of fodder for cattle is a challenge that plagues the entire livestock industry, as stated by Akapali *et al*. (2018) and Konlan *et al*. (2014). It is much more difficult for transporters to find feed either before or during travel since they are often pressed for time and place a low priority on feed provision. A transporter's main objective is to deliver an animal alive and not necessarily in the best condition.

Most transporters (72%) carried only cattle, while some (28%) transported cattle with sheep and goats. Where small ruminants were transported at the same time with cattle;

a make shift upper deck was created for the small ruminants. Transporters carried small and large ruminants on the same vehicles as a way of maximizing profits from each trip. The risk of trampling of sheep and goats was nonexistent because the sheep and goats are carried in the upper compartment and were separated from the cattle.

Transporters did not segregate animals by size or sex during transit, resulting in several injuries and death of animals. The inadequate provision of feed and water, and refusal of transporters to adhere to recommended rest stops greatly affects the animal's welfare. None of the transporters used recommended stocking densities for their transporting of animals. Dalmau *et al*. (2009), Broom (2001), Whiting (2000), and Tarrant *et al*. (1992) found that high stocking densities had deleterious effects on livestock and negatively affected their welfare.

Most of the vehicles were not fit for the purpose of transporting cattle and frequently broke down while transporting animals. When vehicles developed problems in transit, transporters would wait for up to 24 hours for repairs to be carried out. This places major stress on the animals locked up in the carriage. Only 26.3% of vehicles provided bedding for animals. These observations are similar to findings of Masiga and Munyua (2005) and Devereux (2014) who stated that only few countries in Africa have specialized vehicles for animal transport. The high frequency of vehicular breakdown in this study poses substantial welfare concerns since continued vehicular movement is necessary in ensuring adequate ventilation, and time spent in the transporter as a factor in mortality-related losses, as reported by Gibson and Jackson (2017).

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Although most transporters (94.7%) were able to identify sick animals before loading them onto their vehicles; they admitted transporting sick animals all the same. About 60.3% of transporters were observed loading animals that were visibly sick or diseased during this study. Transporters frequently had animals dying in transit, and generally do nothing for animals that were sick or injured during transit. Transporting sick and injured animals may be linked to the high mortalities recorded. The transport induced mortality recorded in this study was also observed by Malena *et al*. (2006)

Animals injured themselves in transit mainly due to poor structures of vehicles, lack of partitioning and poor stockmanship by transporters. The main means of handling aggressive animals was by beating (71.8%) animals with sticks. These welfare challenges observed were stated by Schwartzkopf-Genswein *et al*. (2012), Huertas *et al*. (2010) and Broom (2003). Transporters found the White Fulani breed of cattle to be the easiest breed to handle. In other studies by Anim (2017), the White Fulani was found to be moderately docile. However, Minka and Ayo (2018) in a study on the effects of different road conditions on rectal temperature, behaviour and traumatic injuries during transportation of different crosses of temperate or tropical breeds of heifers, found the Friesian/White Fulani cross to be more susceptible to injuries and stress as compared to the Brahman/Gudali cross. Results (Table 6.2) showed that years of experience was only significant in “disease detection” and “handling of aggressive animals”. This indicates that transporters years of experience had very little impact on their approach to the welfare of animals they transported

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6.8 Conclusions and recommendations

The findings of this study illustrate that the business of transporting animals in Ghana normally revolves around butchers and farmers who congregate their animals and find a transporter willing to take the animals to a desired destination. Therefore, one vehicle could have several animals belonging to different customers on a trip. This presents a number of challenges:

a) The transporters are paid upfront for animals and bear little liability for animals that die or are injured in transit.

b) Since animals are congregated from different farms and markets the potential for disease transfer and ultimate spread across geographical locations is high.

c) Transporters are primarily motivated by profit and have little regard for animal welfare.

The worst levels of animal welfare in the cattle value chain are found in the phase of transporting of animals. The stresses the animals are subjected to also have potential to reduce the profit margins and wholesomeness of meat products since it may result in DFD and PSE meat.

Furthers studies that can observe the conditions of the animals in transit through installed infrared cameras or other means that will yield further information on welfare in transit. Studies that asses the physical stress using biological and laboratory test would be a logical progression to this initial study. There is an urgent need for transporters to be targeted in animal welfare trainings to ensure compliance with standards.

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CHAPTER SEVEN

7.0 APPRAISAL OF WELFARE STANDARDS AT GHANAIAN SLAUGHTERHOUSES

7.1 Introduction

The slaughter house is an area of major concern with regards to animal welfare. During slaughtering, cattle are exposed to many potentially stress-inducing factors of emotional and physical nature (Terlouw *et al*., 2012). Prior to loss of consciousness, the main goal of humane slaughter should be to minimize or eliminate fear, pain, and suffering. As a result, both inducing unconsciousness and handling prior to slaughter must be taken into account. (Leary *et al*., 2016).

Factors that help to contribute to the minimizing of pain and stress for animals at slaughter include transportation with minimum stress, careful handling, non-slip surface to prevent injury, well trained butchers, appropriate means of slaughter to the species being killed, and the method chosen must be effective at the first attempt (Pre-slaughter, 2019)

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Good animal welfare standards have immense benefits for butchers and the consumers. Poor pre-slaughter handling prior to killing is known to have adverse effect on meat quality, and affects consumers acceptance of such meats and reduce profits of farmers, meat processers and all stakeholders (Adzitey *et al*., 2011). It was important to take a critical look at the state of Ghanaian slaughter houses with reference to animal welfare standards. The aim of this study was to appraise welfare standards (conditions and procedures) of Ghanaian slaughterhouses. The appraisal was done by collecting detailed

information on all the stages of slaughter and comparing it with internationally recognized standards of slaughter.

7.2 Materials and methods

Materials and methods carried out as shown in chapter 3

7.2.1 Data Collection

Data collection was carried out as shown in chapter 3.

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7.3 Results

7.3.1 General Assessment.

Results of the assessment of slaughterhouse procedures are seen in Table 7.1

Table 7.1: Assessment of slaughterhouse procedures and animal handling

Assessment of slaughterhouse procedures and animal handling	Yes		No		Chi Square	
	Number of farms	%	Number of farms	%	Stat	P Value
Beating with whips	282	63	168	37	35.1	<0.001
Charging at handlers	287	64	163	36	40.4	<0.001
Defecation and urinating	309	69	141	31	76.3	<0.001
Ear erection	293	65	157	35	49.7	<0.001
Foaming	270	60	180	40.	21.9	<0.001
Forced tripping of animals	344	76	106	24	153.1	<0.001
Head swings	308	68	142	32	74.5	<0.001
Horn pulling	228	51	222	49.	0.1	0.755
Jumping	354	79	96	21	179.9	<0.001
Kicking	304	68	146	32	67.1	<0.001
Crippled during handling	270	60	180	40	21.9	<0.001
Leg pulling	243	54	207	46	3.5	0.061
Lying down and refusing to move	342	76	108	24	148.0	<0.001
Moving without pulling	175	39	275	61	1.1	0.298
Panting	288	64	162	36	41.8	<0.001
Raising of tail	316	70	134	30	89.0	<0.001
Resistance to be lassoed	349	78	101	22	167.1	<0.001
Resistance to be pulled	370	82	80	18	227.3	<0.001
Retreating	346	77	104	23	158.3	<0.001
Running	317	70	133	30	91.5	<0.001
Slapping	231	51	219	49	0.4	0.533
Sniffing	317	70	133	30	92.0	<0.001
Stoning	105	23	345	77	157.4	<0.001
Stretching	276	61.	174	39	28.3	<0.001
Stamping of feet	354	79	96	21	181.9	<0.001
Tail pulling, and twisting.	326	72	124	28	111.5	<0.001
Vocalization	285	63	165	37	35.2	<0.001

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Table 7.2: Evaluation of association of years of experience of butchers with five freedom parameters

Freedoms	Variable	Stat	P Value
Hunger malnutrition and thirst	Provision of feed before slaughter	0.434	<0.001
	Type of feed provided	0.552	<0.001
	Reasons for providing feed	0.531	<0.001
Fear and distress	Respondents' observation on animals showing fear	0.571	<0.001
	If they took any steps to reduce fear	0.415	<0.001
Physical and thermal discomfort	How animals were offloaded from vehicles	0.47	<0.001
	If animals were kept in lairage	0.531	<0.001
Pain, injury and disease	How long animals waited before slaughter.	0.591	<0.001
	Taking precautions to reduce suffering during slaughter	0.45	<0.001
	If welfare was a consideration during slaughter	0.412	<0.001
To express normal patterns of behaviour.	How animals are guided into slaughter hall	0.535	<0.001
	If respondents had ever been injured while slaughtering animals	0.446	<0.001
	If respondents had ever been involved in any animal welfare training	0.489	<0.001

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All slaughterhouses visited had veterinary officers present who regulated activities, carried out antemortem and postmortem inspections and collected levies for use of slaughterhouse. Some of the challenges that veterinary officers faced in the execution of their duties were:

- Lack of resources (medical equipment and drugs)
- Non compliance of butchers to regulations
- No days off, working Monday to Friday.

7.3.2 Freedom from hunger, malnutrition and thirst

Before slaughter 64% of respondents provide feed for animals, while 36% did not provide food (Figure 7.1). The main feed was cut grass, the other feeds they gave animals are seen in Figure 7.2.

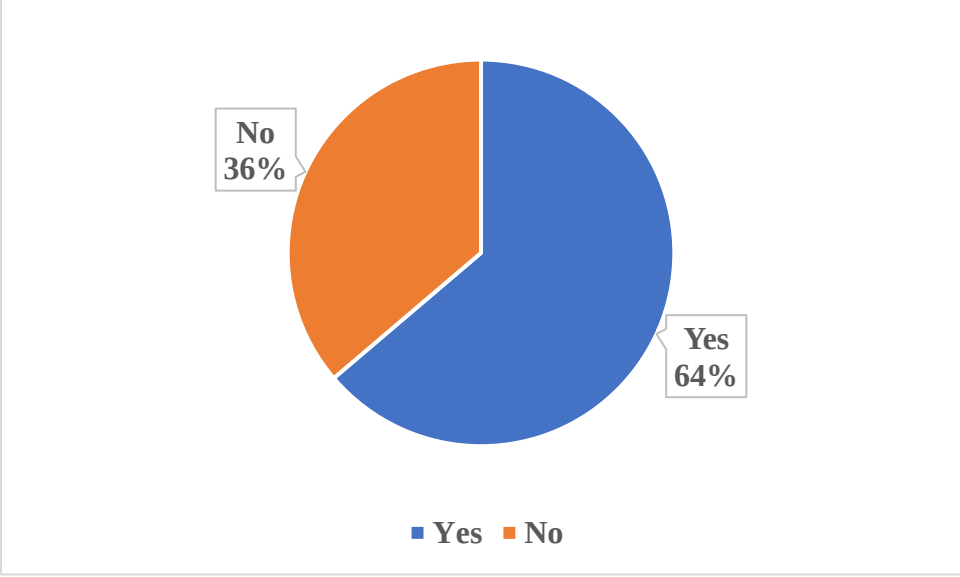

Figure 7.0-1: Provision of feed before slaughter

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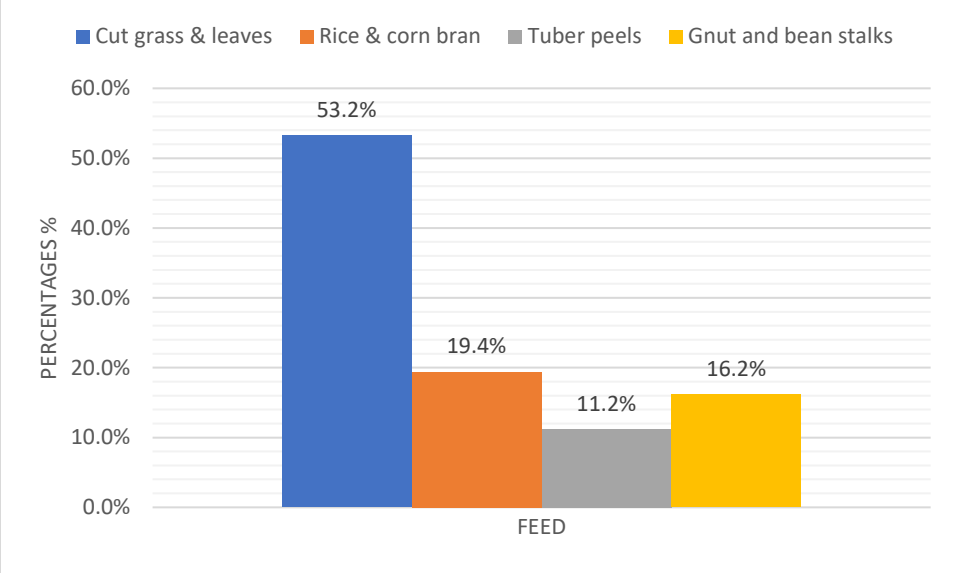

Figure 7.0-2: Types of feed given

The main reason for providing feed was to prevent loss of condition (84.2%), other reasons were: when slaughter was delayed (12.9%) and to show kindness (2.9%) as shown in Figure 7.3.

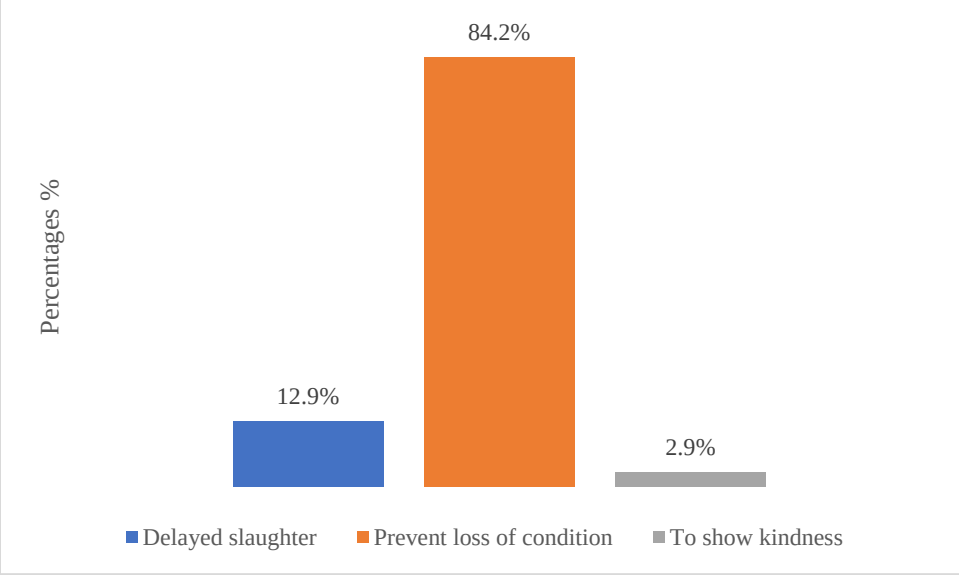

Figure7.0-3: Reasons for feeding

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Water was provided to animals by majority (79%) of respondents, while (21%) did not provide water, the sources of water are shown in Figure 7.4.

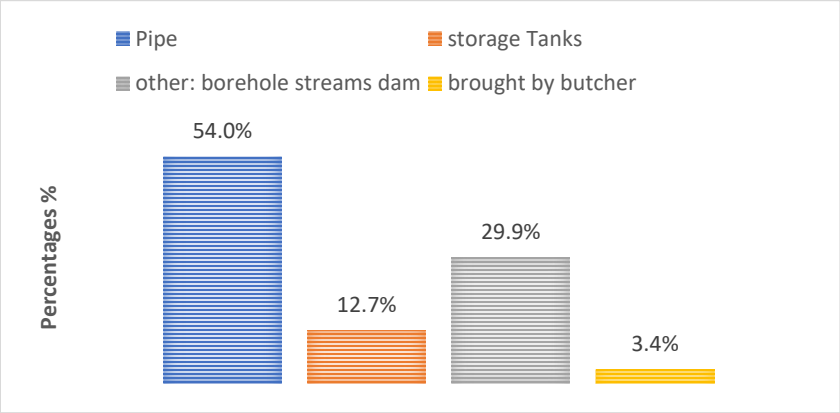

Figure 7.0-4: Source of water

Depending on how long animals would spend in the lairage respondents provided feed and water. The following are the durations that respondents generally provided feed and water: (33.3%) a few hours (0-6 hours) , a day (23.8%), under a week (16.2%) and (26.7%) of respondents provided feed for as long as needed before slaughter (Figure 7.5).

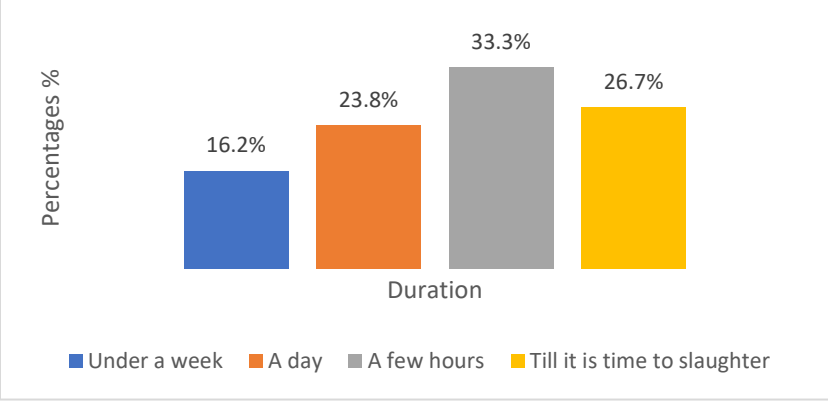

Figure 7.0-5: Duration of feeding before slaughter

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7.3.3 Freedom from fear and distress

Most respondents (79.6%) reported that their animals generally showed fear when entering the slaughterhouse (Figure 7.6).

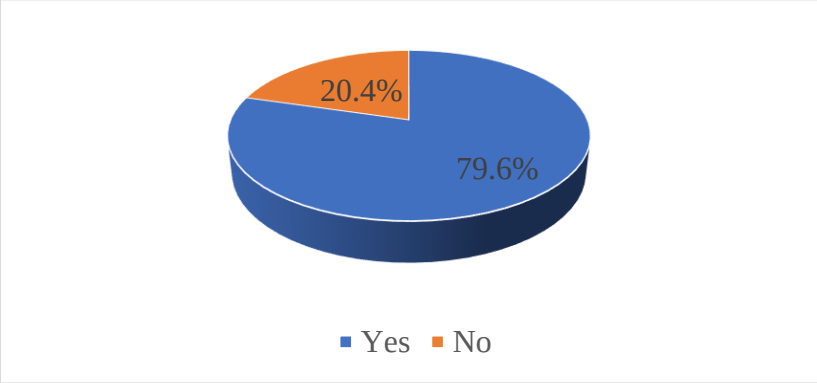

Figure 7.0-6: Animals show fear when entering slaughterhouse

The types of fear they observed were aggression (71.2%) and reluctance to move (26.8%) seen in Table 7.3.

Table 7.3 Observed signs of fear:

Sign	Number of animals	Per (%)
Reluctant to move	96	26.8%
Aggression	255	71.2%
No sign	7	2.0%
Total	358	100.0%

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Majority of respondents (63%) took steps to reduce fear before slaughter, while (37%) did not do anything about fear in the animals. The following actions were taken to reduce fear before slaughter (Table 7.4).

Table 7.4: Actions to reduce fear

Actions to reduce fear.	Number of animals	Per (%)
Rest	108	30%
Restrain with ropes	97	27%
Avoid killing around others	25	7%
Spray with water to calm them down	21	6%
Provide food and water	60	17%
Calming behaviour and gestures	47	13%
Total	358	100.00%

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Most (61%) of the respondents did not slaughter animals in the presence of other animals, 39% did slaughter animals in the presence of others.

7.3.4 Freedom from physical and thermal discomfort

Animals were off-loaded from trucks by dragging (55.6%), a ramp was used (15.8%). Other methods by which animals were offloaded are shown in Figure 7.7.

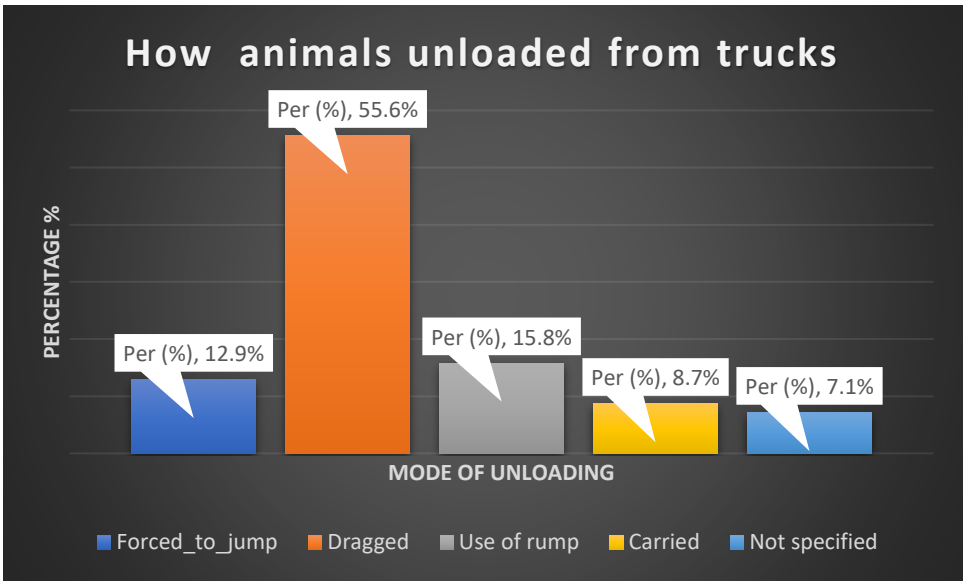

Figure 7.0-7: How animals unloaded from trucks

Lairage was used by 82.2% of respondents, the number of days animals spent in the lairage is shown in Table 7.5.

Table 7.5 : Days spent in lairage

Days	Number of animals	Per (%)
1 day	184	49.7%
2 days	60	16.2%
3 days	47	12.7%
4 days	26	7.0%
5 days	30	8.1%
6 days	6	1.6%
7 days	15	4.1%
14 days	1	0.3%
250 days	1	0.3%
Total	370	100.0%

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Reasons for keeping animals in the lairage are shown in Figure 7.8:

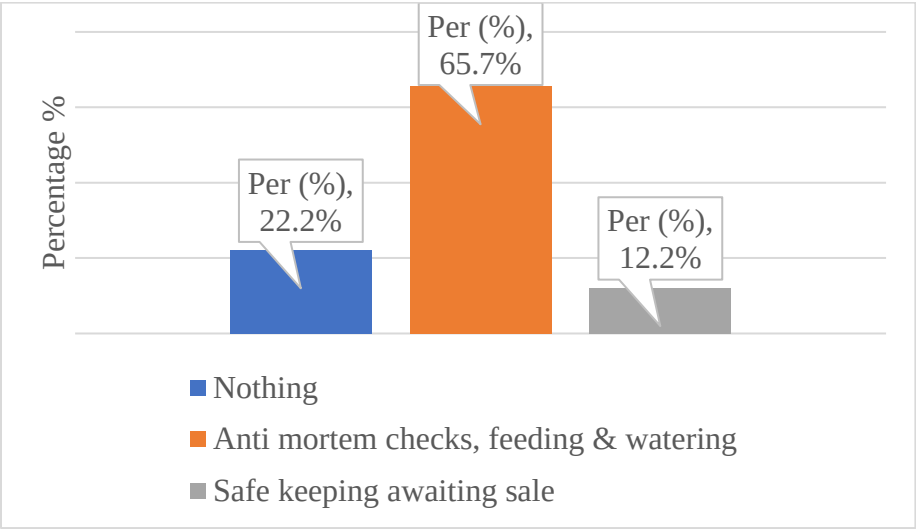

Figure 7.0-8: Reasons for keeping animals in lairage

The various species of animals observed in the various lairage are shown in Figure 7.9.

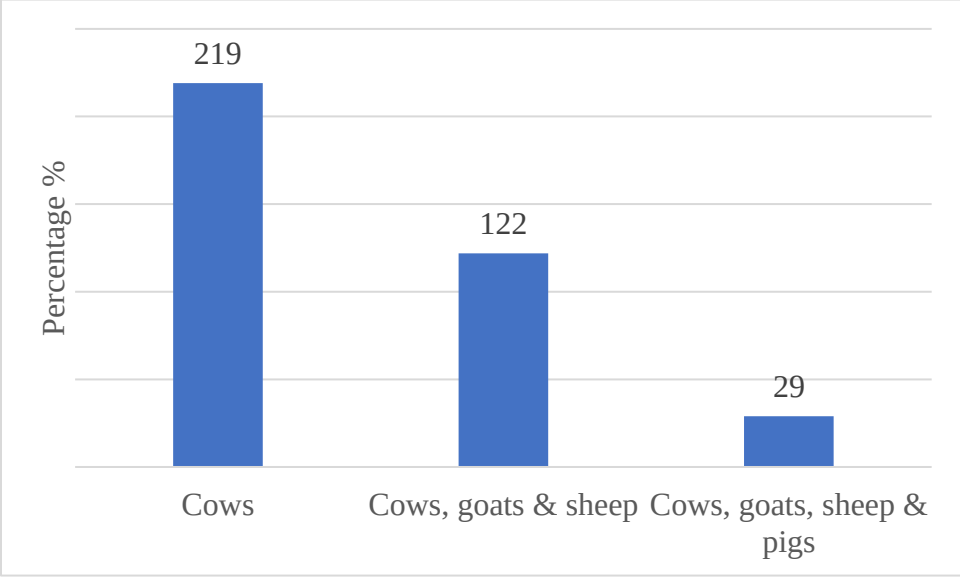

Figure 7.0-9: Animal species kept in lairage

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Cleanliness of lairages is seen in Figure 52.

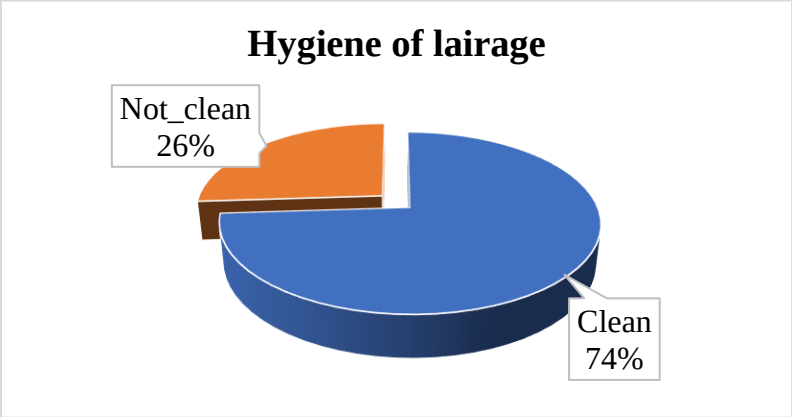

Figure 7.0-10: Hygiene of lairage

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7.3.5 Freedom from pain, injury and disease

Table 7.6: Waiting time before slaughter

Time before slaughter	Number of butchers	%
Less than 1 hour	136	30
Less than a 12 hours	247	55
Less than 120 hours	67	15
Totals	450	100

Most animals spent 12 hours or less in the slaughter house before slaughter (Table 7.6). About a quarter (23.8%) of butchers did not consider the animals' welfare at the point of slaughter while majority (76.2%) indicated that welfare was considered at the point

of slaughter. Precautions taken by respondents to safeguard welfare are shown in Figure 7.11, (41.8%) took no precautions, (29.3%) used calming behaviour, (18.7%) used sharp knives, (8.9%) employed restraints and 1.3% made sure floors were not slippery.

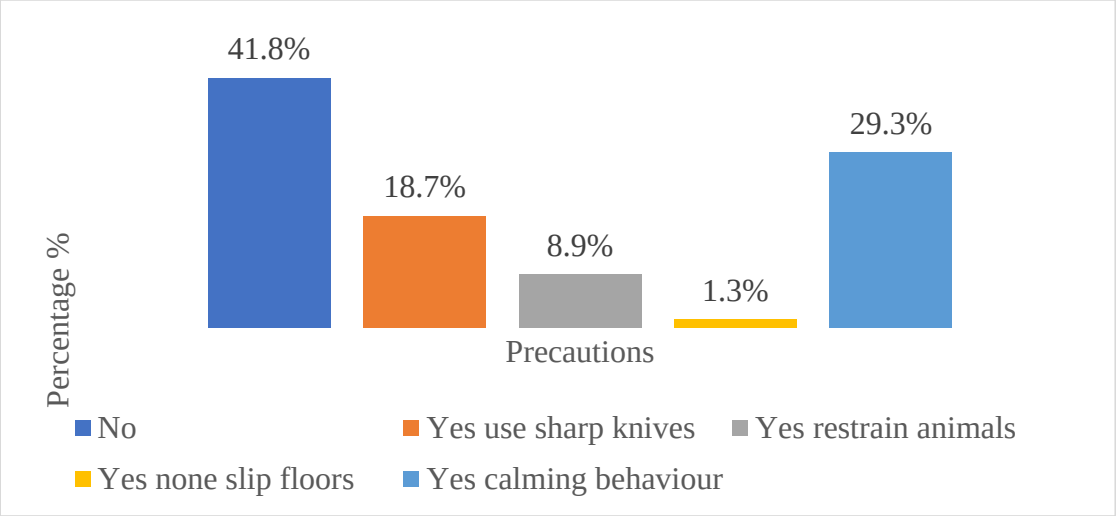

Figure 7.0-11: Precautions taken to safeguard welfare by butchers.

Majority of the butchers (80%) said the slaughter injured animals while, 20% did not, 38% admitted slaughtering sick animals, while 62% did not slaughter sick animals. None of the butchers stunned their animals before slaughter.

7.3.6 Freedom to express normal patterns of behaviour.

With regards to how cattle are guided into the slaughtering area, 46% forced the animals to jump/walk into the area by beating, tail breaking and prodding. 47% dragged the animals by ropes, and 7% were guided in calmly (Table 7.7).

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Table 7.7: Methods of guiding cattle into slaughtering area

Methods of guiding cattle into slaughtering area.	Number of cattle	%
Forced to move	208	46
Dragged	210	47
Walk calmly up ramp	32	7
Total	450	100

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More than half (54%) of the respondents had sustained varying forms of injuries in the process of slaughtering animals, while 46% had never been injured Figure 7.12.

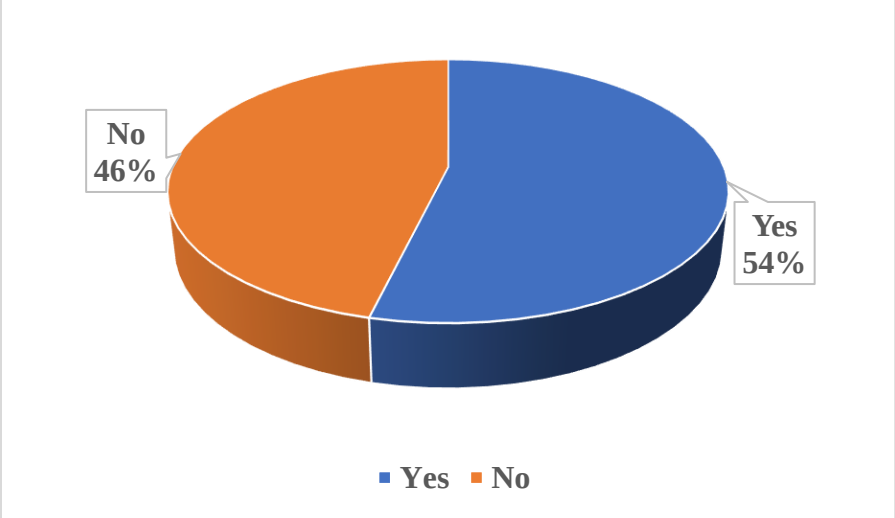

Figure 7.0-12 Injury to butchers

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7.4 Discussion

Upon animals arriving at the slaughterhouses almost all animals exhibited signs of fear and aggression. Resistance to being lassoed, kicking, charging at handlers, collapsing to the floor, head swing and other signs of fear were exhibited. Butchers employed the use of whips, forced tripping, tail breaking as well as horn pulling to control the animals.

Years of experience was significantly associated with all parameters with regards to the five freedoms. This indicates that the year of experience of butchers played a major part in their understanding and acceptance of welfare issues or methods. The greater number of butchers provided feed and water for animals before slaughter. Their reason for providing feed was mainly to prevent the loss of condition, while the animals wait for slaughter, since slaughtering of animals was not always on the same day they were brought to the lairage for some butchers.

Feed and water were provided to animals for the duration of their waiting before slaughter which ranged from a few hours and up to a week. The welfare of animals that spent more than 12 hours in the lairage was impaired. Studies by Tadich *et al*. (2005), Dokmanović *et al*. (2014), Chulayo *et al*. (2016), and Álvarez *et al*. (2009) show that the stay of cattle for prolonged periods is known to increase the stress levels of livestock. The introduction to a new environment, joining a new herd, fighting and mounting by other animals is known to stress animals placed in lairage for long.

Although butchers provide feed even hours before slaughter mainly on compassionate grounds, these actions go against the standard recommendation of fasting for 24 hours before slaughter. Fasting before slaughter reduces the volume of gut contents and

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bacteria load which reduces the risk of contamination of the carcass during dressing as stated by Saucier *et al*. (2007) and Doyle and Erickson (2012). Due to the absence of this procedure slaughtered animals had large quantities of gut content, which made cleaning cumbersome and has health implications for the final consumer.

Butchers observed signs of fear in animals when they arrived at the slaughterhouses. The sense of fear animals experienced upon entering the slaughter house is most likely as a result of the heightened sense of smell domestic animals have that causes them to panic when in the vicinity of a slaughter house as stated by Shimshony and Chaudry (2005). The steps butchers take to calm animals included resting animals and the use of restraints. Animals were slaughtered in succession with most animals unable to see the slaughtering of other animals. These actions are essential in reducing the stress levels of animals before slaughter. Good stockmanship is known to help maintain good animal welfare standards in the slaughterhouse, as reported by Hemsworth *et al*. (2011). However, this was absent in all the slaughterhouses visited. The bulk of animals were dragged from the vehicles or forced to jump out by prodding or tail breaking. It was only in few cases (15.8%) that an offloading ramp was used. The absence of unloading ramps and the refusal of handlers to use them where available posed a major risk of injury and stress to the animals and handlers. Offloading livestock is a major source of stress to animals and is a significant stage in transportation where injuries may occur (Warren *et al.,* 2010; Dalmau *et al.,* 2009; Terlouw *et al.,* 2008). The poor pre-slaughter handling of animals exposes them to several stressors. The methods of offloading and leading to slaughter chamber greatly infringed on the animal's welfare.

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Three quarters of the butchers took the welfare of their animals into consideration at the point of slaughter. The precautions taken to safeguard welfare were the use of calming behaviour, and sharp knives. The lack of properly designed offloading areas, lairage pens and the use the animals' natural exploratory behaviour when moving them forward was found to be absent. This resulted in the use of brute coercion methods. These conditions run counter to approved standards and protocols stated by several authors (Velarde and Dalmau 2012; Leary *et al*., 2016; Shimshony and Chaudry, 2005).

The majority of butchers indicated they slaughter injured animals, while 38% admitted slaughtering sick animals. These observations were similar to those reported by Frimpong *et al*. (2014) that about 60.5 percent of butchers bought and slaughtered non-ambulatory and wounded animals, while 58.1 percent bought and slaughtered sick animals. According to Euthanasia of Livestock (2021), the ideal situation is to treat sick or injured animal and not slaughter, animals with injuries or sickness beyond recovery should be euthanized However, in the African context, Qekwana *et al*. (2019) stated that in Africa, poverty, unemployment, and ongoing climate change continue to be a barrier to solving animal welfare issues. Prescribed restraint, transport, and treatment options for unwell animals are sometimes expensive and inaccessible. As a result, people are compelled to employ non-welfare-friendly alternatives, such as slaughter. None of the butchers stunned their animals before slaughter even though stunning equipment were available in some of the slaughterhouses. Majority of the butchers encountered in this study were Muslim and slaughtered animals according to Halal standards. Butchers used a well-sharpened knife to quickly sever the trachea, carotid

arteries, and jugular veins, without stunning the animal; although halal slaughter may involve a "religiously acceptable stunning" (Njisane and Muchenje, 2017) .

Almost all the cattle were guided into slaughtering area by being forced, beaten, tail breaking, prodding. and dragging the animals with ropes, only 7% were guided calmly into chamber. This finding was similar to observation by Frimpong *et al*. (2014). According to Adzitey (2011) the poor pre-slaughter handling observed may cause carcass damages such as bruising, hemorrhages, and skin blemishes. As a result of the accumulation of blood in tissue caused by hemorrhages, a portion of the carcass may be trimmed, reducing meat yield and value while also increasing processing time.

It was not uncommon for butchers to sustain varying forms of injuries in the process of slaughtering animals. Similar results were reported by Johnson and Etokidem (2019), according to them butchers are exposed to various work-related hazards that may lead to numerous health problems. The sources of injury in this study included, injury from knives, live animals, bones and building structural defects. Handling of cattle inherently exposes handlers to risk of injury, when they are in a heightened state of fear and stress, greatly increases the risk of injury to butchers. Lindahl *et al*. (2016) indicated that moving cattle increased the risk of injuries to handlers, and that certain interactions such as aggressive tactile interactions with an object and pulling a restraint appeared to be linked to potentially dangerous instances in which the handler was kicked, head-butted, or run over by cattle.

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7.5 Conclusions and recommendations

The specific objective of this study was to appraise welfare standards (conditions and procedures) of Ghanaian slaughterhouses was achieved. The findings show that animal welfare standards in the Ghanaian slaughterhouses are very low. Structures in the facilities are obsolete and do little to safeguard the welfare of the animals and handlers. Animals are exposed to great levels of stress and pain before and during slaughter. Butchers have a vague understanding of animal welfare; and they do little to safeguard the welfare of the animals due to poor supervision and enforcement of protocols. The mixing of animals from difference sources before slaughter for long periods poses a major threat of diseases transfer from one animal to the other. Veterinary officers and other workers are under resourced and over stretched, and therefore paid very little attention to animal welfare issues.

There is an urgent need for butchers to be trained on best practices that safeguard animals' welfare. Additionally, there is a need for frequent institutional audits on activities within the various slaughterhouses.

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CHAPTER EIGHT

8.0 EFFECTS OF ANIMAL WELFARE ON MEAT QUALITY

8.1 Introduction

Pre-slaughter handling can affect both carcass and meat quality. Losses in carcass yield are caused by both mobilization of tissues to provide energy for maintaining the vital functions of the body and the dehydration which often accompanies the period of food and water deprivation together with the stress of transport (Warriss, 1990). Animal welfare can be assessed by using indicators of poor welfare, such as behavioural and physiological changes occurring in stressful situations (Broom, 2007). Stress in cattle is known to increase plasma cortisol concentrations. An increase in hypothalamic-pituitary-adrenocortical activity indicates a physiological response to different stressors, and measurement of plasma corticosteroids is frequently used to study stress response (Negrão *et al*., 2004).

Dark Firm and Dry (DFD) carcass can be caused by exposing animals to chronic or long-term stress, such as lengthy hours of transportation, food and water restriction, and overcrowding in the lairage. Pale soft and exudative (PSE) and DFD meats are unappealing and more likely to face rejection by customers (Adzitey, 2011). Also, an excessively long period of stress, especially if stunning has been imperfect, may cause blood spots on the meat, with subsequent low acceptability and lower quality (Guerrero *et al*., 2013).

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This study sought to document the effects of pre-slaughter handling of cattle on carcass and meat quality. This was carried out through testing blood plasma for cortisol level, measuring the pH levels of excised tissue sample and the visual scoring of carcasses.

8.2 Materials and Methods

8.2 1 Data collection

Various off-site test were carried out to determine the plasma cortisol levels in blood samples during exsanguination

8.2.2.1 Study area:

The study was carried out in the Northern region of Ghana. Samples and observations were taken from the Tamale abattoir and laboratory work was carried out on the University for Development Studies, Nyankpala and Tamale campuses.

8.2.2.2 Sample collection

Five (5) ml of blood per cattle was collected from the carotid artery after slaughter into a Serum separator tube (SST). After allowing the blood to clot for 1 hour at room temperature, blood was then placed in a cooling box and transported to the laboratory.

Samples were centrifuged at a speed of 2500 rpm for 10 minutes. Serum was separated and analyzed using a fully automated Roche COBAS E411 analyzer (Roche Diagnostics International, Switzerland). Measuring cortisol using Cobas E411 analyzer (Analytics *et al*., 2017).

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8.2.2.3 Reagent

M-Streptavidin-coated microparticles 6.5 mL: Streptavidin-coated microparticles 0.72 mg/mL; preservative.

R1- Anti-cortisol-Ab~biotin 10 mL: Biotinylated monoclonal anti-cortisol antibody (ovine) 20 ng/mL. danazol 20 µg/mL; MESb) buffer 100 mmol/L, pH 6.0; preservative.

R2- Cortisol-peptide~Ru(bpy) 10 mL: Cortisol derivative (synthetic), labeled with ruthenium complex 20 ng/mL; danazol 20 µg/mL; MES buffer 100 mmol/L, pH 6.0. preservative.

Test principle

Total duration of assay was 18 minutes.

First incubation: 10 µL of sample was incubated with a cortisol-specific biotinylated antibody and a ruthenium complex labeled cortisol derivative. Depending on the concentration of the analyte in the sample and the formation of the respective immune complex, the labeled antibody binding site was occupied in part with sample analyte and in part with ruthenylatedhapten.

Second incubation: After addition of streptavidin-coated microparticles, the complex becomes bound to the solid phase via interaction of biotin and streptavidin.

▪ The reaction mixture was aspirated into the measuring cell where the microparticles were magnetically captured onto the surface of the electrode. Unbound substances were then removed with ProCell/ProCell M. Application of a voltage to the electrode then induces chemiluminescent emission which was measured by a photomultiplier.

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▪ Results were determined via a calibration curve which is instruments specifically generated by 2-point calibration and a master curve provided via the reagent barcode or e-barcode.

Pale Soft Exudative (PSE) and Dark Firm and Dry (DFD) was tested for by checking acidity levels of meat sampls.

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8.2.2.4 Sample collection and testing:

A total of ten cattle carcasses were sampled at random to determine the pH. Ten meat samples (10 grams) were taken from the left longissimus muscle between the 11th and 12th ribs of ten cattle carcasses. These 10 meat samples were taken on the same day. Each sample was taken immediately after slaughter and placed in an airtight bag before being stored in an ice chest with ice cubes; and then sent to the UDS Nyankpala Campus for testing within 20 minutes to one hour of sample taking and held at 1-5°C for 1 to 2 hours.

Each 10 grams sample of meat was sliced up. This is to ensure total sampling of the inner and outer part of the meat. The sliced meat was placed in a petri dish and probe sensor of the pH Meter was used to measure the pH. For repeat sampling, the probe was wash with soap water, and rinsed with distilled water then dry with a tissue paper.

8.2.3 Visual observation of carcasses for meat quality

Meat quality was determined by visual inspection of carcass. To examine carcass bruising, 100 carcasses were randomly selected and inspected for bruises, as seen below:

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1. Cattle were observed as they were brought into the slaughtering chamber. Their levels of aggression were scored as calm or aggressive.

2. Carcass assessment: There were three rating categories: "none," which indicated a clean, non-bruised surface; "slight," which indicated a reddish region with surface damage; and "severe," which indicated a bruise that was reddish, deep, and bleeding damage could be seen on the surface.

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8.2.4 Respiration rate and temperaturemeasurements.

Body temperatures were obtained using a clinical an infra red thermometer pointed at the forehead of each animal.. Respiration rates were taken for 1 min with a stopwatch by counting flank movements. Readings were taken for all cattle in the morning between 06:00-09:00 GMT.

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8.3 Results:

8.3.1` Measurement of respiration rate and temperature at rest and before slaughter.

Table 8.1: Respiration rate and temperature

	In lairage (at rest)		**At point of slaughter**	
Indicator	Temperature (^{o} c)	Respiration Rate (bpm)	Temperature (^{o} c)	Respiration Rate bpm
Mean	37.6	33.6	38.1	39.7
Median	37.2	32	38.1	38
Mode	37	32	38.3	36
Minimum	36.1	28	35.1	24
Maximum	40	48	39.9	56

breaths per minute (bpm)

The correlation between respiration rate and body temperature at rest and at the point of slaughter are shown in Table 8.2.

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Table 8.2 Pearson's correlation and Chi Square for temperature and respiration rate at rest and at slaughter

	TR		TS		RR		RS	
	Pearson's correlation	P value	Pearson's correlation	P value	Pearson's correlation	P value	Pearson's correlation	P value
TR	1	1	0.10	0.008	0.23	<0.001	0.16	<0.001
TS	0.10	0.228	1.00	1	0.13	<0.001	0.25	<0.001
RR	0.23	0.228	0.13	0.008	1.00	1	0.30	<0.001
RS	0.16	0.228	0.25	0.008	0.30	<0.001	1.00	1

TR: temperature at rest TS: temperature at slaughter RR: respiration rate at rest RS: respiration rate at slaughter

8.3.2 Measurement of cortisol, pH levels, behaviour and carcass score.

The mean cortisol reading was 43.4 ng/mL, the mode was 25.6 ng/mL, and 43.2 ng/mL, the minimum reading was 23.6 ng/mL, and maximum reading was 86.4 ng/mL. The mean pH reading was 6.5, mode 6.2, the minimum reading was 6, and maximum reading was 7.1. With regards to behaviour, 90% of cattle were calm and 10% were aggressive; 80% of carcasses had no bruising and 20% were slightly bruised (Table 8.3).

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Table 8.3: Cortisol, pH, behaviour of cattle and carcass bruising.

Cattle Number ID	Cortisol	pH	Cattle Behaviour		Carcass Bruises		
	ng/mL	pH	Aggressive	Calm	none	slight	severe
001	49.2	6		✓	✓		
002	86.4	6.9	✓			✓	
003	54	6.2		✓	✓		
004	25.6	6.9		✓	✓		
005	23.6	6.5		✓	✓		
006	36.4	6.3		✓	✓		
007	46.8	6.2		✓	✓		
008	43.2	6.2		✓	✓		
009	25.6	7.1		✓	✓		
010	43.2	7		✓		✓	

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Pearson Correlation was used to determine correlations between cortisol levels and pH levels. There was a weak negative correlation of -0.09 and a negative covariance of -0.07 (Table 8.4).

Table 8.4: Correlation and covariance between cortisol and pH

Analysis	Stat	P Value
Correlation	-0.09	0.8
Covariance	-0.07	0.16

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8.3.3 Observation of cattle behaviour at point of slaughter and visual scoring of carcass:

One hundred cattle behaviour was observed at the point of slaughter (Table 8.5). The carcasses of these same cattle were inspected after slaughter for degrees of bruising. Out of the hundred cattle observed 36% where aggressive when being brought into the slaughtering hall, while 64% showed minimal resistance when being brought into the chamber. Examination of the carcasses after slaughter showed that 47% had no bruising, 34% had slight bruising, and 19% had severe bruising.

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Table 8.5: Cattle behaviour at point of slaughter and carcass bruising

	Score	Number of Animals	Percentage %
Behaviour	Aggressive	36	36
	calm	64	64
	Total	100	100
Carcass bruising	None	47	47
	slight	34	34
	severe	19	19
	Total	100	100

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8.4 Discussion

Godyń *et al*. (2019) stated that, body temperature and its changes are important indications of animal health and well-being among physiological factors. The mean body temperature for animals at rest in lairage was 37.6 °C. The mean body temperature right before slaughter was slightly higher (38.1°C). Kou *et al*. (2017) reported body temperatures of 35.2 − 35.8 °C, Salles *et al*. (2016) also reported body temperatures of 33.5 -36 °C . The temperatures in this study were marginally higher than those reported by these authors. The mean respiration rate per minute for animals at rest in lairage was 33.6 breaths per minute (bpm). The mean respiration rate right before slaughter was slightly higher (39.7 bpm). Gaughan *et al*. (2000) reported a mean of 54.9 bpm for non-stressed cattle as the respiration rates, Strutzke *et al*. (2019) also reported a 29 bpm respiration rate. The respiration rates recorded in this study were not similar to those reported by these authors. The correlation between respiration rate and body temperature at rest and at the point of slaughter were 0.23 and 0.25, respectively. This positive linear correlation indicates that body temperature and respiration rate are good indicators of each other.

As reported by Gaughan *et al*. (2000), respiration rate (RR) serves as an overall indicator of stress in livestock. Healthy cattle with RR under 60 breaths/min (bpm) indicate minimal to no stress, while RR more than 120 bpm reflect excessive stress. Additionally, elevated respiration rate and body temperatures of cattle are also known to be signs of infection/ disease (Jorquera-Chavez *et al*. 2021, Gloster *et al*. 2011 and Schaefer *et al*. 2007). Since core body temperature is an important physiological measure of animal thermoregulatory responses to environmental stimuli.(Brown–

Brandl *et al*., 2003); and variations in body and skin temperatures are also related to transport stress (Costa, 2016). The elevated body temperatures and respiration rates found in this study suggests that animals brought to the slaughter house for slaughter were under stress, and elevated respiration rate at the point of slaughter indicates poor stockmanship in guiding animals into the slaughter hall. Knowles and Warriss (2007), stated that, inappropriate behaviour of the stockmen during handling and driving of animals could be a significant factor in acute stress. In such condition the body temperature and the respiratory rates increase

This study determined the cortisol and pH levels. The average cortisol level for cattle in this study was 43.4 ng/mL, with a minimum level of 23.6 ng/mL, and maximum level of 86.4 ng/mL. These results were higher than that reported by Ceci *et al*. (2017). Ceci *et al*. (2017) studied the plasmatic cortisol levels of 60 eight-month-old calves during exsanguination and they found the average plasmatic cortisol level to be 27.5±12.2 ng/mL Probst *et al*. (2014) also recorded plasma cortisol concentrations to be 90 ng/ml in exsanguination blood serum, while testing stress levels in cattle. Negrão *et al*. (2004) stated that an increase in hypothalamic-pituitary-adrenocortical activity indicates a physiological response to stress, and measurement of plasma corticosteroids are good indicator in stress studies. Grandin and Shivley (2015) explained that when cattle are exposed to restraints and poor handling, they respond physiologically with elevated levels of cortisol in blood plasm. The elevated levels found in this study indicate that the animals were subjected to major sources of stress just before exsanguination.

The average pH reading was 6.5, with, the minimum reading being 6, and maximum reading being 7.1. The pH levels in this study were higher than those recorded by the

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following researchers: Frimpong *et al*. (2014) pH (6.22), Arik and Karaca (2017) pH (5.80 - 6.19), and Vimiso and Muchenje (2013) pH (5.77 -5.90).

According to Miller (2007) the ultimate pH range of normal meat of an unstressed animal is 5.4-5.7. DFD meat will have a much higher ultimate pH of 5.9-6.5, with some meat pH being as high as a of 6.8. The pH level of meat in this study could classify it as DFD. This most likely was caused by significant reduction in muscle glycogen reserves due to physiological stress during pre-slaughter events as described in previous chapters. This phenomenon was explained by Terlouw (2005) and Cappellozza and Marques (2021). The elevated cortisol levels in this study indicates that the pre-slaughter stress that the animals were subjected to, triggers the fight or flight response which in turn depleted glycogen levels, causing increased pH values leading to dark firm and dry meats.

There was a very weak negative correlation and covariance found between cortisol levels and pH levels. This was contrary to finding by Dokmanović *et al*. (2014)who stated that higher cortisol levels were associated with higher initial and ultimate pH values in a study with pigs.

Out of the hundred cattle observed 36% where aggressive when being brought into the slaughtering chamber, while 64% showed minimal resistance when being brought into the chamber. Examination of the carcasses after slaughter showed that 47% had no bruising 34% had slight bruising and 19% had severe bruising. Majority of the carcasses had bruising which was a result of the whipping and rough treatment prior to slaughter. These levels of bruising were slightly lower than that of Frimpong *et al*. (2014) who

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reported that 60 % of the carcasses they observed had minor bruises, while 22 percent had severe bruises; and also lower than Huertas *et al*. (2010), who reported that 60 percent of the carcasses they observed had minor bruises, while 22 percent had severe bruises. Vimiso and Muchenje (2013) also record bruising as high as 63.1%. Bruising has a negative effect on economic value, taste and aesthetic value of meat. Since portions have to be trimmed off, meats will look dry and reddish and their firm nature reduces consumers' satisfaction.

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8.5 Conclusion and recommendations

This study successfully examined the influence of welfare conditions on carcass and meat quality. The information gather in this study will be useful in shedding light on animal welfare in Ghana and help in safeguarding animal welfare.

The results of body temperature, respiration rate, in addition to the cortisol and pH levels taken from blood plasma and meat samples indicate that animals were exposed to extreme discomfort pre-slaughter. This leads to a detrimental effect on the final meat products acquired from these animals. In turn butchers are negatively affected since they incur economic loss from extra trimming due to bruising, shorter shelf life of meat due to bruising or hematomas and customer dissatisfaction.

Butchers should be educated about the consequences of pre-slaughter handling, and steps must be taken to encourage acceptable animal welfare procedures. Further studies that observe blood cortisol levels from the farm, through transportation, unloading, stay

in lairage and finally at exsanguination would be helpful to detect the point of most stress to animals in the livestock value chain.

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Appendix

Appendix 1: Farmer, transporter and butcher questionnaires

Questionnaires

Farmers' questionnaires

Demographic Details

1. Name (Optional)_____

2. Location Region : UE ☐ NR ☐ BE☐ AR☐ GA☐

3. District _____

4. Phone number (Optional)_____

5. Age:15-20☐ 21-25☐ 26-30☐ 31-35☐ 36-40☐ 41-45☐ 46-50☐ 51-55☐ 56-60☐ other____

6. Education: None☐ Primary☐ Secondary☐ Tertiary☐ Vocational ☐ other _____

7. Years of farming experience: 0-5☐ 6-10☐ 11-15 ☐ 15-20☐ 21-25☐ other ___

8. Number of animals in the herd _____

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9. Number of workers on the farm _____

10. What are their ages? 15-20☐ 21-25☐ 26-30☐ 31-35☐ 36-40☐ 41-45☐ 46-50☐ 51-55☐ 56-60☐ other____

11. How many are male and how many are female? Male___ Female ___

12. How many years have each been working on the farm? 0-5☐ 6-10☐ 11-15 ☐ 15-20☐ 21-25☐ other ___

(Section I) Freedom from hunger, malnutrition, and thirst:

13. What system of farming do you employ: Intensive (Zero Grazing): ☐ Semi-Intensive: ☐ Extensive: ☐

14. Which feeds do you give the animals in the raining season: grazing ☐ cutgrass ☐ grinding mill waste☐ Kitchen Waste☐ Formulated feed☐ Other_____

15. Which feeds do you give the animals in the dry season grazing ☐ cutgrass ☐ grinding mill waste☐ Kitchen Waste☐ Formulated feed☐ Other_____

16. How often do you provide water for the animals in a day? Once ☐ Twice☐ Ad libitum ☐

17. If daily, at what times? Morning ☐ Afternoon ☐ Evening ☐ All Day ☐

18. Do you give any mineral supplements? ☐Yes ☐ No

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19. If yes what supplement? Salt Lick ☐ Food Seasoning ☐ Vitamins ☐ other _____

20. How long do your animals go without feed in the dry season? _____

21. How long do your animals go without feed in the raining season _____

22. Do you have a feeding plan or program? ☐Yes ☐ No

23. Do you graze your animals on free range? ☐Yes ☐ No

24. If yes how often? _____

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(Section II) Freedom from fear and distress;

25. What frightens your animals? …….

26. Are your animals ever bothered by snakes or other wild animals? ☐Yes ☐ No

27. Can you tell if your animals are stressed or afraid? ☐Yes ☐ No

28. If yes, what causes this fear and stress?_____

29. What signs show that they are in fear or distress or what sign do you use to know your animals are distress? _____

30. What do you do when they are in this condition? _____

(Section III) Freedom from physical and thermal discomfort:

31. What kind of housing do you provide for your animals? Shed ☐ Kraal ☐ Stalls ☐ Open space ☐ other _____

32. Where do you house your animals in the rainy season? Shed ☐ Kraal ☐ Stalls ☐ Open space ☐ other _____

33. Where are animals housed at the peak of dry season? Shed ☐ Kraal ☐ Stalls ☐ Open space ☐ other _____

34. Do you have a sick Bay for injured or sick animals? ☐Yes ☐ No

35. How many times is the kraal/ housing cleaned in a month ___

36. Do you ever beat or cane your animals? ☐Yes ☐ No

37. Do you throw stones at them? ☐Yes ☐ No

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(Section IV) Freedom from pain, injury and disease; and

38. Has your farm ever been inspected? ☐Yes ☐ No

39. If yes by whom? _____

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40. Who cares for your animals when they are sick? _____

41. How often do you inspect each animal individually ☐Daily ☐Weekly ☐Monthly ☐Other _____

42. How do you tell if an animal is sick? _____

43. Do you have a scheduled treatment plan? ☐Yes ☐ No

44. When do you give scheduled treatments? _____

45. Where do you store medication? _____

46. Do you assist the pregnant animals when they are calving? ☐Yes ☐ No

47. If yes what do you do? _____

48. Do you do castration ☐Yes ☐ No

49. Do you do dehorning ☐Yes ☐ No

50. Do you do parasite control ☐Yes ☐ No

51. Do you care for hooves ☐Yes ☐ No

(Section V) Freedom to express normal patterns of behaviour.

52. What are some of the behaviour your animals exhibit?_____

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53. Can you tell if your animals behaviour changes? _____

54. Do your animals respond to commands? ☐Yes ☐ No

55. What do you use the command to do? _____

56. Do you feel emotionally attached to your animals? ☐Yes ☐ No

(Section VI) General questions of interest to animal welfare

57. Do you keep any kind of records? ☐Yes ☐ No

58. If yes, what kind of records do you keep on the farm? _____

59. How do you drive the animals or control them? _____

60. How are your animals transported from the farm to the point of sale? _____

(Section VII) Indigenous knowledge of animal welfare:

61. Have you ever been trained in livestock welfare? ☐Yes ☐ No

62. Do you know anything about animal welfare?_____

63. How would you describe animal welfare?_____

64. What do you do to ensure animal welfare is protected? _____

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65. What are some of the welfare techniques the older farmers taught you? _____

Farm observation checklist

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1. Name

2. Location Region District

Yes No

3. Housing

4. Do animals have a shelter

5. Are animals exposed to the harsh weather

6. Do young animals have a separate quarters

7. Is the farm demarcated

8. Are the animals protected from theft

9. Presence of feeding troughs

10. Presence of drinking troughs

11. Prophylactic medication

12. Sick Bay area

13. Record books

14. Do animals seem stressed

15. Do animals seem calm

16. Are animals crowded

17. Is the Farmer comfortable around the animals

18. What equipment are presents

19. Hygiene of Farm premises Good Average poor

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Focus Group Discussion questions

1. How do you view each of the five animal welfare freedoms?

2. Rank the five freedoms and place a weight to each?

3. Do you think animals have feelings?

Transporters questionnaires

Demographic Details

1. Name (Optional)_____
2. Location Region : UE ☐ NR ☐ BE☐ AR☐ GA☐
3. District _____
4. Phone number (Optional)_____
5. Age:15-20☐ 21-25☐ 26-30☐ 31-35☐ 36-40☐ 41-45☐ 46-50☐ 51-55☐ 56-60☐ other____
6. Education: None☐ Primary☐ Secondary☐ Tertiary☐ Vocational ☐ other _____
7. Vehicle registration #
8. Type of vehicle: _____
9. Driving experience/years of driving _____

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(Section I) Freedom from hunger, malnutrition, and thirst:

10. Do you give feed to the animals in transit? ☐Yes ☐ No
11. If yes, what food do you give them? _____
12. Do you give water to the animals in transit? ☐Yes ☐ No
13. If yes where do you get your water?_____
14. What quantity do you give each animal? _____

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15. How many times do you provide food and water? _____

(Section II) Freedom from fear and distress;

16. Do the animals show signs of fear when being transported? ☐Yes ☐ No

17. If yes, what kind of behaviour do they show? _____

18. How do you know the animals are comfortable? _____

(Section III) Freedom from physical and thermal discomfort;

19. How many animals can be stocked into your truck? _____

20. Size of animal carrying area Length_____ Breath _____

21. Is your vehicle purpose for transport of cattle? ☐Yes ☐ No

22. How many attendants do you have in your vehicle? _____

23. Has your vehicle ever broken down on the road? ☐Yes ☐ No

24. In the event of a breakdown what contingency measures do you have in place?

25. Do you provide any bedding for the animals? ☐Yes ☐ No

26. How long (days) does it normally take to fix the vehicle? _____

(Section IV) Freedom from pain, injury and disease

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27. Are you able to identify sick animals before transport? ☐Yes ☐ No

28. What symptoms do you look out for? _____

29. Have you ever lost animals in transit? ☐Yes ☐ No

30. Out of every 10 trips how many animals die? _____

31. Do you transport pregnant animals? ☐Yes ☐ No

32. What do you do to injured or sick animals on the road? _____

33. Do you ever sedate the animals in transit? ☐Yes ☐ No

34. Do you transport injured animals, animals with broken bones?

35. Has any animal gotten injured during transit? What was the cause? How did you handle that?

(Section V) Freedom to express normal patterns of behaviour.

36. How do you handle aggressive animals?_____

37. Which breed of cattle are the easiest to transport? (Ndama, Fulani, sokoto,WASH) _____

38. When animal shows fatigue, tiredness and distress on journey what do you do?

_____

39. Do you observe animals fighting during transport? ☐Yes ☐ No

40. Do you observe mating during transport? ☐Yes ☐ No

(Section VI) General questions of interest to animal welfare nn

41. How long have you been in this business? _____

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42. How often do you transport animals in the dry season _____
43. How often do you transport animals in the raining season _____
44. What are the main destinations you transport animals to? ☐Accra ☐ Kumasi ☐Techiman ☐Other _____
45. How many kilometers do you drive to your destination? _____
46. How many kilometers do you drive per day? _____
47. How many days do you spend on the road during transport? _____
48. How are animals loaded into the trucks? ☐Ramp ☐ Lifting ☐Other _____
49. Are there any regulating bodies you have to report to or take a payment from? ☐Yes ☐ No

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50. List them: _____

51. What are your major problems?
_____
_____
_____
_____

52. What are the major problems you face in the dry season?
_____
_____

53. What are the major problems you face in the wet season?
_____
_____

54. How often do you service your vehicle? _____

55. How much do you charge per transport of each animal ? _____

56. Do you mix different types of animals in transit ? ☐Yes ☐ No

57. Which other animals do you transport? _____

58. Do you mix different sizes of cattle ? ☐Yes ☐ No

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(Section VI) Indigenous knowledge of animal welfare:

59. Have you ever been trained in livestock welfare? ☐Yes ☐ No

60. Do you know anything about animal welfare? ☐Yes ☐ No

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61. How would you describe animal welfare? _____

62. What do you do to ensure animal welfare on the journey?

---

63. Are there any ideas the older transporter taught you that are beneficial in transport? ☐Yes ☐ No

64. What are they?_____

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Transport observation checklist

1. How are animals transported to the convergence point?

_____

_____

_____

_____

2. How are aggressive animals handled?

_____

_____

_____

3.	Yes	No
4. Is the vehicle fabricated for transport of animals		
5. Does the floors of the vehicle have anti-slip		
6. Is the ventilation of vehicles enough?		
7. Drainage on floors, does it flow freely?		
8. Is the carrier partitioned		
9. Presence of a ramp loading		
10. Do animals seem stress during loading		
11. Are animals comfortable in vehicle		
12. Are there any injured or sick animals insight		
13. Do transporters have handling equipment		

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14.		

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Butchers questionnaire

1. Demographic Details
2. Name (Optional)_____
3. Location Region ☐: NR ☐SR ☐UE ☐UW ☐NE
4. District _____
5. Phone number (Optional)_____
6. Age _____
7. level of education: None ☐ Primary ☐ Sec ☐ Tertiary ☐
8. Years of experience ?
9. Gender__ Religion__

(Section I) Freedom from hunger, malnutrition, and thirst:

10. Do you provide any feed for animals before slaughter? ☐Yes ☐ No
11. If yes what kind of feed?_____
12. What are the reasons for providing feed?_ _____ _____ _____
13. Do you provide any water? ☐Yes ☐ No
14. What is the Source of water? Pipe ☐ Tank ☐ Brought by Butcher ☐

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15. How long do you provide feed and water before slaughtering? A few hours ☐ a day ☐ under a week ☐ Other_____

(Section II) Freedom from fear and distress;

16. Do the animals express fear upon entering the abattoir? ☐Yes ☐ No

17. What signs do you notice? _____ _____

18. Is there anything you do to reduce the stress and anxiety the animals go through? Yes ☐ No ☐

19. If Yes

_____ _____

20. Are animals slaughtered/killed in the presence of others? Yes ☐ No ☐

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(Section III) Freedom from physical and thermal discomfort;

21. How are animals unloaded from trucks? Carried☐ Forced to jump ☐ dragged ☐ Other _____ _____

22. Do you keep your animals in the lairage? ☐Yes ☐ No

23. How many days are they kept in lairage? _____

24. What do you do while they are at the lairage? _____

25. How many people are involved in the slaughter of one animal? _____

26. Do lairages have shades? ☐Yes ☐ No

27. What is the capacity of lairage and number of animals kept there? _____

28. Species of animals kept in lairage? Cow ☐ Goat ☐ Sheep ☐ Pigs ☐

29. How clean is the lairage? Clean ☐ Not Clean ☐

a. (Section IV) Freedom from pain, injury and disease;

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30. How long do your animals wait before slaughter? _____

31. Do you consider the animals' welfare in your butchering? ☐Yes ☐ No

32. Are there any precautions you take to ensure the animal does not suffer during slaughtering?

_____

_____

33. Do you slaughter injured animals? ☐Yes ☐ No

34. Do you slaughter sick animals? ☐Yes ☐ No

35. Do you practice stunning? ☐Yes ☐ No

36. If yes, what kind of stunning? _____

(Section V) Freedom to express normal patterns of behaviour.

37. How are animals guided into the slaughter hall?

_____

38. Have you ever been injured slaughtering an animal? ☐Yes ☐ No

39. How lit is the slaughtering environment? Bright ☐ Dim ☐ Dark ☐

b. (Section VI) General questions of interest to animal welfare

40. How many years have you been a butcher? _____

41. What do you know about animal welfare?

_____

_____

_____

_____

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_____
_____

42. Have you ever had a training on animal welfare? ☐Yes ☐ No
43. If yes by whom? _____
44. Does the handling of the animals affect the quality of meat? ☐Yes ☐ No
45. Do you know or have you ever heard about DFD and PSE?
46. What causes DFD? _____
47. What causes PSE? _____

c. (Section VI) Indigenous knowledge of animal welfare:

48. Who taught you how to be a butcher? _____
49. Traditionally how is a butcher trained? _____
50. What do you do as a butcher to prevent injuries to yourself?
    _____
    _____
    _____

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Abattoir observation checklist

2. Cleanliness of lairage

_____
_____
_____
_____

3. How are animals shepherded into slaughterhouse

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_____

_____

_____

_____

4. Noise levels: ☐ Extremely High ☐ High ☐ Normal Silent
5.
6.
7.
8.
9.

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Abattoir Observation Check List				# OBSERVED
Behaviour	**Definition**	**Yes**	**No**	
Easily pulled	The number of animals allowing themselves to be moved from the cattle market into the abattoir by cattle handlers.			
Beatings (whips)	Animals which fail, to move voluntarily being whipped/ lashed			
Charging at handlers	Number of animals that charge at handlers.			
Defecation and urinating	Involuntary urination and defecation triggered by stress.			
Ear erection	Stress induced raised their ears.			

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	Foaming	Stress induced foaming at mouth and nostrils.			
	Forced tripping of animals.	Forced tripping of animals which refuse to walk into abattoir.			
	Head swings	Stress induced swinging of head.			
	Horn pulling	Animals that need to be held by the horn by cattle handlers and pulled.			
	Jumping	Distressed jumping and odd behaviour.			
	Kicking	Attempts of animals to kick handlers.			
	Crippled during handling	Animals which become lame and cannot walk due to inappropriate handling by cattle handlers.			

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	Leg pulling	Animals pulled by ropes attached to legs.			
	Lying down and refusing to move	Animals that are crippled with fear.			
	Moving without pulling	Animals moved voluntarily into the abattoir without being pulled by cattle handlers.			
	Panting	Animals that pant heavily while being handled.			
	Raising of tail	Some animals due to agitation raised their tails while they are being moved by cattle handlers into the abattoir.			
	Resistance to be lassoed	Animals that resist the use of lassoes on them.			
	Resistance to be pulled	Animals which resist being pulled by cattle handlers from the cattle			

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	market into the Abattoir.			
Retreating	Due to fear and inappropriate handling by cattle handlers, some animals moved backwards while they are being moved into the abattoir for slaughter.			
Running	Some animals run when being moved by cattle handlers into the abattoir.			
Slapping	Animals that require slapping in addition to other methods of guiding.			
Sniffing	Due to fear and inappropriate handling by cattle handlers, some animals sniff the air.			

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Stoning	Hitting animals with stones when animals failed to move voluntarily			
Stretching	Some animals stretched their bodies by extending their forelegs forward and their hind legs backwards and arched their bodies due to stress from inappropriate handling by cattle handlers.			
Stamping of feet	Due to fear and inappropriate handling by cowboys, some animals remained stationary and kept stamping their feet on the ground while they were being moved into the abattoir for slaughter.			

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Tail pulling/twisting and, stumping on tail	Animals which lay down and refused to stand up while they are being sent into the abattoir have to have their tails pulled, twisted or stamped upon by the cattle handlers before they stood up and began to move.			
Vocalizations	All kinds of vocalizations made that deviate from normal behaviour.			

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Appendix 2 Pictures

Figure 0-1: Cattle going to graze

Figure 2::Cattle being transported to market

Figure 3:: Cattle packed in trucks for long distance trips

Figure 4:: Cattle closesly transported with little space for movement.

Figure5::Cattle awaiting slaughter at Tamale slaughterhouse

Figure 6:: Cattle in lairage

Figure 7:: Humane slaughter equipment not being used at Accra slaughterhouse

Figure 8: Animal being dragged into slaughter chamber

Figure 9: enumerator interviewing transporter.

Figure 10:: animal being offloaded by ear dragging.

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