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Beef handling Practices at Abattoirs and Butcher Shops in Uganda: Implications for Meat Safety and Health of Consumers

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ABSTRACT

Proper beef handling contributes to achieving sustainable development goals 3 (good health and well-being) and 12 (sustainable consumption and production patterns). This is because it ensures the safety of meat and consumers' health. However, the meat sector is still underdeveloped in most African countries. In addition, there is limited research addressing meat safety challenges. In Uganda particularly, in the recent past, there was whistle-blowing over contaminated beef on the market, indicating a loophole in food safety. Despite this, studies focusing on beef handling practices have remained scanty. Thus, this study aimed to examine beef handling practices at the abattoirs and butcher shops in Uganda's Central, Western and Eastern regions. A mixed-methods approach was employed to collect data through a survey, in-depth interviews and on-site observations. Findings revealed that beef handling practices were poor at abattoirs and butcher shops and that most facilities for safety measures were lacking or inadequate. Only 3% of the respondents had cold room storage facilities, and meat spoilage was relatively high (85.3%). Appropriate knowledge of meat safety among abattoir and butcher operators was inadequate, contributing to low compliance with food safety guidelines. Inappropriate handling practices and poor handling facilities may put consumers at a health risk. The study recommends that responsible authorities should ensure compliance mechanisms and sensitization initiatives are prioritized.

INTRODUCTION

Food safety ensures proper food handling, including beef and is crucial for ensuring the good health of consumers. Proper beef handling refers particularly to the practices that prevent microbial contamination and spoilage of beef at all points along the meat value chain, from the abattoir to the dining table (Niyonzima *et al*., 2013). It is noted that the unhygienic environment at both abattoirs and butcher shops (Bafanda *et al*., 2017) leads to unsafe meat due to microbial contamination. Poor handling of beef can result in the survival and multiplication of harmful microorganisms which grow on beef leading to beef spoilage (Rouger *et al*., 2017). Such meat is unsafe for consumption and may

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lead to food poisoning (Haileselassie *et al*., 2013). This may contravene Sustainable Development Goal (SDG) number three, which focuses on good health and well-being of people. Additionally, suppose meat spoilage is high at butcher shops and abattoirs, fulfilment of the SDG 12 target of reduction of food waste at the retail and consumer levels to reduce food losses along production and supply chains may not be achieved (UNDP, 2015). Thus, appropriate handling of beef during and after slaughter is significant for fulfilling the SDGs. Poor food handling has been identified as one of the contributing factors to various ailments. For instance, poor food handling contributes to foodborne disease outbreaks (Gorman *et al*., 2002; Gilbert *et al*., 2007; PEH, 2008). Notably, microbial pathogens are responsible for most of the food borne disease burden in developing countries and cause 20%–40% of intestinal disorders (Grace, 2015). Food-borne illnesses manifest in ill health such as stomach upsets, diarrhoea, fever, vomiting, abdominal cramps, and dehydration to more severe illness and even death (Scallan *et al*., 2011; Thomas *et al*., 2013; Tegegne and Phyo, 2017; Yenealem *et al*., 2020). In pregnant women, foodborne illness may result in complications such as miscarriages, premature births, maternal and neonatal sepsis, and infant mortality (Tam *et al*., 2010). In this respect, promoting safe handling in the meat value chain contributes to food safety and is significant for the safe consumption of meat.

Meat safety requirements and standards in most poor countries are below the desired status. For instance, at the abattoirs, meat may be dressed on the floor (Fearon *et al*., 2014), and there are no basic facilities like stunning, bleeding, evisceration, and cooling rooms (Haileselassie *et al*., 2013). After slaughter, meat is transported in open trucks and poorly packaged without regard to safety measures (Fearon *et al*., 2014) when delivered to butcher shops. At most butcher shops, hand washing and water storage facilities may be lacking, inadequate, or inappropriate (Bogere and Baluka, 2014). In some premises, the meat is exposed to heat from the sun, which attracts dust and flies from the surrounding environment (Kyayesimira *et al*., 2019). Worse still, most people engaged in the meat production and processing value chain may not even be trained in hygienic procedures or meat technology (Akabanda *et al*., 2017). Therefore, such handlers may not implement measures they are unaware of or may not comprehend the significance of upholding the required standards.

A considerable amount of literature has been published on the meat sector. These include; studies on microbiological quality and meat safety (Koutsoumanis and Taoukis, 2005; Niyonzima *et al*., 2013; Obeng *et al*., 2013; Kebede *et al*., 2014; Santos *et al*., 2017) and meat handling practices (Birhanu *et al*., 2017; Pal *et al*., 2018). These studies above have been conducted in different contexts and are content specific. For instance, Santo and colleagues' study on butcher shops in Portugal cannot reflect the situation in developing countries because the food safety standards vary significantly. Although studies by; Kebede and colleagues in Ethiopia, Niyonzima in Kigali and Obeng in Ghana may represent the Sub-Saharan context, they do not holistically look at the practices in the meat value chain from slaughter houses to shops. Hence, studies on meat handling practices in Sub-Saharan Africa remain scanty.

Other scholars have studied meat hygiene and associated health hazards to consumers (Chepkemoi *et al*., 2015; Bafanda *et al*., 2017; Wambui *et al*., 2017) and knowledge and practices of meat safety (Sulleyman *et al*., 2018). Bafanda and colleagues (2017) focus on awareness among consumers, which may not change if meat handlers, who are the culprits, do not improve handling standards. Chepkemoi and colleagues (2015) focus on the sanitation of butcheries, while Wambui and colleagues focus on good hygiene in slaughterhouses. The two studies do not address the contamination that may occur both at slaughterhouses and butcher shops, putting consumers' health at risk.

In Uganda, studies on meat safety have also been conducted. Musoke *et al* (2016) examined meat inspection at slaughter to detect meat that may be unfit for home consumption for the prevention of zoonotic diseases. A study on the contamination of ready-to-eat meat in highway markets was also conducted (Bagumire and Karumuna, 2017). Compliance with post-harvest handling practices of beef along the Meat Value Chain has been studied (Kyayesimira *et al*., 2019). However, these studies do not focus on beef handling practices at abattoirs and butcher shops and meat safety for consumers' health, which is the focus of the present study.

In recent years, there has been an increasing amount of literature on meat, but few studies have been conducted in Uganda emphasising beef handling. Yet, in the year 2018, Uganda woke up to the news that meat in butcher shops had been contaminated with a chemical known as Formaldehyde, commonly found in hospitals to preserve dead bodies (Ssali, 2018). When sprayed over the meat, it was revealed that it keeps away the flies. Such premises attract customers who are lured into thinking that the butcher shop has high standards of hygienic conditions (Yiga, 2018). Such incidents revealed consumers' vulnerability to unsafe meat and meat products. Meat may appear appetizing or luring and may not be fit for human consumption. This may be due to contamination at either slaughterhouse before it reaches butcher shops. Improper meat handling practices contribute to making it unsafe for consumption. At any point of contamination, if such meat is consumed, it might contribute to health disorders of consumers. Therefore, the present study explored beef handling practices in the abattoirs and butcher shops in Uganda and implications for meat safety and consumers' health.

MATERIALS AND METHODS

Study sites

The research was conducted in the districts of Mbarara, Kampala, and Mbale, situated in the Western, Central, and Eastern regions of Uganda, respectively. The three (3) districts were selected because they are the biggest destinations for cattle market, with Kampala district housing the biggest abattoir in the country, which slaughters 500-700 cattle daily (Thorell, 2014).

Study design and data collection

A cross-sectional study design was employed. A survey, in-depth interviews, and observations were conducted using a mixed methods approach. The study units were slaughterhouses and abattoirs and butcher shops. A total of 460 respondents, comprising 105 respondents from

abattoirs and 355 from butcher shops, were selected from the three districts using simple random sampling. At each district, the department in charge of production provided the number of abattoirs and butcher shops. Respondents from abattoir and butcher shops were selected using the formula of Taro Yamane (1967), as indicated below

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

where n=the sample size, population size (30156 for butcher shops and 142 abattoirs), e= the acceptable sampling error at a 95% confidence interval.

This formula was chosen because proponents of this formula recommend that when one is studying a finite population, it is more appropriate (Adam, 2020; Singh *et al*, 2014). In this study, the finite population was respondents from abattoirs and butcher shops from the 3 study districts.

Respondents included abattoir operators, butchery owners, butchery operators, and butchers. Butchers are directly involved in slaughtering, transporting, and selling meat. They were selected to get views on the handling practices regarding the quality of meat, hygiene and safety measures and standards. Key informants (30) were purposively selected and distributed equally in all study districts. They included District Veterinary Officers (DVOs), meat inspectors, Uganda National Bureau of Standards (UNBS) staff and chairpersons of meat associations of butcher shops and abattoirs. These were interviewed to get perspectives on meat safety and compliance standards. The data was collected between June, 2018 to January, 2019.

Data collection methods

An interview guide enabled information collection on food safety guidelines and standards awareness. It also facilitated the collection of information on whether the meat processing industry and value chain actors understood the consequences of their actions on the health of families and the community. Participants were interviewed at workplaces and given priority to serve clients. The interviews were conducted in the mornings, afternoons, and evenings depending on customer flow at the butcher shops. The research team did not want to disrupt the attendants from serving customers but focused on gaining the respondents' undivided attention for more information. At the abattoir, interviews were conducted in the mornings when slaughtering was usually done. The research team wanted to observe the processes and practices of meat handling as it was slaughtered and distributed to customers. The time frame of the interview schedule varied from one place to another but took more than one hour to two on average. The time taken to conduct interviews was long because of the disruptions when clients showed up, and the researcher would pause the session to enable the respondent to attend to the client first. Interviews were conducted in the predominant local languages of the respective study areas which were Runyankore in Mbarara, Lumasaba in Mbale and Luganda in Kampala, to allow the respondents to express themselves freely.

Observation was also employed as a critical tool to establish the status of the butcher shops and abattoirs. In this exercise, the sense of smell and

vision were vital in establishing the hygiene of the business units operating as butcher shops and abattoirs. The researchers observed how customers were served the meat they had purchased. The processes of cutting meat, measuring and packaging for customers, chopping boards, the equipment used, the storage facilities, and the hygiene of the surroundings were observed.

Some relevant documents were also reviewed to understand and comprehend the meat handling practices and their implication for consumers. Reviewed documents included the Sustainable Development Goals, the UNBS standards, the National Environment Management Authority (NEMA) regulations and other policy documents, as well as, regulatory guidelines.

Data analysis

All quantitative data, mainly generated from the questionnaire, were processed and analyzed using the Statistical Package for Social Sciences (SPSS) version 20 (IBM Corp. Armonk, NY: Released 2011) and Sigma plot Version 14. Frequencies and percentages were computed for meaningful interpretation of results presented in the form of tables in the results and discussion section. Qualitative data were analyzed using the thematic approach, where common themes were categorized, coded, and interpreted for meaning. These were used to complement data from in-depth interviews and document reviews.

Research Ethical Considerations

Before data collection, approval was obtained from the National Council for Science and Technology in Uganda to implement this research under the RELOAD research project Uganda (RELOAD/A0401UNSCST2012). At the University, approval was acquired from the Mbarara University of Science and Technology Research Ethics Committee (MUST-REC). During data collection, participants were briefed about the aim of the research to seek consent and voluntary participation. This was done verbally, and a request to take pictures was made. Pictures taken and provided in this paper were taken from premises where respondents had consented verbally, and for those who were not willing, their concerns were respected. The pictures have been presented in blurred form to protect the participants' identities.

RESULTS AND DISCUSSION

Socio-demographic characteristics of respondents

This study was interested in the levels of education and gender of respondents. The study presumed that education should influence better meat handling practices. Previous studies reported high education level was related to safe food handling (Karabudak *et al*., 2008; Jianu and Goleț, 2014). Findings from the study (Table 1) revealed that most beef handlers at the abattoir and butcher shops had attained basic education. For instance, most abattoir operators had primary education (48.6%), while most butcher shop operators (46.2%) had acquired secondary education. Few of the respondents had no formal education. As this study reveals, there seems to be a basic literacy level among the meat industry operators. Similarly, in Malaysia, the majority of food handlers had primary and secondary level education (Rosnani *et al*., 2014). Contrary, in Ogun State of Nigeria, it was found that the majority of the handlers had low literacy levels of up to primary

education (Fasae and Bakare, 2016). These revelations suggest that the level of education of operators in the meat industry is low and could contribute to the unsafe handling of meat.

Gender was thought pertinent to this study because men and women may have different ways of conduct. This may determine varying meat handling practices. This study revealed that men dominated the meat sector, as indicated in Table 1. This could be attributed to the masculine nature of the work at the abattoirs and butcher shops. The findings of this study are similar to those of other scholars (Abdeirazig *et al*., 2017; Kikulwe *et al*., 2018) who found males dominating several food value chain nodes compared to their female counterparts. Notably, in Nigeria, 100% of beef handlers were male (Fasae and Bakare, 2016). Given the findings, men seem to dominate in sectors where activities may be strenuous.

Table- 1: Number of Respondents by Education and gender

Variable	Abattoir operators	Butcher shops operators
No formal Education	7 (6.7 %)	5 (1.4%)
Primary Education	51 (48.6%)	154 (43.4%)
Secondary Education	35 (33.3%)	164 (46.2%)
Tertiary Education	7 (6.7%)	16 (4.5%)
Graduate	5 (4.8%)	16 (4.5%)
Male	103 (98.1%)	352 (99.2%)
Female	2 (1.9%)	3 (0.8%)

Meat handling practices at slaughterhouses and butcher shops

Results from observations at abattoirs (slaughterhouses) showed that tools and carcasses were being handled unhygienically during and after the slaughter process, as shown in Plate 1.

Plate 1: Unhygienic slaughter process: on floor slaughter (left) and unhygienic meat handling practices at a slaughterhouse (right)

It was noted that workers wore dirty and torn protective wear, kept knives in gumboots, and carried meat over clothes. Also, flaying and dressing were done on the dirty floor. Most slaughterhouses did not separate stunning rooms from other processes. The slaughterhouses in all the study districts had substandard facilities and lacked design requirements per the standard for the design and construction of slaughter areas (UNBS, 2017). This seems not to have improved since an earlier study in Uganda also confirmed similar flaying practices and dressing on the floor (Bogere and Baluka, 2014). A similar study in Northern Nigeria reported that slaughterhouses lacked basic structures leading to unsafe meat (Bello *et al*., 2015).

In an interview with one of the officials from the meat inspection unit, it was further explained that, particularly in Mbarara and Mbale, the slaughterhouses were operating below the required standards, unlike in Kampala, where a few were complying. The official attributed this to the fact that the rate of compliance to standards in Kampala, a city, is higher than in urban areas in other regions. This study noted that in Mbale and Mbarara, there was one meat inspector per district, unlike in Kampala. This could probably explain the revelation from one of the key informants that there is slightly fair compliance to better meat handling practices in the city. However, from the observation in this study, there was no clear distinction in terms of compliance with proper meat handling in all the study areas. This seems to concur with the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) report, which indicated that Uganda lacks better slaughter facilities that respect health, food safety, and environmental standards (MAAIF, 2020). In line with the current findings, a study in Abiia and the Immo states of Nigeria revealed low compliance of meat handlers to best practices (Iro *et al*., 2017). In Kenya, slaughterhouse meat handlers were not washing their hands, and equipment handling practices were inadequate (Wambui *et al*., 2017). These revelations suggest that Uganda is not the only country that does not meet the desired handling practices at slaughterhouses.

Regarding butchery structures (meat shops), findings revealed that most (96.6%) of beef sales in the study were made from kiosks with no cold rooms. Other beef sales were made in open structures, under the tree and a few butchers (3%) owned kiosks with cold rooms, as shown in Plate 2. .

Plate 2: The meat shops common in the study areas showing meat displayed along the dusty roads

Most of the butchery establishments (96.6%) lacked cooling facilities. It was observed that meat is displayed for sale, exposing it to dust and flies. When one of the respondents was probed about why meat was being displayed in the open, he had this to say,

'*…You may not attract potential clients if you do not display your meat. That is what everyone selling meat does in this area. When customers come, they move around as they check out the best and attractive meat before deciding to buy. If you do not display, nobody will know that you are selling meat, and they might think that your stock is finished….'*

This study indicates that meat retailers have been accustomed to displaying meat, and customers are used to buying meat on display. This could be attributed to the ignorance of both parties on proper meat handling and food safety standards. It is acknowledged that informal butcheries are widespread in Uganda (Agriterra, 2012). In this study, it was also observed that most butcheries lacked fly-proof windows or doors to prevent the entry of insects, and none had running water. A similar study in Kampala, Uganda, found that most butcheries lacked a standard fly screen and fly-proof window (Mirembe *et al*., 2015). This means the flies can transmit pathogens/microbes from one point of meat sale to another, leading to unhygienic situations. The close proximity of several butcheries and their practice of sharing weighing scales, stones, and cutting tools created a high risk of cross-contamination. If one piece of shared equipment became contaminated, it could potentially spread to all the participating businesses.

Storage facilities and transportation of beef

According to hygiene requirements for a butchery, a chilly environment for storage is a requirement for optimum meat safety. It was, therefore, significant for this study to examine storage facilities in the study area. Study findings revealed that slaughterhouses in Kampala had chillers but were lacking in the slaughterhouses in Mbarara and Mbale. Meat shops lacked cold storage facilities; daily meat for sale was stocked, but if all was not sold, it was left hanging in the facility. Butcheries lacked cold storage rooms because there was no power supply coupled with limited innovation on solar usage in refrigeration. In one of the discussions with the veterinary personnel, it was revealed that butcher operators in Mbarara and Mbale were reluctant to use cold storage rooms because the temperatures were not as high as in Kampala. This was also on the assumption that in places with cool temperatures, the spoilage rate and level of contamination may be below. In contrast, the contamination rates and levels are higher in the wet and rainy seasons (Bagumire and Karumuna, 2017). Another reason that was provided for not refrigerating meat was that customers consider refrigerated meat not to be fresh, as one respondent during the interviews noted:

'*You see most customers when they come, especially in the morning, they want to see the meat dripping with blood, and they even caution you that…please do not give me any meat that stayed overnight…some even check to confirm it is not chilled*.' *For that matter, I do not store meat in the chillers.*

In relation to this study, Agriterra (2012) reported that enormous roadside small-scaled butcheries in Kampala lacked refrigeration. The butchers preferred to buy meat in relatively small quantities that could be sold in one day. Agriterra further reveals that the butchery structures were not appropriate according to the Ugandan standard on hygienic requirements of butcheries (UNBS, 2007). In Kenya, Chepkemoi *et al*. (2015) noted that butcher shops in Nairobi and Isiolo counties stored meat by hanging it in

open spaces. Similarly, a study in South Sudan noted that many meat-selling structures were open shelters and kiosks that left meat hanging in the open air (Aburi, 2012). These revelations portray poor storage conditions, which can accelerate microbial growth and hence quicken meat contamination.

Transportation is another aspect that compromises the hygiene of meat and hence its safety. The conditions of transporting meat should provide adequate protection from contamination (Rani *et al*., 2017). This study aimed to understand how meat was transported, especially from slaughterhouses to butcheries. The results of the present study indicated that the majority (54%) of the carcass (beef) was transported by motorcycles, followed by bicycles (25%), and a few (1%) used wheel barrows or shoulder-to-shoulder logs. Motorcycles were not only popular in Uganda for transporting meat but also in Ghana, where the majority (93%) of the butcher men transport beef on bicycles, motorbikes, and motorized tricycles, popularly known as motor kings under very unhygienic conditions (Fearon *et al*., 2014). This study also observed that sometimes meat was carried in sacs or polythene bags and would drip blood, attracting dust and flies along the way. This is unlike Kenya, where meat is mostly transported in metallic containers (Chepkemoi *et al*., 2015). In this study, motorcycles were also loaded with wooden boxes where beef is placed and then covered during transportation, but some were left open. In Kenya, Chepkemoi *et al*. (2015) noted that metallic boxes in which meat is transported are mainly closed. Covering meat is important because in cases where the boxes are left open, and meat is not wrapped, it may expose it to dust, flies, and other sorts of contamination.

There are standards for transporting and handling meat at both the global and local levels. For instance, the code of hygienic practice for meat requires that it is handled, stored, and transported in a manner that will protect it from contamination and deterioration (CAC/RCP, 2005). The modes of transport of meat should maintain proper refrigeration temperatures at critical points such as loading and off-loading (Richardson *et al.,* 2009). However, refrigeration is unavailable in some abattoirs and during transportation in developing countries (Aburi, 2012; Agriterra, 2012; Chepkemoi *et al*., 2015; Rani *et al*., 2017). Poor modes of transport like shoulder-to-shoulder logs provide a conducive environment for contamination with and growth of some pathogenic and spoilage micro-organisms that would put consumers at risk.

Occurrences of beef spoilage at butcher shops

Beef spoilage could be common in facilities with poor storage and handling practices. Study results indicate that beef spoilage was common in butcheries. The kind of beef spoilage occurring at the slaughter included; bad odor, bruised meat, change of color, and rotting, among others, due to beef overstay at the point of sale. Over 85.3% of butchery operators reported beef spoilage, as in table 2.

Meat handling practices at slaughterhouses and butcher shops

Results from observations at abattoirs (slaughterhouses) showed that tools and carcasses were being handled unhygienically during and after the slaughter process, as shown in Plate 1.

Table 2: Frequency of beef spoilage occurrence at Butcher shops

		Mbarara	Kampala	Mbale	Average
% Occurrence of beef spoilage	Yes	102(85.2%)	100 (75.5%)	97 (95.1%)	85.3
	No	18 (14.8%)	33 (24.5%)	5(4.9%)	14.7
% Occurrence of beef spoilage	Daily	37 (27.9%)	41(34.4%)	37 (36.3%)	32.8
	Weekly	52 (39.3%)	28 (22.9%)	33 (32.4%)	31.5
	Biweekly	4 (3.3%)	1 (0.5%)	2 (2.0%)	1.9
	Monthly	18 (13.2%)	18 (15.1%)	17 (16.7%)	15.0
	Occasionally	2 (1.6%)	3 (2.1%)	8 (7.8%)	3.9
	Not applicable	20 (14.8%)	30 (25%)	5 (4.9%)	14.9
Type of spoilage incurred (%)	Bad odor	20 (14.8%)	1 (1.0%)	13(12.7%)	9.5
	Meat changes color	4 (3.4%)	8 (6.7%)	7 (6.9%)	5.6
	Rots after some days	22 (16.4%)	9 (7.8%)	12 (11.8%)	12.0
	Bruised meat	2 (1.6%)	3 (2.1%)	3 (2.9%)	2.2
	Drip loss	20 (14.8%)	19 (15.6%)	14 (13.7%)	14.7
	Beef wastes	48 (36.1%)	51 (42.7%)	48 (47.1%)	41.9
	Not applicable	17 (13.1%)	29 (24.0%)	5 (4.9%)	14.0
The fate of spoilt beef	Given to dog owners for free	22 (16.4%)	10 (8.3%)	39 (38.2%)	21.0
	Thrown away	89 (67.2%)	62 (51.6%)	9 (8.8%)	42.5
	Sells it to clients for dogs	20 (14.8%)	48 (40.1%)	33 (32.4%)	29.1
	Takes it home for consumption	2 (1.6%)	0 (0%)	21 (20.6%)	7.4

Daily, the average beef spoilage was reported at 32.8% in the study areas. The respondents at the butcher shops indicated that, at times, beef that remains at the end of the day is left hanging in the retail premises because of a limited refrigeration system. Similarly, butcher shops in Nairobi and Isiolo Counties, Kenya, also store meat by hanging it in open spaces (Chepkemoi *et al*., 2015). In this study, meat sales are made near dusty roadsides, and the meat is displayed for customers by hanging it on the veranda (close to the road). This exposes meat to contamination, accelerating the rate at which meat may get spoilt. A study in Uganda found that enormous roadside small-scaled butcheries in Kampala lacked refrigeration (Agriterra, 2012) and could accelerate beef spoilage. A previous pilot study in Uganda revealed that any balance of meat was either stored in the freezer or left hanging in the butchery. In contrast, the rest of the butcheries sold off the balance cheaply to avoid carry-over to another day (Kyayesimira *et al*., 2018). The beef left hanging in the butchery overnight is susceptible to microbial growth that quickens spoilage.

This study revealed that meat not sold off is carried on to the next day, mixed with fresh stock and sold to unsuspecting customers. One of the attendants of a butcher shop (key informant) confirmed this practice by saying:

'Normally the meat that stays is very little and so to avoid making losses when a customer comes, we cut fresh meat and as we measure the

amount requested by the customer, we add on the meat of the previous day'.

This practice is absurd since it lures consumers into thinking that the shops are selling fresh meat but instead, the meat is mixed with the previous stock, which may be spoilt. Mixing fresh stock with the previous one (unrefrigerated) may also contribute to the rate at which all stock may get spoilt.

This study observed that meat tending to spoilage attracted many fly populations. It was also revealed that when the environment of the meat-selling premises is not hygienic, it acts as fly breeding grounds that swim to butcher shops worsening the hygienic conditions of the premises and the meat. This situation could lead to a disease outbreak. As noted, in Thailand, there was a linkage between fly populations associated with disease outbreaks and cases of food-associated pathogens, for instance, *Vibrio fluvialis*, *E. coli*, *Vibrio cholera* and *Campylobacter spp* (Graczyk *et al*., 2001).

It was in the interest of this study to find out where the spoilt beef was taken. Findings revealed that the fate of beef after spoilage was to throw it away, as was reported by 42.5% of respondents, 29.1% reported that the spoilt meat was sold to clients, while 7.4% mentioned that they took it home for consumption. When probed about it, the respondents claimed that despite the unpleasant odour, it may not pose a danger to consumers' health if it is well cooked. The respondent's perspectives seem to concur with Bogere and Baluka (2014),who also noted that microorganisms might be destroyed if cooking is effectively conducted. However, in some households where raw meat is consumed, it could pose a health risk.

Other respondents explained that spoilt meat is roasted first to eliminate the unpleasant odour, a delicacy in some households. These revelations indicate that operators lack adequate knowledge regarding food safety and its health implications.

Meat inspection at slaughter and butcher shops

Meat inspection is crucial in the meat industry because it ensures meat safety and hygiene. During the study, it was observed that there were no meat inspections taking place at the slaughter slabs. Instead, the inspection was observed being conducted at the slaughterhouses. This may not conform to effective monitoring principles, where every stage in the slaughtering process is critical for meat safety. Abattoir operators informed the study that meat inspectors are supposed to inspect the meat that is slaughtered before it is distributed to clients. At butcher shops, respondents revealed that the team from the district does inspections. However, there seems to be concerns that meat inspection in Uganda has been inadequate. For instance, Bogere and Baluka (2014) noted that the inspection of abattoirs and butcher shops by both the veterinary and public health inspectors had been insufficient. Thus, the meat safety and hygiene standards have deteriorated (Bogere and Baluka, 2014). It should be noted that butcher's shops act as links between the inspected and approved safe meat for consumption, and therefore, inspection in the whole meat value chain is crucial for ensuring meat safety (Waldman *et al*., 2020).

At the slaughterhouses, it is a requirement to conduct ante mortem inspections. This study established that Kampala district had higher