



Assessment of Hygiene practices used by Small Butchers and Slaughter Slabs in beef value chain in Juba town-South Sudan



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Acronyms

CAHWS	Community Animal Health Workers
EFSA	European Food Safety Authority
EHCE	Enterohaemorrhagic Escherichia Coli
EHEDG	European Hygiene Equipment Design
FAO	Food and Agriculture Organization
GDP	Gross Domestic products
GHP	Good Hygiene Practices
GOSS	Government of South Sudan
HACCP	Hazard Analysis and Critical Control Point
SSP	South Sudan Pound
WHO	World Health Organization

SUMMARY

South Sudan is an infant country which still has challenges of developing government system, policies and legal frameworks formulation and capacity building of government institutions. Beef subsector has high potential in the area it represents 95% of red meat and most available sources of animal protein in Juba Town (capital city), but it has food safety problems along the beef value chain.

The objective of this study is to assess hygiene practices used by small butchers and slaughter slabs; and identify causes of unhygienic beef handling practices in small butcherries and slaughter sites, in order to improve food safety in beef chain.

Data for this study was derived from desk study and Survey conducted with forty small butchers, 8 from Konyokonyo, 8 from Juba, 7 from Lebia, 7 from Nykoron, 5 from Gabat and 5 from Jebel market were interviewed using structured questionnaire, and multistage cluster sampling. Two senior government officials were interviewed using check list for getting insight information about the government role in maintaining food safety in beef chain, discussion with other chain actors for obtaining information about beef value chain in study area. And observational assessment for 4 slaughter sites, and discussion with livestock traders was done by researcher to know hygiene condition of meat in pre-slaughter and during slaughtering process.

The collected data from survey was process by SPSS version 19, where cross tabulation and bar chart was used for description of relationship between variables. The qualitative data (Case study and discussion) was process by reporting system.

The survey result of study shows that young men of ages range from less than 25-35 years old are dominant butchers, 26 of them are 10 primary and 16 secondary leavers, hired to work at butcherries. 35 small butchers were operating in open shelter butcherries and 21 of them did not have health card for operating butcherries; 5 small butchers were operating in kiosk butcherries. Only 9 small butchers attended training on hygiene practices in meat handling. On hygiene practices, 28 small butchers were transporting meat by open vehicles while the rest were using motor bikes; 33 small butchers hanged meat in open air as storage system and 3 small butchers stored meat inside fridges; 23 small butchers cleaned their tools by smearing with pieces of cloth, 8 small butchers used water and soaps, 7 small butchers were used sharpening of knives as a way of cleaning knives and 2 butchers only use water; also 75% of small butchers were willing to attend any training on meat hygiene.

The result of case study shows that currently the governments (all levels) do not have clear legal framework for maintaining food safety along the beef chain.

Observational assessment comes with result that 3 slaughter slabs have concrete floor and one is without any structure as animals were slaughter on bare ground; all slabs do not have necessary facilities for provision of good hygiene condition, all are nearer to residential areas.

Both lack of legal framework and insufficient knowledge of good hygiene practices in meat handling by small butchers led to deteriorated hygiene condition of slaughter slabs and butcherries, which will cause food risk for meat consumers in the study area.

The improvement of food safety will be attained if the government at national level formulate legal framework for food safety and be apply and control by other levels of government with the support of chain actors and chain supporters. In addition of creating awareness to chain actors on good hygiene practices, and organize small butchers to easier the coordination and access to credit and technical support.

1. INTRODUCTION

South Sudan is an area of 619,745 square kilometers, bordered by Ethiopia to the east, Kenya to the southeast; Uganda to the south; the Democratic Republic of Congo to the southwest; the Central African Republic to the west; and Sudan to the north. It is inhabited by 8,260,490 people (Government of the Republic of South Sudan, 2012). Before the independence of this country, it has a semi autonomy government which have direct link with the national government of Sudan where legal frameworks are shared, and after the independence, the new country is accelerating toward development of government system, policies and strategic plans and legal frameworks for regulation of developmental activities in all sectors.

South Sudan is enriching with animal resources, it has 10 million heads of cattle which is part of animal resources which has the potential to contribute by 15% of the GDP of Southern Sudan (Ministry of Animal Resources and Fisheries-GOSS, 2006).

Beef is the main and the most available source of animal protein in Juba town which account for 95% of red meat consumption, the total annual red meat consumption has raise up to 9234 tonnes (8784 tones beef and 450 tones shoat's meat) (Muli et al, 2010).

This increase in demand led to rise in beef marketing in the Juba. The actors of beef production chain form an important core in meeting the growing demand of meat in Juba Town. This chain supported the livelihood of people engage on it such as farmers, traders, transporters, wholesaling and butchers as well as retailers. But due to poor infrastructure (roads, slaughter sites and butcherries) and insufficient knowledge of food safety, Meat is poorly handled right from slaughtering, transportation and trading of the meat; in Juba County for instance there is only one designated slaughter house that is also not sufficiently facilitated and equipped to the required standards of a slaughter house. Despite the policies in place to regulate livestock and meat hygiene requirements, there is illegal slaughtering of animals in an individual and undesignated slaughter places that exposes the meat to health risk (Southern Sudan Centre for Census, Statistics and Evaluation-GOSS, 2009). All these become challenges for chain actors to provide consumers with a safe food.

There is a need to reduce food risks through control of food safety in beef chain which has to begin at farm level, slaughter sites and butchers or retailing sites, but slaughter sites and butcherries are most vulnerable areas to cross contamination of beef. Therefore, this study aim to assess small butcherries and slaughter slabs on good hygiene practices and identify causes of unhygienic beef handling in small butcherries and slaughter sites.

1.2 Main Problem:

The problem of beef handling and hygiene in Juba Town is focusing in slaughter slabs, beef transportation and butcherries especially some of small butchers are slaughtering their animals on bare ground in residential areas where some residents use as toilets, while others slaughter animals on unhygienic slab and lay meat on already decaying dry hides which they removed from carcasses weeks before (Francis and James, 2010). In addition to unhygienic meat in slaughter sites, there is a problem of selling meat in unsanitary environment such as open shelters and unclean kiosk butcherries which sell meat in unacceptable way of meat handling (Southern Sudan Centre for Census, Statistics and Evaluation-GOSS, 2009).

This force majority of restaurants who were supplied by these small butchers to look for an alternative and shift to the large butchers as a result of pressure from the middle income class who mainly eat in those restaurants (Muli et al, 2010).

This make a reduction in beef demand from small butchers which will also cause a risk to small butchers' business.

1.3 Research Objective:

To assess small butchers and slaughter slabs on hygiene practices for beef handling; and identify causes of unhygienic beef handling practices in small butcheries and slaughter sites, in order to improve food safety in beef chain.

1.4.1 Main Research Question (1):

- (1) What are the hygienic practices used by chain actors in beef value chain?
 - 1.1 What are the hygiene practices applied in small butcheries and slaughter slabs?
 - 1.2 What are the causes of unhygienic beef handling practices in slaughter sites and butchers?
 - 1.3 What is the level of awareness on meat hygiene practices among small butchers?
 - 1.4 What are the possibilities for improving meat hygiene practices at small butcheries?

1.4.2 Main Research question (2):

- (2) What is the government role in maintaining food safety along the beef chain?
 - 2.1 What are the government regulations for maintaining food safety along the beef chain?
 - 2.2 What are the challenges facing the implementation of food safety measures along beef chain?
 - 2.3 How does the meat hygiene regulation be introduced and enforced in the beef value chain?

1.5. Conceptual Framework:

This study will focus on value chain analysis as a conceptual framework to show how food safety be maintained in both slaughter sites and butcheries or retailing site, role of the supporter and influencers in controlling food safety along beef value chain.

Value chain concept:

There are different studies come up with different definition for value chain, according to Labaste, value chain” describes the full range of value-adding activities required to bring a product or service through different phases of production, including procurement of raw materials and other inputs, assembly, physical transformation, acquisition of required services such as transport or cooling, and ultimately response to consumer demand (Webber & and Labaste, 2010).

While Wältring, defined value chain as the sequence of activities involved in transforming raw materials into a product that is acquired by the final customer. It includes business activities from the generation of raw materials, to transforming them into intermediate products, to manufacturing the final product (Jörg and Frank, 2007).

1.6 Definition of terms:

Good Hygiene Practice : Good Hygiene Practice consists of practical procedures and processes that return the processing environment to its original condition (disinfection or sanitation programs); keep building and equipment in efficient operation (maintenance program); control of cross-contamination during manufacture (usually related to people, surfaces, the air and the segregation of raw and processed product) (Raspor, 2008).

Good hygiene Practices in meat is consist of a qualitative description of all practices regarding the conditions and measures necessary to ensure the safety and suitability of food.

Food Safety Measures: are measures and conditions necessary to control hazards and ensure fitness of foodstuff for human consumption. Also it was defined as all conditions and measures necessary to ensure the safety and suitability of food at all stages of food chain.

Hazard Analysis Critical Control Points (HACCP): A quality management system used for effectively and efficiently ensuring farm-to-table food safety, which can be achieved through controlling of chemical, microbial and physical hazards associated with food production. It is a prevention-based system, and takes a proactive approach by identifying the principal hazards and control points where contamination can be prevented, limited, or eliminated across the whole food production process – rather than trying to identify and control contamination after it has occurred (American Society for Quality, 2009).

Critical Control Points: A step (point, procedure, operation, or stage in the food production system) at which control can be applied, and where control is essential to prevent or eliminate food safety hazard or to reduce it to an acceptable level (Luning, 2006).

Awareness: is a state of having knowledge or perception of a situation or fact, or it is a concern about and well-informed interest in a particular situation or development.

Large butchers: are meat retailers who follow the formal meat marketing channel through selling one or more carcasses (of bull) and addition to shoat carcasses that is comes from the slaughter house, and they have ability to process some meat parts into mincemeat, all of them have structured butchery (kiosk).

Small butchers: are meat retailers, who have ability to sell one carcass (of Bull) per day as a maximum volume, they depend on meat from slaughter house and slabs, they do not have processing equipment, some of them are usually practicing the informal meat marketing such as selling meat from not inspected animals.

2. LITERATURE

2.1 Livestock sector in South Sudan

Livestock production is an inheritance, a tradition and a way of life, which for centuries has shaped the thought, culture, social values and the economic life of the majority of Southern Sudanese. It contributes to national food security by converting rangeland resources into products suitable for trade and human consumption and it is projected that the livestock sector has the potential to contribute by 15% of the GDP of Southern Sudan. (Ministry of Animal Resources and Fisheries-GOSS, 2006).

Cattle can still be considered as the main livestock species accounting for 70% of the stock while goats account for 14.7% and sheep 14.5%. Although chicken are kept in most communities throughout Southern Sudan and it account for less than 0.5% of total livestock (Muli et al, 2010).

Total cattle population in South Sudan is estimated to 11.735 million heads, with the annual growth rate of 2.95. It is the most available source of the red meat which is supply to major towns. (Swithun and Jonathan, 2012)

Table 1: Shows South Sudan – Cattle numbers (thousands) by state (2005-2011)

State	2005	2006	2007	2008	2009	2010*	2011*
Central Equatoria	895	908	922	926	878	896	914
Eastern Equatoria	883	896	910	913	888	906	925
Western Equatoria	680	690	701	703	675	689	703
Jonglei	1475	1497	1521	1526	1465	1495	1526
Upper Nile	990	1005	1021	1024	983	1003	1024
Unity	1189	1207	1226	1230	1180	1204	1229
Lakes	Na	Na	Na	Na	1311	1338	1365
Warrap	1539	1562	1586	1592	1528	1559	1591
Western Bahr el Gazal	1256	1275	1295	1300	1248	1274	1300
Northern Bahr el Gazal	1590	1275	1295	1300	1248	1274	1300
Total	10497	10655	10822	10860	11735	11976	12221

Na = no record, * Data for 2010-2011 are approximations, based on population growth

Source: Ministry of Animal Resources and Fisheries for 2005-2008; FAO livestock population estimate for 2009-2011 (Swithun and Jonathan, 2012)

As indicated in above table, Greater Equatoria region has less cattle population due to East Cost Fever endemic for long time in the area.

This table shows a very slight trend for the total cattle population between three years 2005, 2006 and 2007, and this is due to many challenges facing livestock production such as poor pastures, diseases, poor management and cattle raiding.

2.2 Livestock marketing in South Sudan

According Rosemirta and Ndikumana, livestock marketing system is defined by the chain actors operating in the market and the purpose for which livestock is purchased. The study of livestock marketing in 3 states of South Sudan (Jonglei, Central Equatoria and Eastern Equatoria state) shows that almost (40.1%) of the livestock trade is dominated by cattle and more than half of the trade volume (58%) taking place in Central Equatoria, proceeded by trade in goats (28.1%), trade in sheep (18%), and 13.8% as trade in poultry (comprising 11.4% chicken, 1.8% ducks, and 0.6% turkey). The high volume of cattle trade in Central

Equatoria is supported by Juba town being the biggest commercial town and being in proximity to the cross-border markets with Northern Uganda as mention in figure 1 below.

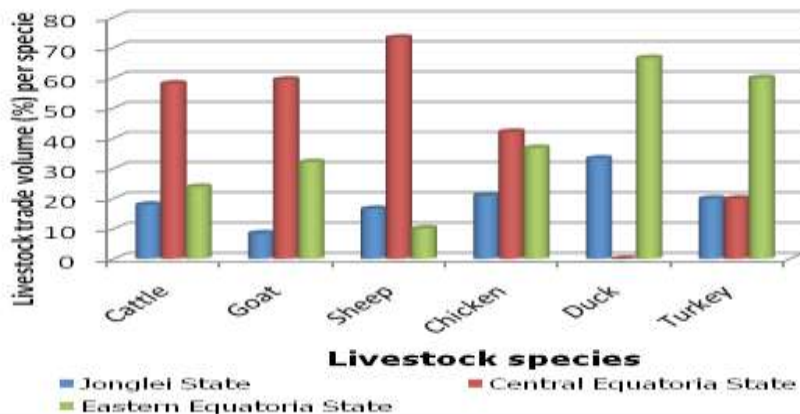


Figure 1: Livestock trade volume (%) per state
Source: Sources: report on livestock marketing in South Sudan

The study found that beef takes a lead by contributing 39% of the total trade share, follow by Milk 20.3%, and chicken and Eggs equally taking 10.9%. These products dominate the trade share of livestock products portfolio. Goat meat, mutton and hides & skins also have a low but recognizable market share of 5.5% (goat meat), 3.8% (Mutton) and 5.4% (Hides & skins). Ghee, liver and pork equally comprise 1.4% each of the trade share of livestock products as stipulated in figure 2 below.

The share analysis of these livestock products indicates a trade potential of promoting trade product development and marketing of livestock in Southern Sudan. This is further supported by increasing consumer demand and willingness to pay for high value quality products. (Rosemirta and Ndikumana, 2010).



Figure 2: Trade shares of the livestock products.
Sources: report on livestock marketing in South Sudan

Although beef have highest trade share, but it can be grade as poor quality meat due to poor husbandry practices; unavailability of appropriate transportation means for meat; and low levels of awareness of the importance of quality standards of meat by suppliers (producers and traders) as well as consumers.

2.3 Control of meat hygiene and safety:

The safety of meat needs control throughout food chain from farm of origin, and inspection before and after slaughter, to handling and storage of meat and products until the time of

consumption. The responsibility of the production of safe meat is shared by all the actors along meat chain and the controlling authority who have legal power to enforce safety and hygiene requirements (Food and Agriculture Organization , 2005).

According to Vilas et al, the abattoirs have played an important role in the surveillance of various diseases of human and animal health importance, and Surveillance at the abattoir allows for all animals passing into the human food chain to be examined for unusual signs, lesions or specific diseases (Vilas, 2008).

2.4 Codex Alimentarius' General principles for meat Hygiene:

These principles are focusing on meat safety which should be achieved through the involvement of all parties, as government has legal authority to develop and enforce regulations for meat hygiene requirements and it has responsibility to verify whether legal hygiene conditions are met. The hygiene program should aim to protect human health base on the scientific examination of meat borne pathogens. The hygiene program has to be done by the competent personals. These principles should be executed to the following functions of beef chain:

1. Primary production:

Farmers should manage animals in a way that reduce the likelihood of entrance of hazards, it should be achieved through good hygiene practices which involve health and hygiene of animals, records for treatments, feed and environmental factors, program for zoonotic disease should be reported and notified. All these have to contribute for safety of meat for human consumption. It has to collect and use available information on hazards and conditions that can be presented in animal populations and may affect the safety and fitness of meat for human consumption.

At the production or pre-harvest level, diseases such as brucellosis, leptospirosis and tuberculosis and in some cases anthrax represent direct hazards for farm workers, and the entry of animals affected with these diseases into meat plants clearly poses extreme risk for operators and consequently production of contaminated meat in food chain (Collins, 2000).

2. Transportation of the live animal:

Transportation means of slaughter animals might be an important link in the spread of *Salmonella typhimurium* among calves (Morrow and Swanson, 2001).

this transportation should be done in a way that does not have a negative impact on safety and quality of meat, the transport vehicles should be designed to ensure cross-contamination with fecal material, dirtiness or soiling is minimize. The spread of disease between animals may well compromise their welfare, and the spread of pathogens potentially compromises meat hygiene.

3. Conditions of lairage:

Handling of animals which need to be slaughtered has an influence on many stages of slaughter, dressing and production of safe meat that is fit for human consumption. The sanitary condition of animals has great effect on the level of microbial cross-contamination of meat during slaughter and dressing. The cleanliness of livestock depends on husbandry, weather and climate (rainy, dry), methods of transport (stress causes, defecation and urination) and holding conditions at the abattoir (Veterinary Public Health National-RSA, 2007). A series of requirements appropriate to animal species may be implemented to guarantee that only animals that are adequately clean are slaughtered so that it can help in decreasing microbiological cross- contamination. Sava Buncic proved that the lairage should allow recovery of animals from transport stress, abnormal animal behavior and interaction, cleaning and also effective ante-mortem inspection by the Official Veterinary Surgeon (Buncic, 2006).

4. Presentation of animals for slaughter:

The slaughter animals should be presented to ante-mortem inspection, where competent authority determining measures and tests to be used, it should be done by competent personnel, this inspection should include the confirmation that animal is properly identify, test that consider the behavior, demeanor, appearance as well as symptoms of disease in live animals with the recognition of relevant information on slaughter population (Codex Alimentarius Commission (FAO & WHO), 2005).

It is an excellent opportunity for notifiable disease surveillance which plays an important part of the process involved in the production of wholesome, safe meat (Buncic, 2006).

5. Post-mortem Inspection:

Post-mortem inspection of meat and other relevant parts should be used information from production at farm level and ante-mortem inspection, to gather with the result from organoleptic inspection of the head, carcass and viscera to make decision on the safety and suitability of meat needed for human consumption. Post-mortem and test may be integrated and implemented to gather so as to attain public health and animal health objectives. This inspection should be made by competent personal base on scientific knowledge- and risk-based methods.

6. Design of slaughter areas:

All areas and equipment where bodies of animals are dressed or meat be offered should be designed and built to allow good hygiene practices and cross-contamination of meat is reduced through effective cleaning, sanitation and maintenance which can be done during and between functional periods. Floors have sufficient slop to grilled water or protected outlets so as to guarantee frequent drainage, Separate rooms are design for different purposes such as emptying and cleaning of alimentary tracts, keeping hide and skin, dressing and chilling carcasses which should be equipped with enough tools for washing hands, cleaning and sanitation of implements. Ventilation should be designed to minimise flow of air from unclean areas (slaughter and dressing areas) to clean areas (chilling room) (Codex Alimentarius Commission (FAO & WHO), 2005).

Whyte et al have noted that greatest reductions in microbiological contamination on carcasses were achieved by adoption of dressing procedures that minimized hand contact with the carcass during pelt removal (Whyte et al., 2002).

Sava Buncic emphasized on materials and equipment to be used in the abattoir, as it should be considered from the point of view of controlling contamination, they should be as durable as possible and be capable of being cleaned and sanitized effectively (Buncic, 2006).

7. Water Supply:

Sufficient facilities should be provided for monitoring and maintaining, storage, temperature control, distribution of water and for the disposal of waste water. Equipment should be installed to provide adequate and easily accessible supply of hot and cold portable water at all times (Codex Alimentarius Commission (FAO & WHO), 2005).

Hot water may be applied for meat decontamination by spraying at higher, or low, pressures, deluging with cascading sheets of hot water, may take place at pre-evisceration and after final washing during slaughter and dressing, and after chilling during carcass deboning on meat cuts and trimmings for manufacturing ground beef (Panel, 2010).

Research has proved that immersion red meat in hot water at 80°C for 10 seconds resulted in 1-3 log-cycle reduction in counts of *E. coli* and *Salmonella* on beef and sheep carcasses (Kiermeier et al, 2006). According to Hugas and Tsigarida, the effectiveness of hot water for carcass decontamination interventions depends on operational and product-related factors. Operational factors may include water temperature, pressure, and flow rate and target surface distance, method of application, time or stage of application in the slaughtering process, and plant design and its operational characteristics (Tsigarida and Hugas, 2008).

8. Temperature control:

Facilities and tools should be sufficient for cooling, chilling and storage of meat at temperature that attain the safety and fitness requirements. It is also imperative that the cold chain is not interrupted except to the minimal level necessary for practical operations.

9. Facilities and equipment for personal hygiene:

This should include protective clothing that can be effectively cleaned and reduces accumulation of contaminants. In addition to change rooms, showers, flush toilets, hand washing and drying facilities.

10. Means of carcass transportation:

Vehicles should be designed and equipped so that meat does not contact the floor, have door seal that prevent entry of all sources of contamination, it should be equipped to temperature control and humidity can be maintained and monitored. (Codex Alimentarius Commission (FAO & WHO), 2005).

2.5 Meat cold chain

To provide safe meat and meat products of high organoleptic quality, attention must be paid to every aspect of the cold chain. The process commences with the initial chilling and continues through to the storage of chilled retail portion or meat products at home.

There are processes within the cold chain which involve primary and secondary chilling, freezing, thawing, and tempering of meat, where the aim is to change the average temperature of meat. In other way, chilled and frozen storage, transport, and retail display, and maintain the temperature of meat is prime aim, which will prevent excessive weight loss, reduced shelf life and deterioration of meat quality (Devine and Jensen, 2004).

Elements of cold chain:

- Primary chilling: the majority of carcass meat is chilled in conventional air chill room normally operating at one or sometimes two conditions during the chilling cycle, temperature reduction at the surface and within the carcass has a substantial influence on the weight loss, storage life and eating quality of the meat produced, therefore, it is necessary to have legislation for chilling temperature of the meat, European Union regulations require that all meat temperature within the carcass must be reduced below 7°C before the carcass is further process.
- Freezing: meat for processing is usually frozen in the form of carcasses, quarters or boned in the air-blast freezers. It is aim to reduce weight loss from unwrapped meat.

2.6 Hygienic Design Concept

This is a concept which aims at the design, construction, and installation of such equipment so that it does not adversely affect food quality, especially safety. It can be applied to processing and packaging equipment used in slaughter sites and butcheries.

Hygiene design requirements as recommended by European Hygiene Equipment Design Group (EHEDG) are described in the functional requirements and state that equipment must be easy to clean, disinfect and it should protect the product from microbial and chemical contamination (Pieternel and Willem, 2011).

2.7 Beef quality Attributes

Meat quality is highly subjective issue which is depending on consumers and it may vary according to cultures. But there are a number of important traits that industries and consumers can agree upon as being important indicators of beef quality; these include

intrinsic attributes such as tenderness and juiciness, flavour, appearance (colour- bright red and structure), intramuscular fat and nutritive value and safety.

In addition to extrinsic quality attribute which include the production system, processing process, transporting and retailing practice of meat. (Devine and Jensen, 2004).

2.8 Food borne diseases related to beef

Bacterial pathogens contribute to 60% of foodborne illnesses that lead to hospitalization and account for nearly two-thirds of the estimated number of foodborne pathogen-related deaths. The study revealed that retail raw meats are often contaminated with foodborne pathogens (Buncic, 2006). And pathogens associated with beef are as follows:

2.8.1 Escherichia Coli O157:H7

E. coli O157:H7 and non-O157 STEC are mostly associated with raw beef products; it is capable of producing large quantity of toxin (shiga toxin) that causes severe damage to the intestinal lining of human being. Dirt and feces that attached on the hides of cattle can therefore be contaminated with *E. coli* O157:H7 for long periods of time (Arthur et al, 2007). Research has indicated that the number of hides positive for *E. coli* O157:H7 is more accurate predictor for carcass contamination than fecal prevalence (Barkocy-Gallagher et al, 2003). The hide was identified as the primary source of pathogens on beef carcasses, the efficiency of various hide and carcass interventions, and other developments that have led or will lead to even greater improvements in the microbiological quality of beef. In relation to public health, *E. coli* (O157:H7) strain is the most important Enterohaemorrhagic *E. coli* (EHEC) serotype linked to foodborne disease, that resulting in a high incidence of EHEC infections and deaths each year (Mead et al, 1999).

In-plant intervention strategies can reduce the spread of *E. coli* O157:H7 on and between carcasses, enhance the effectiveness of in-plant intervention strategies should reduce the burden of pathogens entering the abattoir should enhance human health (Todd et al, 2010). Therefore, methods that reduce *E. coli* O157:H7 populations in food animals prior to entry to the food chain have great potential to reduce human illnesses.

2.8.2 Salmonella

Salmonella typhimurium is a pathogenic bacterium which is concentrating in hide and fecal of the cattle, rates of carcass contamination are highest immediately after hide removal and consistently decline during processing as antimicrobial interventions are applied (Koochmarai et al, 2005). Several species of *Salmonella* are pathogenic, some producing a severe and often fatal food poisoning. There are mainly two major sources of bacteria in meat causing diseases that are from living animal environment and carcass contaminate; Cross contamination routes involve feces of animals to carcass then carcass to carcass and environment to carcass (Majagaiya et al, 2008). Contamination of food with *Salmonella* may occur anywhere along the farm-to-table continuum including production, processing, distribution, retail marketing, and handling or preparation (Moon, 2011).

2.8.3 Listeria Spp:

Listeria monocytogenes and other *Listeria* species are widely spread in the environment, the risk of contamination with *Listeria* in red meat processing industry has to be considered as rather probable, possible *Listeria* cross-contamination by employees, equipment, and environment surfaces, animal skin, food additives, packing material and many other sources has been reported. (Grebenc and Marinšek, 2002) The carcasses and their products may be contaminated during slaughtering and meat processing, thus they can be recognized as

feasible transmission routes of *Listeria* to humans. (EFSA, 2006) It could be potentially transmitted by air and colonize various surfaces including raw and ready-to-eat meat products (Burfoot, 2003).

2.9 THE MEAT ACT, 1974 Sudan

This act is emphasis on hygienic condition of the slaughter houses, personnel and equipment used, it prevent the slaughtering of animals for public consumption in designated place outside the official slaughter sites where meat inspection will take place, no slaughtering of animals will take place without proper ante-mortem examination, and all carcasses have to be re-inspect by veterinary officer and stamp before pass for distribution to ensure the meat is fit for human consumption.

If authorize authority find any one selling meat not bearing an official stamp or slaughter in unauthorized slaughter site, meat have to be condemned and the person exercising illegal activities should prosecute base on regulations made according this act.

All vehicles designated for transporting meat should comply with regulations made according to this act. All butchers who are selling meat or working in slaughter houses should have health certificate to prove they are free from zoonotic diseases. And this certificate should be re-new after six month (Sudan Rules - a comprehensive legal encyclopedia, 2012).

2.10 The Meat Control Regulation, 2010-Kenya

This act have more light on sanitation and hygiene practices in slaughter houses such as sanitary cleaning of slaughter house and equipment and hygiene of personnel working in the slaughter house, it also prevent the bringing of sick animal and carcass of dead animal or carcass of animal slaughter in any place outside of slaughter house. The act prohibits selling of any carcasses unless the carcass or meat has been inspected by inspecting officer and found to be fit for human consumption (Kenya National council for laws reporting, 2010).

These acts are mention in this study for the reason of comparison, how Kenya and Sudan tackle the issue of food safety along meat value chain.

3. METHODOLOGY

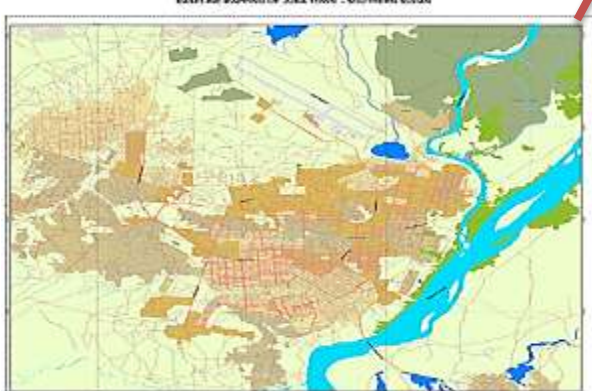
3.1 The study area

Juba town is the capital city of Central Equatoria state southern part of the country; it is also hosting the government of the Republic of South Sudan as a current capital city of the new country, administratively it is divided into three payams namely (Juba, Kator and Muniki), the signing of the comprehensive peace agreement between National Congress party in the North & Sudan People Liberation Movement in the South in 2005; mark an end to the civil war, this led to rapid flow of population to Juba town which cause rapid population growth from 163,000 in 2005 to 224,993 adult Southern Sudanese in 2011, in addition to foreigners (Southern Sudan Referendum Commission, 2011) this lead to rapid growth of different market segments, and cause an increase to needs for food items (crops and animal products).

Juba town has 5 formal slaughter slabs and one informal slab, in addition to one slaughter house without equipment for minimize cross contamination of microbial pathogens (Muli et al, 2010).



Source: A MoJo's journal of reportages, multimedia & resources



Picture 1: show location of Juba Town

Baseline map of Juba Town

Source: Ministry of Housing and Town Planning-GOSS

3.2 Research methodology

3.2.1 Desk Study

The work of research started by desk study where the secondary data was gathered from books, journals, reports and internet search sites with the aim to get insight information about literature on good hygiene practices used worldwide in beef chain, livestock sector and marketing of the country, food safety measures be maintained in beef chain and foodborne diseases.

3.2.2 Survey:

The field work started as the researcher consulted the Director of public Health in Juba County for selection of location for survey. Based on discussion, three payams were selected based on number of small butchers, organize market and they fall under the administration of Juba City Council. The researcher and public health officer (Mr. Silvestro Peter) worked to gather for collecting primary data on hygiene practices used by small butchers, through conducting a survey to forty small butchers as a sample size for this study, using structured questionnaires, and multistage cluster sampling where number of respondents were divided equally in to the three payams (Kator, Munuki and Juba payam); six markets (Konykony, Jebel, Lebia, Nykoron, Juba and Gabat markets) are the main survey area.

In each market respondents were selected at randomly basis as one responder after two small butchers. And the respondents were interviewed by using a simple Arabic language which made them understand questions of the questionnaire.

3.2.3 Observational assessment of slaughter slabs

The researcher conducted an observational assessment for four formal slaughter sites which consist of Juba, Munuki, Jebel and army slab, to assess the locations, building and facilities, inspectorate services (ante-mortem and post-mortem) and hygiene of slaughter site and personnel and meat handling. In addition to ensure meat transportation means used.

3.2.4 Interview with other chain actors

The researcher also had a discussion with other chain actors such as input suppliers and livestock traders to get insight information about type of inputs supply, cattle tracking and animal health certification during transportation from different sources to Juba town.

3.2.5 Case Study

The researcher used semi structured question (check list) and voice recorder to interview the Director of Public Health and the Director of veterinary Services in Juba County to get insight information about food safety measures to be used by butcherries, the mechanism used in enforcing food safety at both slaughter sites and butcherries, common diseases reported during inspection and measures used to stop random slaughtering of animals out of formal slaughter sites

3.3. Data processing:

The data collected was analyse qualitatively and quantitatively

The Value chain analysis tool was used to map the chain actors, supporters and influencers of beef value chain in the study area.

Descriptive statistics was used where cross tabulation was used to describe the relationship between age and educational level of respondents, level of education per operation location; also to test the relationship between market and time spent for selling meat per day. Bar chart was use to show butchery structure per market, percentage of respondents who have health certificate, sources of meat per market, type of customer per butchery structure hygiene practice per butchery structure and butcher willingness to attend training. The qualitative data from case study was written in a report form.

4. RESULTS

4.1 Survey result

4.1. Information about respondents, location of operation and type of butchery structure

This section is illustrating the characteristics of small butchers such as age, educational background, main operational area, butchery structure, main customers, and knowledge about meat hygiene practices, sources of meat per each market and owning formal document for operating the butchery (health card). These characteristics of small butchers are very vital as they pave the way for interventions to improve working condition of small butchers, by giving them instructions which are written in simple way so that they can able to read and understand files and forms.

(a) Age of respondents per educational level

Table 2: The age of respondents per educational level

Educational level	Age				Total	
	Less than 25 years old	25-35 years old	36-45 years old	46-55 years old		
Non educated	3 (42.9%)	2 (28.6%)	2 (28.6%)	0 (0.0%)	7	17.5%
Primary or basic	6 (31.6%)	10 (52.6%)	3 (15.8%)	0 (0.0%)	19	47.5%
Intermediate	1 (50.0%)	0 (0.0%)	0 (0.0%)	1 (50.0%)	2	5.0%
Secondary	3 (25.0%)	6 (50.0%)	2 (16.7%)	1 (8.3%)	12	30.0%
Total	13 (32.5%)	18 (45.0%)	7 (17.5%)	2 (5.0%)	40	100%

As revealed in table 2, it shows that majority of respondents (butchers) are young men who have age range from less than 25-35 years old, and 45% of respondents have age range between 25-35 years old, follow by 32.5% respondents who have age less than 25 years old. Respondents with the age range from 46-55 have minor representation, and 17% of respondents have age range from 36-45 years old, while ages from 46-55 years old have 5% respondents. Most of these respondents are paid staff hired by owners of butcheries.

In terms of educational level, most of respondents are educated, and primary level is a leading educational level which have 47.5% of respondents, follow by secondary level which have 30% of respondents, whereas an intermediate level have less representation of 5% of respondents. There are a quite number of uneducated respondents and they represent 17% of total number of respondents.

(b) Educational level of respondents per market

Table 3: Educational level of respondents per market

Market	Educational Level				Total	
	Non Educated	Primary	Intermediate	Secondary		
Konyokonyo	2 (25.0%)	2 (25.0%)	1 (12.5%)	3 (37.5%)	8	20.0%
Jebel	0 (0.0%)	3 (60.0%)	0 (0.0%)	2 (40.0%)	5	12.5%
Lebia	2 (28.6%)	2 (28.6%)	1 (14.3%)	2 (28.6%)	7	17.5%
Nykoron	3 (42.9%)	3 (42.9%)	0 (0.0%)	1 (14.3%)	7	17.5%
Juba	0 (0.0%)	4 (50.0%)	0 (0.0%)	4 (50.0%)	8	20.0%
Gabat	0 (0.0%)	5 (100%)	0 (0.0%)	0 (0.0%)	5	12.5%
Total	7 (17.5%)	19 (47.5%)	2 (5.0%)	12 (30.0%)	40	100%

The result present by table 3 shows that respondents from Juba Market are all educated, 50% of respondents are primary level leavers, while other 50% are secondary leavers. But Gabat and Jebel markets are also have all educated respondents with representation of 60% primary leavers and 40% secondary leavers for Jebel, and 100% of respondents from Gabat are primary leavers.

Nykoron is a leading Market for uneducated respondents which have 42.9% of respondents compare to all markets, follow by 25% and 28.6% of both Lebia and Konyokonyo market respectively. 28.6%, 25% and 28.6%, 37.5% is a primary and secondary level of respondents for both Lebia and Konyokonyo markets respectively.

(c) Butchery structure per market

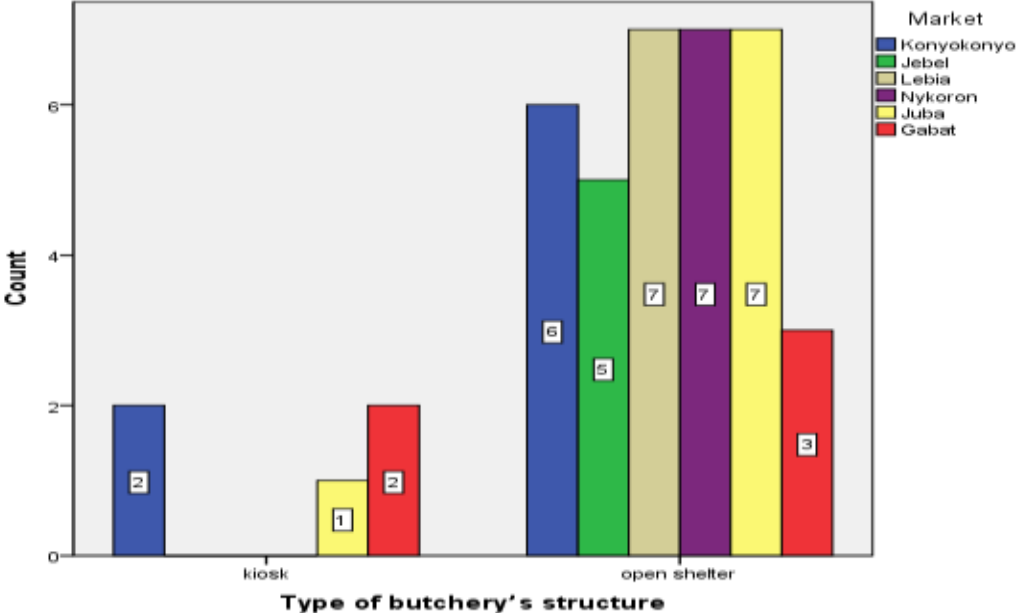


Figure 3: Type of butchery structure per market

As can be seen from figure 3 all butcheries (100%) in Jebel, Nykoron and Lebia market are open shelters, whereas 40%, 25% and 12.5% of butcheries in Gabat, Konyokonyo and Juba markets are in Kiosk form.

(d) Number of respondents with health certificate per butchery structure

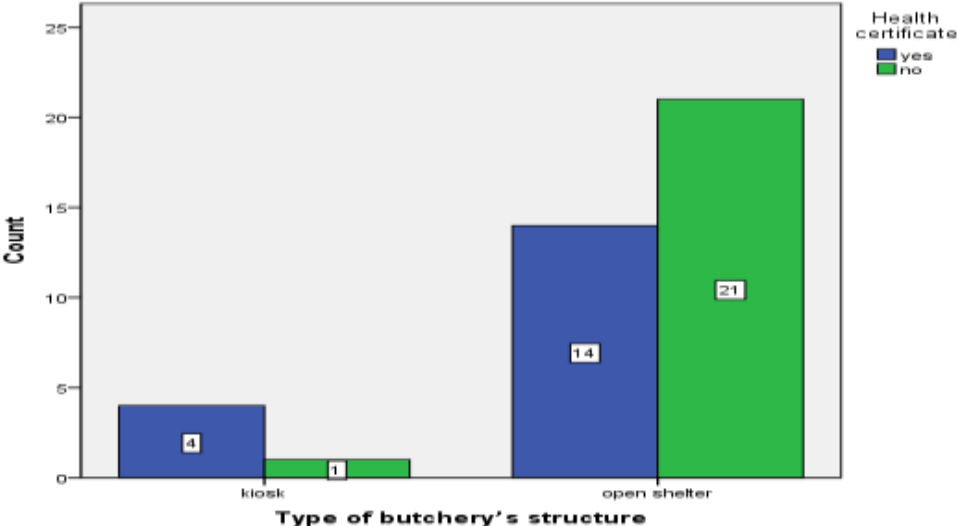


Figure 4: Respondents who have health certificate per butcher structure

The result demonstrated in figure 4 shows that more than half of the respondents (22) are not having health certificate for operating the butchery except few respondents as represented by 14 and 4 respondents for open shelter and kiosk butcheries respectively.

(e) Source of meat (slaughter sites) per market

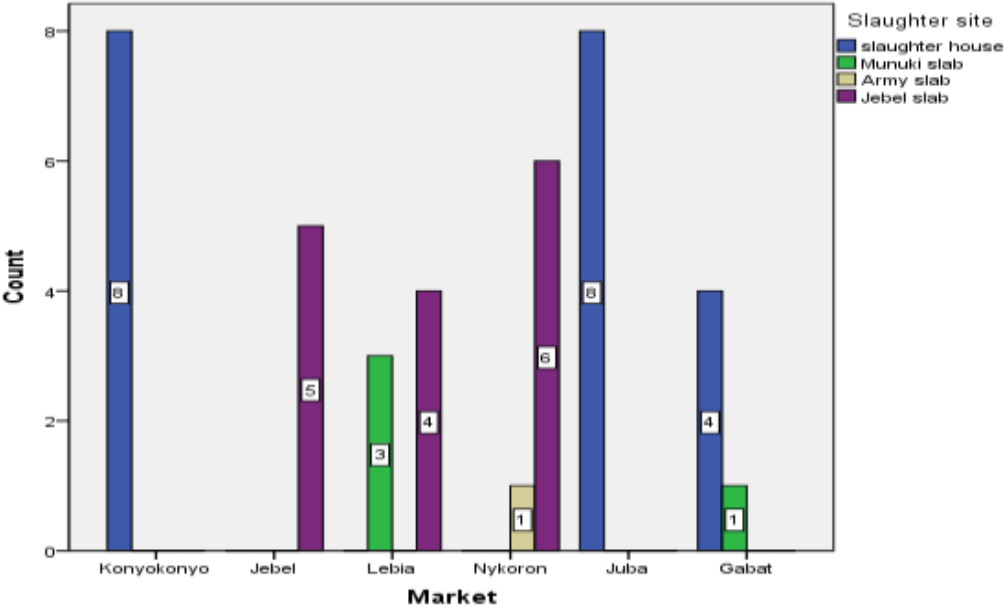


Figure 5: Describe the sources of meat per Market

The survey result presented in figure 5 express that all meat sold in Konyokonyo and Juba markets come from main slaughter house, and 80% of meat in Gabat market comes from the slaughter house, and 100% of meat sold in Jebel market comes from Jebel slab; 85.7% of meat in Nykoro market is supplied by Jebel slab. While Lebia market is supplied by both Jebel and Munuki Slab.

(f) Customer per butchery structure

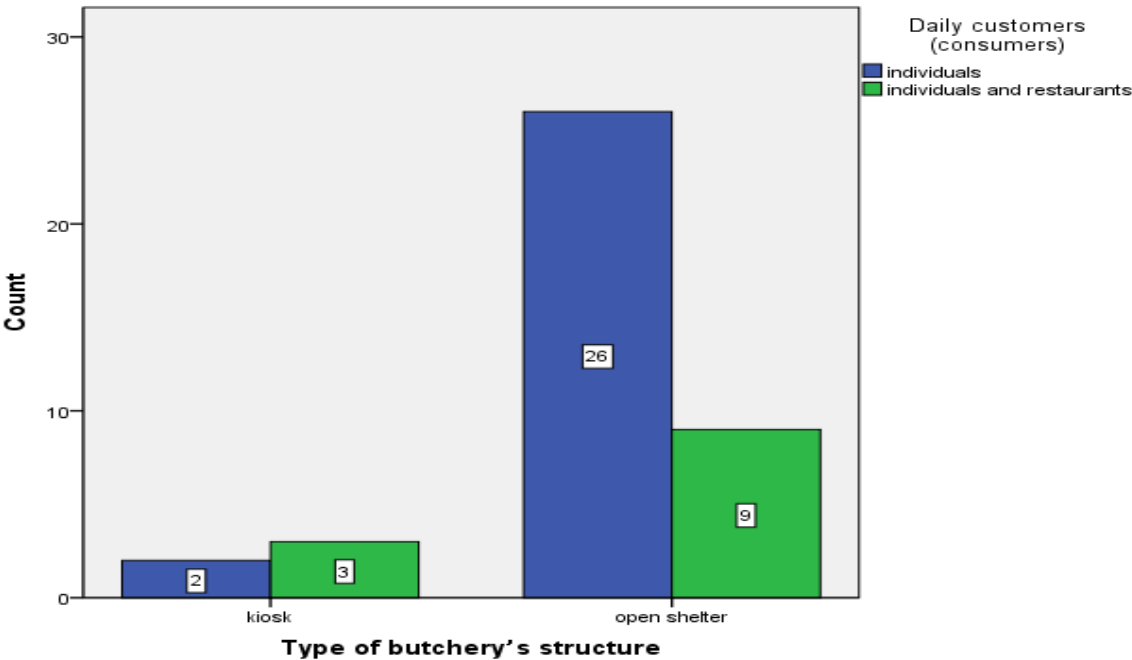


Figure 6: Type of customers per butchery structure

Generally, the result obtained from survey express that 74% of respondents of open shelter butcheries were depending on individuals as main customers, while 60% respondents of kiosk butcheries were depending on individuals and restaurants as the main customers as demonstrated in the figure 6.

(g) Number of respondents attended training on meat hygiene per butchery structure

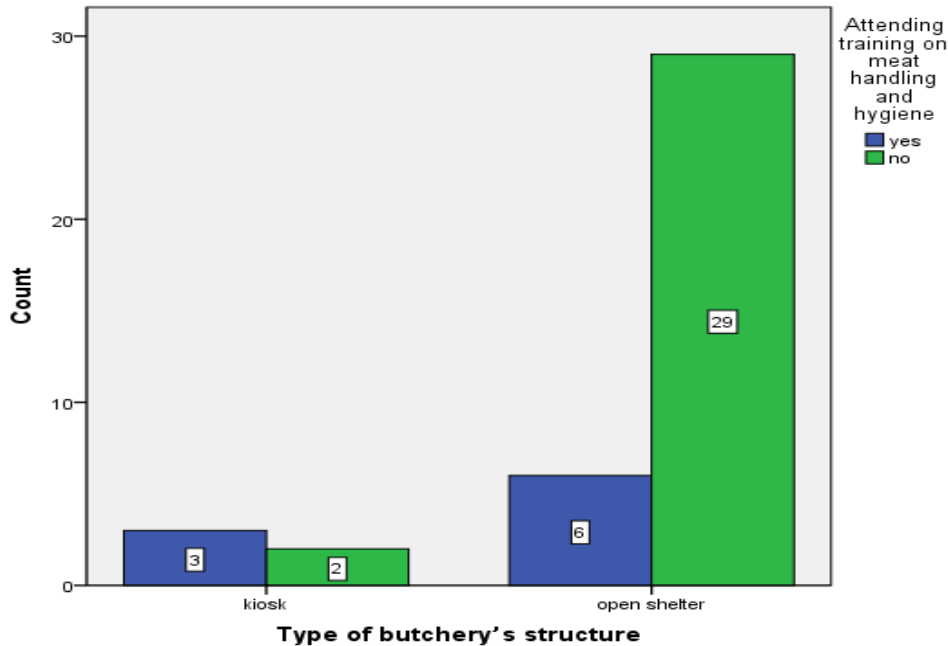


Figure 7: Number of respondents attended Meat hygiene training per butchery structure

The survey result that reflected in figure 7 express that majority of respondents (82.86%) from open shelter butcheries were not attending training on meat hygiene, while 60% of respondents from kiosk butcheries attended training on meat hygiene.

(h) Respondents pinion on keeping meat on an open air per butcher structure

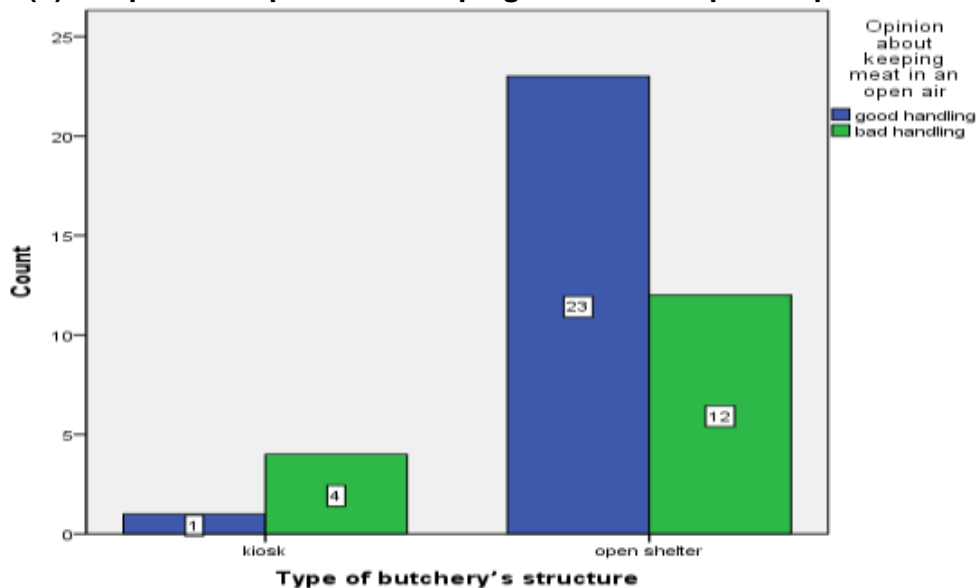


Figure 8: Respondents pinion on keeping meat on an open air per butcher structure

This chart shows the awareness of respondents on hygiene condition for selling meat, 60% of all respondents are describe selling meat in an open site is a good handling, and 65% representing respondents from open shelter butcherries, 20% from kiosk butcherries. 40% of all respondents disagreed with selling of meat in an open site and they describe it as a bad way of selling meat, and 80% of respondents from kiosk and 34% of the total respondents from open shelter butcherries as describe in the figure 8.

4.1.2 Meat Hygiene practices used by butchers:

This section is elucidates the current hygiene practices used by small butchers, and it contains meat transportation means, cleaning of equipment, meat storage before selling, wearing of specific cloth during selling of meat and practices of allowing customer to touch the meat. This will assist in development of need assessment for butchers during the intervention for strengthening their business through technical support.

(a) Means of meat transportation per butchery structure

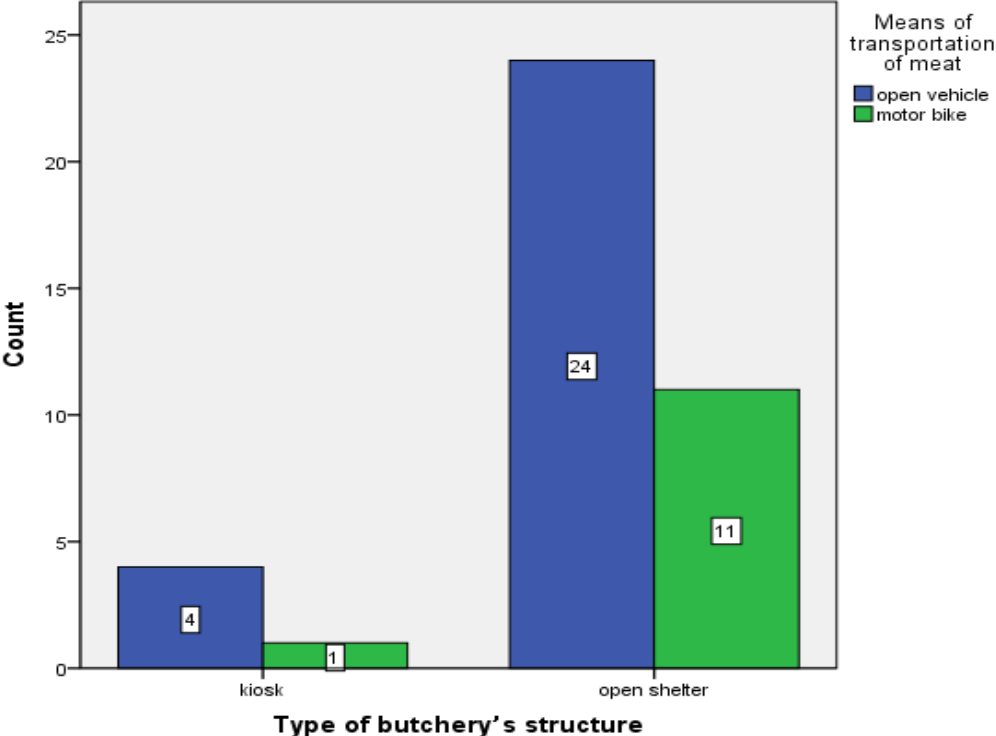


Figure 9: Meat transportation means per butchery structure

As observed from figure 9 above, open vehicles are most appropriate means of meat transportation used by both kiosk and open shelter butcherries, 80% and 68.57% representing as means of transportation for kiosk and open shelter respectively, while motor bike is mostly used by open shelter butcherries (31.43%) compare to kiosk which is 20%.

(b) Meat storage per butchery structure

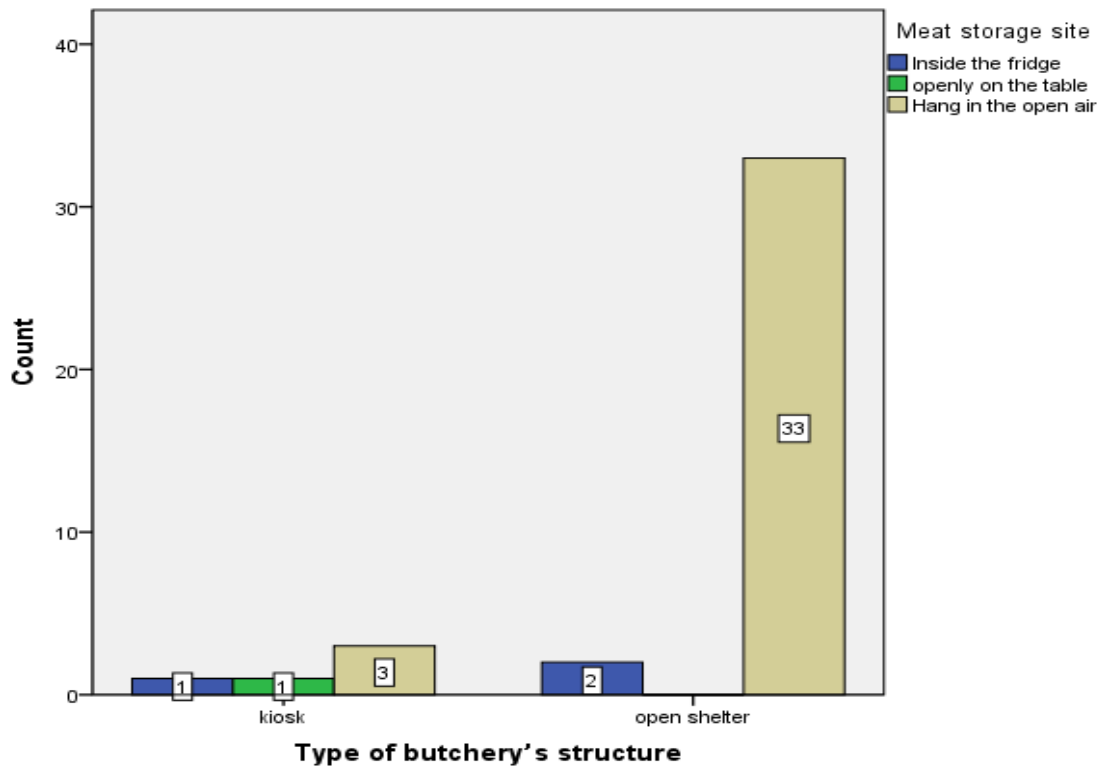


Figure10: place for keeping meat before selling per butchery structure

The survey result that presented in figure 10 describes hanging of meat in open air is the most storage system used by both kiosk and open shelter butcheries, as 94.29% of open shelter butcheries hang meat in an open air, while kiosk butcheries are storing 60%, 20% and 20% of the meat as hang in open air, openly on tables and inside fridges respectively.

(c)Meat selling time per market

Table 4: Meat selling time per market

Market	Time spent for selling meat per day			Total
	2-4 hours	5-7 hours	8-10 hours	
Konyokonyo	0 (0.0%)	7 (87.5%)	1 (12.5%)	8
Jebel	2 (40.0%)	2 (40.0%)	1 (20.0%)	5
Lebia	0 (0.0%)	1 (14.3%)	6 (85.7%)	7
Nykoron	1 (14.3%)	2 (28.6%)	4 (57.1%)	7
Juba	1 (12.5%)	4 (50.0%)	3 (37.5%)	8
Gabat	0 (0.0%)	1 (20.0%)	4 (80.0%)	5
Total	4 (10.0%)	17 (42.5%)	19 (47.5%)	40

This table clarify the appropriate time butchers used for selling meat, 87.5%, 85.7% and 80% of respondents from Konyokonyo, Lebia and Gabat Market are spending time range from 5-7hours and 8-10 hours respectively. 10% of the respondents are spending 2-4 hours for selling meat, and 42.5% of respondents are selling meat in 5-7 hours' time, meanwhile 47.5% of respondents which are the majority are spending 8-10 hours for selling meat.

(c) Practice of wearing coat during selling meat per butchery structure

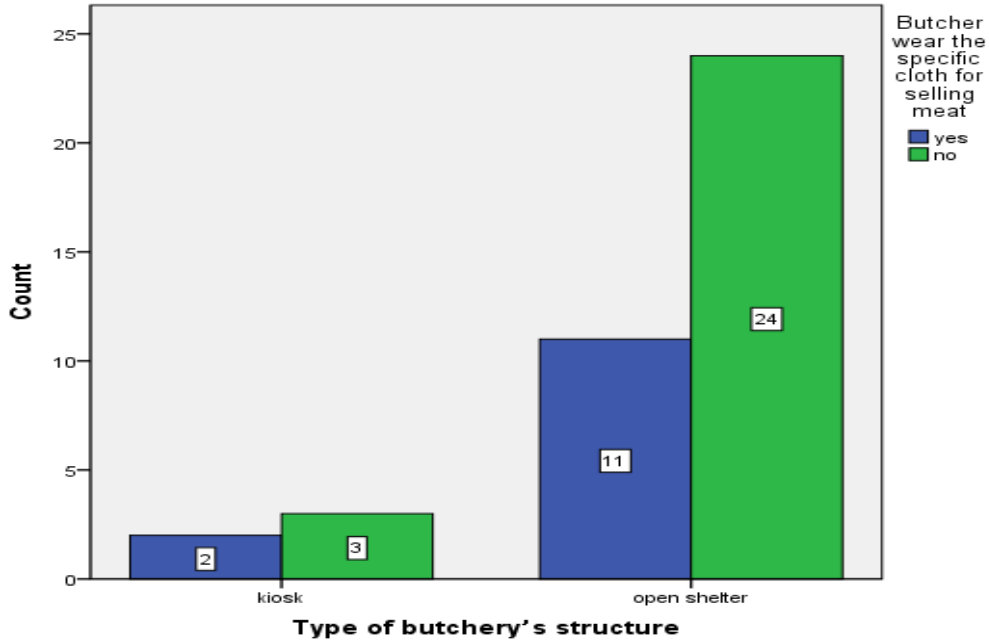


Figure 11: Butchery structure and wearing of coat per respondents

As can be seen in the figure 11, majority of butchers from both types of butcheries were not wearing specific cloth during selling of meat, 68.57% of respondents from open shelter butcheries were not wearing cloth, and also 60% of the respondents from Kiosk were not wearing cloth, whereas 40% and 31.4% of respondents from Kiosk and open shelter are wearing cloth.

(d) Hygiene Practice used for cleaning equipment per butchery structure

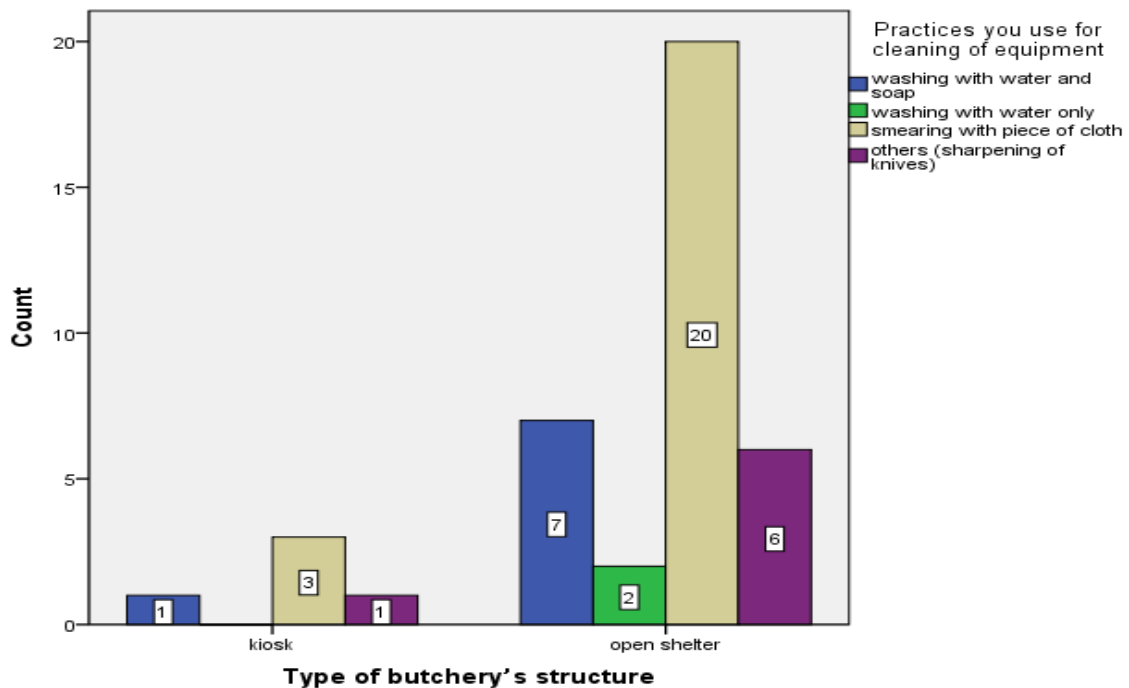


Figure 12: Cleaning of the equipment per butchery structure

The result of survey about hygiene practice used for cleaning equipment during selling of meat is stipulates in the above figure 12, it shows that no significant different between both kiosk and open shelter butcheries in way of cleaning equipment as majority of respondents 20, 3 respondents from open shelter and kiosk are cleaning their equipment by smearing with a piece of cloth. But also 7 respondents from open shelter are cleaning their equipment through washing with water and soap.

(e) Practice of touching meat by customer per butchery structure

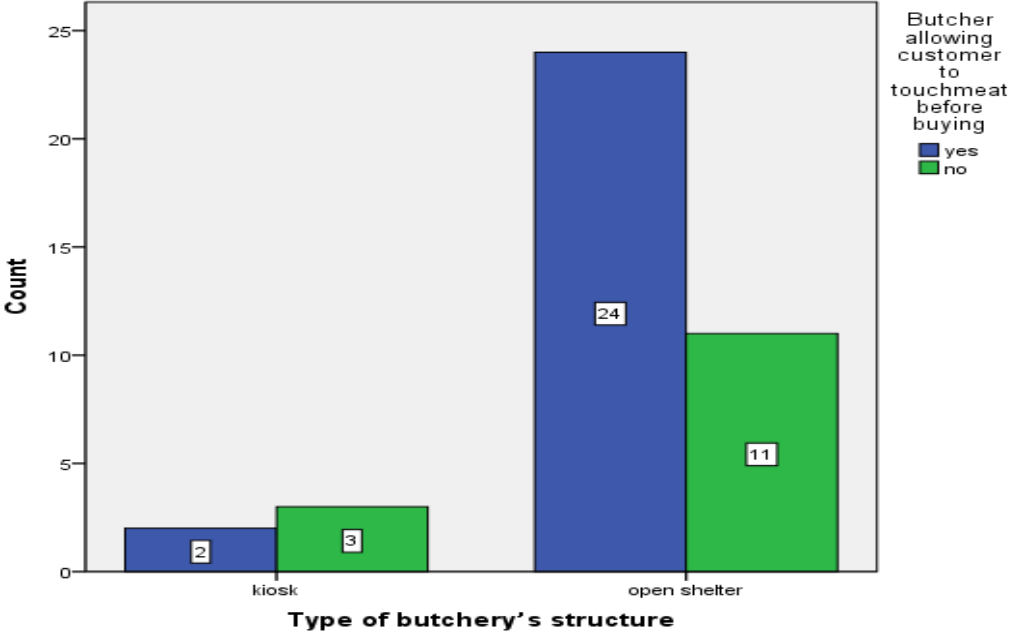


Figure 13: practice of touching meat by customers

The figure 13 expose the result of unhygienic practice used by customers as 65% from respondents were allowing customers to touch meat during selling, respondent from open shelter represent 60% of the total, while respondents from kiosk represent 5%. And this was used as means of attracting customers. 35% of all respondents are preserving not to allow customers to touch meat.

4.1.3 Number of butchers attended training on good hygiene practices for meat handling

This section shows how readiness of respondents to attend any training on good hygiene practice for meat handling, and it has a significant impact on development of any intervention for improving and maintaining hygiene condition of butcheries.

(a) Willingness to attend training on meat hygiene

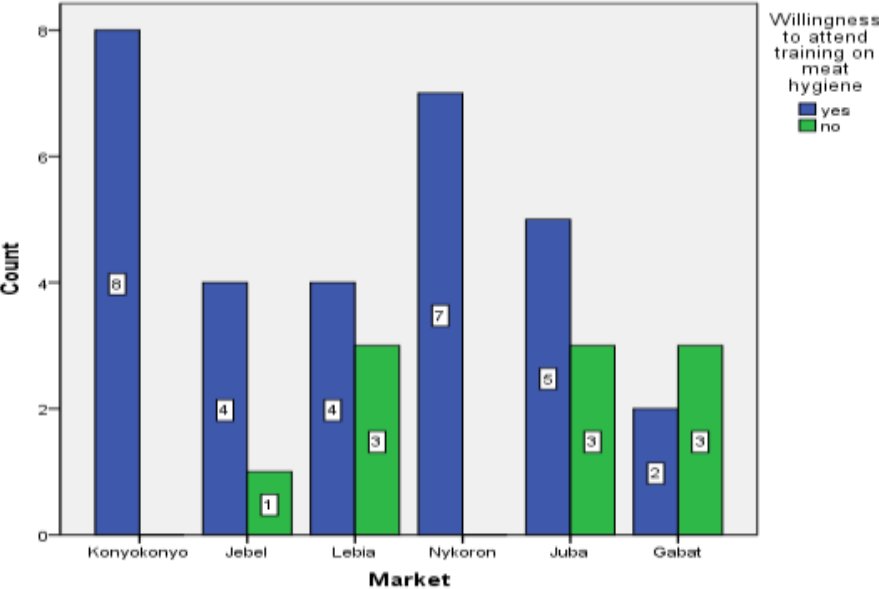


Figure 14: Market and number of respondent willing to attend training on meat hygiene.

Generally majority of respondents are willing to attend training as all respondents from Konyokony and Nykoron markets are willing to attend training on meat hygiene, they represented by 80% and 62.5% of respondents from Jebel and Juba markets, while majority (60%) of respondents from Gabat are not willing to attend a training as appeared in figure (14).

4.2 Observational assessment of slaughter slabs

The result of the observational assessment of slaughter slabs (Juba, Munuki, Jebel and Army/ suiksita slab), shows that all slabs have concrete floor except Munuki slab which does not have any structure as indicated in picture 2 below. All slabs are lacking the ante-mortem inspection, no water system for washing meat, light during slaughtering process, and no carcass carriers, very poor drainage system, very poor hygiene condition, no appropriate structured rooms for division of different slaughtering process as can be seen in picture 5 below.

All slabs are not having fence except Juba slab which have concrete fence but there is no control system for entrance, it also has roof as an open shelter.

In Munuki, Juba, Jebel and army slabs meat inspection is done by veterinary Technician and veterinary assistant respectively and there is no public health personnel for monitoring the hygienic condition of slabs. Butchers are obliging themselves to do roughly cleaning of slabs to make their business go smoothly as reveal in picture (13) in annex. All the surrounding of slabs

is full of hips of animal byproducts. Generally the slabs are very poor in terms of structure and hygiene situation as stipulated in the assessment table 5 below.



Picture 2: butchers are working on skinning of cattle (Munuki Slab)

Table 5: Observational Assessment of slaughter sites

Assessment criteria	Requirements	Condition of Slaughter Slabs			
		Juba	Munuki	Jebel	Army/Suik sita
1. Building	Location: far from residential area	Very poor	poor	moderate	Poor
	Water Supply: there is water for washing meat and cleaning of the slab.	moderate	Very poor	Very poor	Very poor
	Concrete slab (floor): it has well-constructed floor which is cleanable.	Moderate	Very poor	Very poor	Very poor
	Wall and Roofing: it has well-constructed wall and roofing which prevent cross-contamination	Moderate	Very poor	Very poor	Very poor
	Light: does it has good lighting during slaughtering and inspection	Very poor	Very poor	Very poor	Very poor
	Carcass carriers: does it has good carcass carriers which can avoid carcass contact with floor	moderate	Very poor	Very poor	Very poor
	Facilities for cleaning: is there good facilities for thorough cleaning of the slab	Moderate	Very poor	Very poor	Very poor
	Meat Cooling facilities: is there cooling facilities which can reduce meat temperature before it transport to the market	Very poor	Very poor	Very poor	Very poor
	Fence: is there good fence which can restrict the entrance to the slab	Good	Poor	Very poor	Very poor
2. Inspection	Ante-mortem: does it done by a competent personnel	Very poor	Very poor	Very poor	Very poor
	Postmortem: does is done by a competent personnel	Good	Good	Moderate	Poor
3. hygiene	Slab hygiene: does it has good sanitary condition	moderate	Very poor	Very poor	Very poor
	Personal hygiene: are butchers wearing uniform to minimize cross-contamination of meat.	Poor	Very poor	Very poor	Very poor
	Public health personal: is there effective activities of public health personal	Very poor	Very poor	Very poor	Very poor

Very poor: it has nothing.

Poor: it has very few facilities, services or incompetent personal

Moderate: it has inadequate facilities, services or personal with some competency

Good: it has adequate facilities, services or competent personal

4.3 hygiene practices used in beef chain

4.3.1 Input suppliers:

Juba Veterinary Pharmacy and Tuli Veterinary Pharmacies:

These are pharmacies which retail veterinary drugs in Juba town, they used to import veterinary drugs ((oxytetracycline-Alamycin), anthelmintics (Albendazole for deworming) from Uganda and sell them to farmers, especially in rain seasons where the demand is high.

4.3.2 Beef's cattle Production:

Cattle production system in Southern Sudan is mainly depend on tradition extensive system (transhumance system) where cattle are fully dependent on rangeland grazing as 100% of their dry matter intake have to be taken from natural pastures as cattle graze from 11:00-6:00PM; and during dry seasons cattle move for long distance searching for green pastures and water especially in swampy areas and they will spend 3-5 months depending on the start of rain seasons, and in wet seasons they return to high lands where their homestead are located, cattle gain weight during the wet season but often suffer considerable weight loss during the dry seasons, depending on the harshness and duration of the season. In Southern Sudan, zebu breed is the main cattle breed kept in most of states, it characterized by low productivity of milk and meat. The two common zebu breeds are the long-horned and white colour cattle kept by the Dinka, and Mundari communities; and the short-horned zebu cattle (black, white and grey colour) mainly kept by the Nuer, Murle and Toposa ethnic groups. The long-horned zebu cattle are generally big-sized with live weights of 160 – 200 kg, while the short-horned zebu cattle are generally of small stature with live weights of around 150 kg on average, livestock owners are normally categorize into two main groups: pastoralists and agro-pastoralists, but they are more less the same as all livestock producers practice crop farming; they do not use crop residues or other mechanisms of supplementary feeding for their cattle.

The farmers struggle to build up herds through different means such as buying cows for restocking or breeding purpose, receiving number of cattle as dowry from marriage of his sister or daughter, and also some of the cattle were inherent as the entire family wealth. Mostly livestock owners used to keep cattle at the rate of 70% female and 30% male, and the summarize function of the farmers is focus on acquisition of initial stock and herd build-up; breeding, pasturing/herding, healthcare, and general administration and management.



Picture 3: cattle camp in Terekeka

The hygiene practice used by cattle owners is focusing on drying and burning of cattle faeces to avoid contamination and reduce the accumulation of flies in herds (cattle Camps).

4.3.3 Cattle trading:

according to livestock trader (Mr. Paul Lokeriam) The primary market (Kapoeta livestock Market) is the market where livestock traders negotiate and buy one cow or bull or group of cattle from individual farmers who sell cattle to livestock traders who used to buy a bulk 30 heads of cattle per day with average live weight of 150 Kg (local breed) and 300kg (exotic breed), and this number will fluctuate base on consumer needs and this marketing process should be witness by the community leaders (chiefs or sub-chiefs) to avoid selling of stolen cattle; these cattle will be transported to Juba town. The same process also practiced by



Picture 4: butcher herding the cattle from market (Guma & Rajaf livestock) to lairage.

livestock traders in Terkeka County, livestock traders collect 15-20 heads of cattle per day.

Livestock traders from Masindi and Soroti (northern Uganda) also supply Juba with beef cattle which were transported through Gulu (North Uganda) to Juba town.

In Juba there are three livestock markets (secondary market) as well as Juba-Rajaf, and Salakana Market and Munuki market as the trucked cattle normally arrive in Juba extremely tired, hungry and thirsty after 2 - 4 days travel without feed or water; they allow to rest, graze, and watered, and, traders pay 50 South Sudanese pounds for registration (for customs/taxation purposes) and 50 South Sudanese pounds for keeping cattle in kraals.

In these market the selection and grading of cattle take place based on observational

assessment on age, body condition, weight and healthiness as good body condition, young breeding bull and heavy weight have highest price (3000-6000SSP/head) and old bad body condition or emaciated bull or cow will have less price (1800-2500SSP/head). And after paying traders butchers will trek cattle to lairage place as cited in picture 4 above.

4.3.4 Processing (slaughter house or slab):

According to Direct of Veterinary Service in Juba County, Juba was served by five known slaughter areas (Juba main slaughter slab, Munuki, Jebel, Army and Gumba slab) spread in various parts of the town. Out of the five, only one (Juba) has an old structure and the rest are merely open slabs. All of these slaughter sites were recognized by Juba City Council authorities as formal slaughter sites where meat inspection (only post-mortem) is practice during slaughter process and they were establish by butchers except Juba slab. In these slabs butchers are the one in charge of their cattle, the veterinary staff are inspecting the meat, no public health staff in all slabs. All these slabs have hygiene problems as hips of animal by-products have surrounded slabs. Lack of requirements for good hygiene practices in all slaughter slabs as cited in table (5) above and picture 5 below.



Picture 5: Juba Slaughter house

4.3.5 Meat Transportation:

As mentioned by the Director Public Health in Juba County in above section 4.2, in the past, public health authority has specific truck for transportation of meat, but that truck is no long there as butchers are hiring motorbike and open vehicles (multipurpose one) to transport the meat to respective markets as stipulated in figure 7, without considering the hygienic condition of the transportation means. The following pictures are meat transportation means.



Picture (6): Meat Transportation means in Juba Town.

4.3.6 Beef handling and retailing:

The beef retailing is practice by the butchers (large and small butchers), who differ in the way of handling the meat as the small one transport the carcass by motorbike or open vehicle

and sell it in an open site (open shops and open shelters) with the less price (27SSP/Kg) as indicated in picture 7, and also picture 15 in annex, whereas the large butchers transport the meat by the same means and sell it in kiosk with high price (30SSP/Kg) and keep meat in close small glass containers or fridges. As majority of the large retailers used to refrigerate the surplus meat after sale, while small butchers (small retailers) preserve in the nylon sacs and sell it on the second day or preserve by either salting or sun-drying and store the meat at home for future domestic consumption. In terms of hygiene 87.5% of total respondents are selling meat in an open shelter where meat is exposing to air microbial contamination, no water for washing equipment and lack of structure building as some are selling meat in temporary and hired sites for shops.



Picture 7: small butcher selling meat in open shelter site

4.3.7 Chain supporters:

Farm Africa Organization:

Is the international organization which support livestock farmers of Greater Kapoeta by train and equip a network of Community Animal Health Workers (CAHWs) to provide basic animal healthcare to surrounding villages.

Food and Agriculture Organization:

FAO is a closer organization to livestock farmers in south Sudan; it has various support such training community animal health workers (CAHWs), Supplying drugs, vaccines and cold chain facilities, Emergency response to livestock diseases.

Malakia Veterinary Clinic:

It is a government institution which supports livestock owners by treating the sick animals and selling veterinary medicine in terms of cost recovery program where cattle owners from Jonglei, central and Eastern Equatoria State are buying drugs from this institution.

Italian Cooperation in South Sudan:

Is an international organization that help with the rehabilitation of Juba slaughter slabs and it also constructed butcheries for some butchers.

Ivory Bank:

The saving services rendered by this bank has tremendous value for business of butchers in the study area, as small butchers used to save their money especially during decrease of meat market due to bankruptcy of customers (low income consumers).

Muniki, Salahna and Juba-Rajaf Kraals:

According to livestock traders, these Kraals are areas where offloading of trucked cattle take place, both Muniki and Juba- Rajaf Kraals do the registration (for customs/taxation purposes), and all of them take the responsibility of offload cattle during grazing, watering, herding and secure them from raiding before selling or slaughter (Salahna Kraal), and the cattle owners will pay 5 Sudanese Pounds per cattle/day.

4.3.8 Chain influencers:

Juba City Council:

According to both Director of Public Health and Director of Veterinary Services in Juba County, city council is the right administrative body which is responsible for technical and administrative issues in the three payams (Kator, Juba and Munuki). So the responsibility of slaughter slabs and butcheries is under its authority.

Veterinary Department in the Juba County:

This department is supporting the whole county in terms of vaccination and supplies of veterinary medicine. In the cost recovery program, it is contributing in executing of food safety measures by assigning the staff to conduct meat inspection in all slabs.

Department of Public Health in Juba City council:

Reference to the statement of key informant (Director of Public Health in the Juba County), in the past this department has a very effective and efficient contribution for enforcement of food safety measures in both slaughter slabs and butcheries, but due to creation of nuclear administration within Juba county (Juba City Council), the activities of this department in slaughter slabs and butcheries are dismantled.

Ministry of Animal resources and Fisheries

This ministry at both national and state level are mandated to formulate plans and regulations for livestock development and safety measures for animal products, capacity building of the staff at national, state and county level. As a new country there is no proper system yet for enforcing food safety measures to a required level due to lack of regulations and administrative overlapping.

Value chain map of beef production

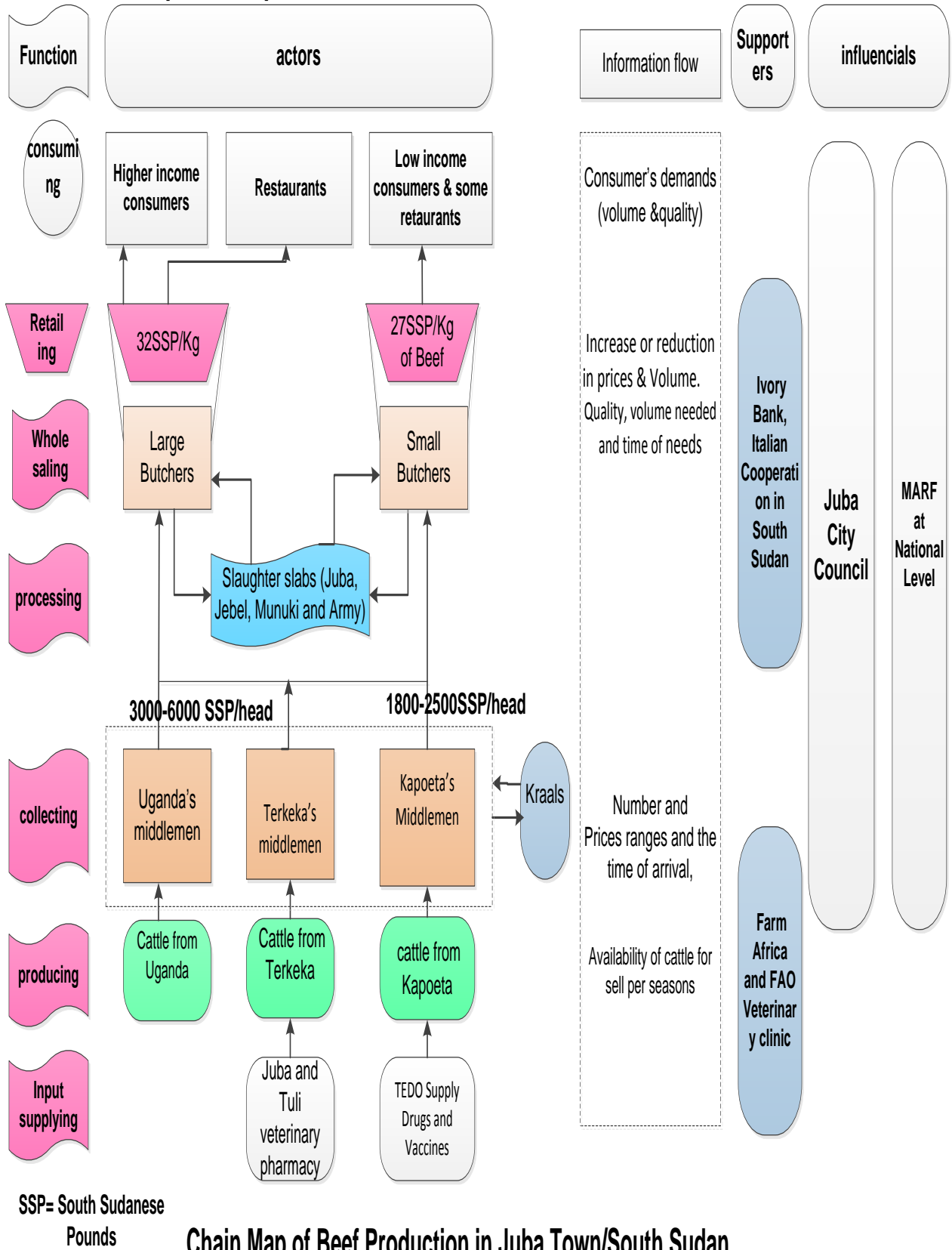


Figure 15: Value chain map of beef production

4.4 Case study: Role of the government in maintaining food safety along the beef chain.

According to Director of Veterinary Services in Juba County (Dr. Kwajok Tongun), food safety measures used in meat chain in Juba Town are normally starts by postmortem inspection where animals were slaughtering at early morning (4:30-6:30 am) and inspected (postmortem inspection) by veterinary technician and veterinary assistant, where the infected part of meat should be condemn or the whole carcass should be condemn especially in case of serious infection. And the common diseases normally reported from slaughter slabs are Tuberculosis, Fasiolosis and tab worms; and due to un-recognition of vital role of animal health certification for cattle movement and no ante-mortem inspection, the detection of these diseases increases during the postmortem inspection. Due to ignorance of butchers about the danger of these diseases, they used to hide carcass of unhealthy animals, and this make difficulties in traceability of meat from sick animals. Cases of random slaughtering of animals have been reduced but still practice by some butchers.

The implementation of food safety measures in Juba slaughter slabs faces a lot of challenges such as lack of clear legal framework which can facilitate the execution of food safety measures along the chain, specify the management responsibility of slaughter slabs, in addition to local government authorities (Juba City Council) ineffectiveness in implementing food safety program in slaughter and retailing sites as all slabs are lacking water system, electricity, no space for conduct ante-mortem inspection, no public health personnel to provide good hygiene condition in slabs and all slab are nearer to residential areas.

According to Director of Public Health in Juba County (Mr. Sebit Amossa), previously the county authority used to deploy Public health officers in slaughter slabs to monitor activities of Public Health such as stamping of meat, provision of hygiene condition to slaughter slabs through cleaning of slabs and burying of all animal byproducts; and transportation of meat with specific truck. In addition to that they inspect butcherries by checking whether the meat is bearing the public health stamp or not and if not this meat should be confiscated, and this is to ensure the safety of meat, and they also give instructions to butchers in order to enlighten them on hygiene practices and those who are no comply with order should be fine; but butchers ignorance about meat hygiene and their work system (changing personnel from time to time) are challenging creation of awareness on good hygiene practices.

But currently Juba city council has the responsibility of taking care of public health activities in three payams (Kator, Munuki and Juba); and cleaning of slaughter slabs and inspection of butcherries fall under it administration, but it does not has senior public health officer who should manage these activities, and this cause ineffectiveness of public health activities in areas such as slaughter slabs and butcherries.

Juba city council do not have clear plans for demarcating markets, as these payams are implementing their plans without coordinating and consulting the technical departments (Roads, water system, public health and electricity) who should give plans for town planning so that specific sites will be given to different business sectors such as butcherries, vegetables shops and shops for other items; therefore, butchers do not have specific shops allocate to them and this make them unable to construct shops base on the specifications. And this makes some difficulties for public health authority to inspect the hygiene and safety of food items in places as well as butcherries.

5. DISCUSSION

5.1 Information about respondents, location of operation and type of butchery structure

The survey result inferred that butchering profession was exercised by youths who are early school leavers as 77.5% of respondents are young men with age range from less than 25-35 years old, and majority of them are primary 47.5% and secondary 30% leavers who leave schools due to poverty. And this support the study of Linda (Linda et al, 2011), which proved that “young men were less likely to be engaged in school than young women and were more likely want to join work/earn money as a reason for dropping from primary and secondary school”. It also reflects that meat retailing job is a hard work which cannot be tolerated by old men. With regards to education level per market, Nykoron market have high rate of uneducated respondents compare with other markets and this is due to its peri-urban position and been as a temporary market.

The butchery's structure result, all butcheries in Lebia and Jebel market are open shelter, and this is because they are in new markets which were demarcated without allocation of specific shops for butcheries or ineffective law enforcement for butchers, which should force butcher to sell meat in places with specific design for provision of good hygienic condition. In Nykoron and Juba markets butcheries have temporary places which force them to sell meat in open shelters, Konyokonyo and Gabat markets are oldest markets without specific design for building of butcheries, and this make butcher to sell meat in inexpensive place such as open shelter butcheries. This supported by study of Muli (Muli et al, 2010), which demonstrate that “where trade occurs in the open air or in makeshift structures, the butcheries do not pay for the workspace other than taxes/charges paid to the local authorities”.

There is a significant relationship between butchery's structures and town planning's plans and policy for demarcation of markets.

The descriptive result of meat supplied by slaughter slabs to six markets is an evident that each market was supplied by the nearest slab and this is due to distance and transportation cost.

The daily customers of kiosk and open shelter butcheries are depending on hygiene condition of the butchery, knowledge and socio-economic status of consumers as open shelter butcheries are relying on individual customers who are not aware about the safety of meat and they are price wise, while Kiosk butcheries are supplying the individuals and restaurants that have reservations on hygienic situation of the butcheries. And this supports the study of Mbogoh which indicates that “the location of butcheries and their cleanliness will certainly influence the type of customers who buy from the particular butcheries” (Food and Agriculture Organization, 2001). Also Mohammad and Samuel (Mohammad and Samuel, 2010), pointed out that “low income consumers are sensitive to meat freshness but not caring about the sourcing of meat and hygiene of butcheries, while the high income consumers are concern about hygiene of butcheries and personal and in addition to sources of meat”.

The survey results also indicated that open shelter butcheries have high number of respondents that did not attend training on meat hygiene and this is because the markets they operated in are new or temporary markets and also they are new in joining butchering profession.

The result represented for butchers' opinions on hygienic place for selling meat show high number of respondents from open shelter butcheries are supporting selling meat in an open air this is as a result of ignorance about meat hygiene practice.

5.2 Meat hygiene practices used by the butchers

The hygienic practices of meat, sellers at six markets of Juba did not meet the hygiene levels for the handling of meat products as recommended by World Health Organization and the Food and Agriculture Organization joint committee.

Indeed, the sellers never transported meat by good means, nor stored meat at an appropriate low temperature or protected it against flies, they never washed their hands, majority are not wearing protective clothes, or used piece of cloth and inadequate amounts of water to clean cutting tools, selling meat in an open air for long time (5-10 hours). It is evidence that these conditions can lead to contamination of meat and to various cross-contamination situations. This is according to the study of Koutsoumanis (Koutsoumanis, 2005), that “temperature seems to be the most important factor that influences the spoilage as well as the safety of meat”.

These practices show lack of awareness on good hygiene practice, lack of legal framework to standardize hygienic means of transporting meat, hygiene situation of butcheries and personnel and ineffective enforcement and monitoring of rules by public health authorities in Juba city council. This agree with study of Lupien (Lupien, 2007), which reveal that “assuring the quality and safety of foods requires adequate legislation and properly funded and staffed government offices and laboratories equip and meet food risk challenges of today”. In Addition to butchers insufficient knowledge about good hygiene practice, poor infrastructure of butcheries, lack of electric power and fridges and no permanents places for building butcheries are also the main challenges for application of good hygiene practices in selling meat, as support by Lupien (Lupien, 2007), assuring food quality and safety today requires adequate knowledge and ability by all in the food business to meet or exceed the basic food legislation requirements.

The survey result show that more than half of the butchers (21) do not have health card for operating their butcheries and this prove that there is a possibility of selling meat by sick butchers which can be a threat to food safety. As recommended by FAO/WHO, “Persons who come into direct or indirect contact with edible parts of animals or meat in the course of their work should maintain appropriate personal cleanliness and behaviour, and should not be clinically affected by communicable agents likely to be transmitted by meat” (Codex Alimentarius Committee(FAO & WHO), 2005)

5.3 Willingness to attend on meat hygiene practices

During survey almost 75% of butchers have shown their readiness to attend any training on meat hygiene, and this percentage is quite high it might be because of giving social answers or fearing from public health officer who accompanied the research during survey, but it also shows their willingness to develop their business or operating their own butcheries in future with the aim to attract more clients such as high income consumers and institutional consumers as well as restaurants and hotels. It coincides with study of Lupien (Lupien, 2007), “Preparing, testing, adjusting and implementing adequate control systems requires a good level of knowledge of factors that are important in producing good quality and safe foods”. Also FAO/WHO (Codex Alimentarius Committee(FAO & WHO), 2005), support this by recommending training as “Persons engaged in meat hygiene activities should be trained, and/or instructed to a required level of training, knowledge, skills, and ability”.

5.4 Observational assessment of slaughter slabs

Being a key element in the production and distribution chain for meat it is essential that slaughter house or slab should be hygienic as possible in order to prevent the spread of both human and animal diseases as well as to reduce economic losses due to premature spoilage of meat caused by cross-contamination.

Based on the study conducted, all slabs are lacking ante-mortem inspection, water system for washing meat, light during slaughtering process, carcass carriers and very poor drainage system, hygiene condition, no appropriate structured rooms for division of different slaughtering process, no fence except for Juba slab, use of unsterilized and improperly cleaned knives and equipment, cattle are slaughtered on filthy slaughter floor. Also inadequate of veterinary doctors has a significant challenge on postmortem inspection as veterinary assistants are mostly the ones inspecting the meat in all slabs except Munuki slab which have a veterinary technician. This coincides with the study of Erick (Erick et al, 2012) that comes with evidence that “many abattoirs and slaughter slabs in developing countries are poorly constructed, have poor slaughter and meat inspection facilities and qualified meat inspectors are always inadequate”.

These slabs are operating without any hygiene measures which make them to contain high level of cross contamination with high risky food pathogens such as salmonella and E. Coli O157:H7 as meat from all slabs are not washed. This is supported by the study of Abdalla (Abdalla et al, 2009), who found that “microbiological contamination of carcasses occurs mainly during processing and manipulation, such as skinning, evisceration, storage and distribution at slaughterhouses and retail establishments”. Also Asse (Asse et al, 2011), pointed that “slaughtered animals may harbour relatively few bacteria, but the meat surface is exposed to contamination during slaughter, evisceration, and other operations after slaughter, transportation conditions and exposure during vending operations can lead to contamination”.

Both lack of awareness, resources of the butchers and improper control by government are driving factors which led butchers to slaughter animals in bare ground or open slabs which are selected by them for continuing of their business.

The absence of public health personnel from all the slabs led to undesirable hygiene of slabs as revealed by occurrence of heaps of fecal and animal byproducts surrounding the slabs which is very poor hygiene especially during rain seasons.

5.5 hygiene practices in beef value chain

Cattle keepers in South Sudan are mainly still practice a traditional way of keeping livestock such as extensive system of livestock rearing, as the introduction of good agricultural practices are not yet exercised by livestock owners, although they are using extensive or transhumance system, but some have a traditional way of keeping a hygienic condition of the herd as they dry all cattle feces of the herd and burn it so that it can minimize the number of ticks and flies in the herd, and this makes cattle clean at production stage. This practice is used by Nilotic pastoralists (Terkeka is part of it). This supports the research of Veen (Veen, 1997) who found that “Nuer cattle herders in South Sudan keep their animals’ smoke-filled byres by burning animals’ feces during the dry and wet seasons to alleviate the otherwise severe fly attacks”. While pastoralists of Eastern Equatoria state (Kapoeta) are not doing the same, and this makes cattle from their site have some dirtiness on their skin. And cattle from Northern Uganda are also clean.

After a deal between farmers (cattle keepers) and livestock traders, traders used to transport cattle on trucks, using bed from grass and saw mill, and this minimizes the contamination with feces. Cattle from secondary market are clean with minimum dirtiness, but lariat condition is very unhygienic as cattle lying in dirty space full of feces especially during wet seasons cattle are more carriers of cross contamination in pre-slaughter stage. As supported by Reid (Reid et al, 2002), research that “the degree of visible contamination on the hide has been shown to affect the degree of subsequent contamination of carcass”.

All slaughter slabs in Juba town are more dangerous sources of cross contamination due to its shocking or severe unhygienic condition as cattle are being slaughtered in unclean slabs or on

contaminated bare ground and they are operating without washing carcasses and this increase direct contamination of meat. And this was proved by Nørrung and Buncic (Nørrung and Buncic, 2008). as “once the slaughter line environment becomes contaminated, “secondary” sources of carcass contamination include aerosols, the contaminated surfaces and equipment/tools on the slaughter line, in the chiller and in the boning area, in addition, to meat handlers including meat inspectors may serve as the contamination source”.

Meat transportation means is another challenge confronting meat hygiene as transportation is done by motor bike and open vehicles which have multipurpose use such as carrying cement, timbers and any item to be carry from markets and this become sources of physical contamination. And meat handling and hygiene practices at retailing or butcheries were discussed more in section 5.2 above.

5.6 Role of the government in maintaining food safety along the beef chain

From the interviews made with key informants (Director of Veterinary Services and Director of Public health in Juba County), it is clear that before and after the independence of The Republic of South Sudan, Government of South Sudan have no clear legal framework for maintaining food safety along the beef chain in the country, and this cause the administrative overlap for management responsibilities between state, county and city council (Juba City Council) and especially in terms of food quality and hygiene practices along agri-food chain. Also it gives butchers room to maneuver especially in slaughtering, transportation and selling of meat in inexpensive means and places such as open slabs and open shelter butcheries.

The current political system in Juba town is moving toward decentralization of authorities to the people at grass root level, but due to its unclear policy and rules, it has negative impact on enforcement of good hygiene practice and food safety measure along the beef chain as butchers are practicing their business without proper control system for ensuring food safety.

As political and administrative will of Juba City Council a current administrative body of Juba town appears to be principally directed at maintaining and control of markets and slaughter house and forget to carry out any maintenance, cleaning and provision of facilities for slaughter slabs. Even identification of appropriate location for establishment of slaughter slabs. In addition to that there is lack of coordination between departments in Juba City Council which reveal in the development of plans for demarcation of markets without involvement of technical departments such as public health, urban water and electricity, therefore there is no standard specification identified for construction of butcheries shops.

Ministry of Animal Resources and Fisheries at both national state levels are presently aware of the undesirable situation of unhygienic practices along beef chain in entire country, and they are pushing for change, however progress is extremely very slow. A major impediment to progress is differences in implementation of comparative plans, scarce resources of these ministries and political will of decision makers in these ministries.

In order to have proper control of food risks, close cooperation and coordination is needed between government, food producers and marketers, academia, and with policy makers and consumers. Each group has a role to carry out, and if any fail, the entire food system can be at risk. In addition to this, there is a need for conducting a further research on prevalence of microbiological contaminants in slaughter sites and butcheries of the study area.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This study concludes that, young men are main actors of beef retailing in Juba town, and two third of them are school leavers of primary and secondary levels and hired to do the job. As a result of improper system, most of these butchers are operating in six markets (Konyokonyo, Jebel, Ibia, Nykoron, Juba and Gabat) by selling meat in open shelter butcheries as markets was demarcated without putting consideration to proper location for butchery's shops and no specific design was identified for operationalization of butcheries. Majority of butchers especially the one operating in open shelter didn't attend any training on good hygiene practices for meat handling as a result of been new in butchering profession. The six markets were supplied by the nearest slabs (Juba, Jebel, Munuki and Army slab) due to distance and transportation cost.

The hygiene practices usually used by butchers in all markets are still too far from what is recommended by FAO/WHO, they are mainly focusing on transportation of meat by open vehicles as a dominant means used and motor bike, majority of butchers were hanging meat in open air for whole day while few are keeping it inside fridges, cutting and weighing tools are clean by smearing with piece of cloth as a common practice used by majority, and use of water and soaps are usually exercise by few butchers, and meat is expose to open air for five to seven and seven to ten hours, all butchers were not washing their hand during selling time, majority were not wearing especial cloth and also allowing customers to touch the meat; and despite all this majority of respondents from open shelter butcheries were supporting selling meat in an open air as a good way of selling meat, also more than half of butchers did not have health cards for operating butcheries. This is as a result of insufficient knowledge about importance of good hygiene practice; and lack of legal framework to standardize hygienic means of transporting meat, hygiene situation of butcheries and personnel and ineffective enforcement and monitoring of rules by public health authorities. As a result of this, both open shelter and kiosk butcheries have different customers base on knowledge on hygiene and socioeconomic status of the customers.

The study concludes that, currently there is no effective policy and legal framework for maintaining food safety along the beef chain in entire country, and therefore, management responsibility of slaughter sites are not well defined as Juba City Council was founded as a new administrative body of the town, but it seems not responsible for slaughter slabs as reveal in it ineffectiveness in enforcing previous regulations used before formation of government of Southern Sudan, this make butchers do their business without proper control system for maintaining food safety along the beef chain.

The study concludes that, beef production in the study area is confronted with problems of inappropriate pre-slaughter handling of animals especially in lairage condition, slaughtering process and unhygienic meat handling. Such practices include the use of unsterilized and improperly cleaned knives and equipment, cattle are slaughter on filthy slaughter floor, which led to contamination of meat before getting into the retailing stage of food chain as a consequence of poor infrastructure for livestock development such slaughter houses; lack of legal framework to control food safety along the beef chain and ineffective monitoring and control in enforcement of previous regulations used before the independence of the country.

Ministry of Animal Resources and Fisheries at both national state levels are knowledgeable about the situation of unhygienic practices along beef chain in entire country and they are very slow to address this situation due to limitations of resources and political will of decision makers.

The improvement of food safety in beef chain is a core responsibility of all levels of government, with support of chain actors and chain supporters.

6.2 Recommendations

In order to minimize food risks in beef chain to acceptable level, proper policy and legal framework has to be put in place and awareness of chain actors should be created, effective monitoring and control of law enforcement has to be done in adequate manner, cooperation and coordination is needed between government, food producers and marketers, academia, and with policy makers and consumers. And to achieve all this following recommendations have to be considered:

1. The Ministry of Animal Resources and Fisheries at national level should speed up with the formulation of legal framework for ensuring food safety along the beef chain and identified clear strategies for enforcement.
2. The government through university of Juba or other universities should conduct a research on prevalence of microbiological contaminants in slaughter sites and meat retailing shops to ensure the consumers about safety of meat produce from Juba slaughter sites.
3. The government through Juba City Council should close all current slaughter slabs and identified appropriate location outside the town to establish standard abattoir with hygiene design facilities, large slaughter capacity, proper meat inspectorate services and effective implementation of food safety measures through application of hazard analysis and critical control point (HACCP) and, and employ well train butchers so that cross contamination at abattoir level should be reduced.
4. Juba City Council authority should spear head the organization of butchers into butchers' union so that it facilitates coordination between authority and butchers, and easier the access of butchers for credit and technical supports.
5. The BRAC Southern Sudan and South Sudan Microfinance Development Facility Ltd institutions Should give loans to small butchers with reasonable interest rate so that they can able to construct shops with good hygienic condition which can help them to attract high income consumers and institutional consumers (restaurants) which sustainably can pay good price.
6. Juba City Council with the help of university of Juba should organize annual training (7 days) for butchers on good hygiene practice, and restrict the provision of license for operating butcheries, and attending training will be a pre-condition for getting license, and make simple bylaws and monitoring strategy for maintaining food safety so as butchers can understand and apply it.

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ANNEX 1



Picture 10: Lairage condition



Picture 11: Surrounding of Juba slab



Picture 11: Floor of Juba slab



Picture 12: Munuki slab



Picture 13: Jebel slab



Picture 14: transportation means



Picture 14: transportation means



Picture 15: storage and selling of meat



Picture 16: storage system in Kiosk butcheries



Picture 17: selling meat in Kiosk butcheries

ANNEX 2

Structured and observational questionnaire for conducting survey among the small butchers
In Juba Town – South Sudan

Market name..... payam.....

Q. NO.	The statement									
1	From which slaughter site are you bringing the meat from?									
	a	Slaughter house	b	Gudele slab	c	Munuki slab	d	Suiksita	e	others
2	How many kilograms are you buying from the slaughter sites?									
	a) 10-40kg <input type="checkbox"/> b) 40-70kg <input type="checkbox"/> c) 70-100kg <input type="checkbox"/> d) 100-130kg <input type="checkbox"/> e) 130-160kg <input type="checkbox"/>									
3	What are the means of transportation of meat from slaughter site to the butchery?									
	A	Open vehicle	b	Close vehicle	c	Motor bike	d	Bicycle		
4	Where do you keep the meat after reaching the butcher and before selling?									
	a	Inside the fridge	b	Keep openly on the table.	c	Hang in the open air				
5	What is your opinion about keeping meat in an open air? is									
	a) very good handling <input type="checkbox"/> b) good handling <input type="checkbox"/> c) bad handling <input type="checkbox"/> d) very bad handling <input type="checkbox"/>									
6	Which of the following practices you use for cleaning of equipment (selling table, weighing, and knives) during meat's selling?									
	a	Washing the equipment with water and soap.	d) other <input type="checkbox"/>							
	b	Washing with water only.								
	c	Smearing the equipment with piece of cloth.								
7	Did you ever attend any extension training about meat handling and hygiene? Yes <input type="checkbox"/> Or No <input type="checkbox"/>									
8	Do you have licence for opening the butcher? Yes <input type="checkbox"/> or No <input type="checkbox"/>									
9	Who are your daily customers (consumers) you are mainly depend on?									
	a) Individuals <input type="checkbox"/> b) Restaurants <input type="checkbox"/> c) Individuals & restaura <input type="checkbox"/>									
10	How many kilograms do you normally used to sell per day? (average sell quantity)									
	A) Less than 30kg <input type="checkbox"/> B) 30-60k <input type="checkbox"/> C) 60-90kg <input type="checkbox"/> D) 90-120kg <input type="checkbox"/> E) 120-150kg <input type="checkbox"/>									
11	How many customers can you expect per hour?									
	a) 4-8 person/hour <input type="checkbox"/> b) 9-13 person/hour <input type="checkbox"/> c) 14-18 person/ hour <input type="checkbox"/> d) 19-23 person/hour <input type="checkbox"/>									

12	How many hours do you normally spent in selling the volume of meat you have? A) 2-4 hours. <input type="checkbox"/> B) 5-7 hours <input type="checkbox"/> C) 8-10 hours <input type="checkbox"/>				
14	How do you know that the bull you buy is free from diseases? Through:				
	a	Observation of body condition	b	Health certificate from the sources	
				c	Advice from the trader
15	How do you assure the customers that the meat is coming from official slaughter site? through				
	a	stamped of slaughter site	b	History of bringing meat from slaughter site	
				c	Verbal explanation.
16	Do you think keeping meat in a condition better than this is very important? Yes <input type="checkbox"/> Or No <input type="checkbox"/>				
17	Do you have willingness to attend training on meat hygiene? Yes <input type="checkbox"/> Or No. <input type="checkbox"/>				
18	How older are you?				
	a	Less than old 25 years	b	25-35 years	
				c	36-45 years old
				d	46-55 years old
19	Have you been in the school before? Yes <input type="checkbox"/> Or No <input type="checkbox"/> if yes in what educational level you leave the study?				
	a	Basic or primary level	b	Intermediate level	
				c	Secondary level

List for Observational check

Q. NO.	The Statement				
1	What is the type of butchery's structure?				
	a	Kiosk	b	Open shelter	
				c	Under the tree
2	Does the butcher wear the specific cloth for selling meat? Yes <input type="checkbox"/> Or No <input type="checkbox"/>				
3.	Is there a water source for washing hands and equipment? Yes <input type="checkbox"/> Or No. <input type="checkbox"/>				
4	Does the butcher wash his hands during meat's selling? Yes <input type="checkbox"/> Or No. <input type="checkbox"/>				
5	Does the butcher allow the customer to touch the meat before buying? Yes. <input type="checkbox"/> Or No. <input type="checkbox"/>				

Check List for interviewing the Public Health Authority:

1. What is the quality management system recognised by the public health authority in maintain food safety in beef chain?
2. What are the regulations the public health authorities used to enforce to the small butchers to adopt this system in their business?
3. What are the respond of small butchers to these regulations?
4. What can the public health authorities do with small butchers who are not compiling with regulations?
5. What are the responses of the public health authorities to consumers complain about unhygienic condition of slaughter slabs?

6. How do the public health authorities manage the solid waste of the slaughter site?
7. What are the challenges facing your department in executing its function for achieving food safety in beef chain?

Check list for interviewing the veterinary authorities:

1. What are the common diseases reported from the slaughter sites?
2. What are the steps taken by veterinary authorities in order to stop random slaughtering of animals outside the slaughter site?
3. What are respond of the veterinary authorities to consumers complain about unhygienic condition of slaughter slabs?
4. What is qualification of veterinary staff who inspecting meat at the slaughter slabs?
5. What are challenges affecting veterinary services in executing anti-mortem and post-mortem activities in slaughter sites.

Check list for observation of slaughter sites:

- I. Location.
- II. Building and facilities.
- III. Inspection (ante-mortem and post-mortem).
- IV. Hygiene of slaughter site and personnel.