Sudan University of Science and Technology

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Assessment of Red Meat Markets Based on the Food Safety Management System and HACCP Approach Principles Nyala-South Darfur State - Sudan

تقييم أسواق اللحوم الحمراء بناء" على نظام إدارة سلامة الأغذية و مبادئي نهج الهسب ـ نيالا ـ ولاية جنوب دارفور ـ السودان

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Dedication

This study dedicated to the soul of my mother and father.

And lastly, I dedicated this thesis to my lovely kids Muhammed, Messdar, and Mayassin. My best wishes are to be healthy, happy, and secure.

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Abstract

Assessment of meat market hygiene conditions is a subject of wide scope. It focuses on multi-dimensions relevant to hygienic conditions of meat market that, could contribute to the quality of meat. The objective of this study is to assess red meat market hygiene conditions, meat handlers' hygiene practices, and identify gaps related to food safety knowledge, skills, and attitudes of meat handlers as well as to determine potential barriers that may inhibit the roles of food safety authorized bodies in the study area. Secondary quantitative data about all individuals related to the subject of the study was obtained through interviews (desk study) with managers of veterinary services, public health services administrations and, five chairmens of the butchers' committees, one for each market. A total of 195 respondents selected by using stratified random sampling method and interviewed using structured five rating Likert's scale questionnaire. Also, observational assessment data for 25 butcheries obtained by using checklist sheet. Questionnaire data from survey was process by SPSS version 24. Where, frequency distributions, percentages and Chi-square test at significance level (5%) were used to analyze the data. Study results revealed that, unsatisfactory level of meat handlers' formal education level, 39.6% of respondents felt under category of basic level and 48.1% respondents at secondary level. Moreover, they were totally not trained before on Good Hygiene Practices (GHPs). 56% of butcheries observed that built near to public toilets and 79.2% found close to fruits and vegetable displaying areas. Nearly, all butcheries lack of hygiene facilities such as potable water, drainage system and hygiene equipment. Almost, all butcheries not issued with valid licenses. Lack of commitment to wear personal protective gear, washing hands and negative habits such as smocking inside the butchery were observed. Approximately, 88% of meat handlers were observed that working without having valid personal health

cards. Pets such as flies were observed on the surfaces of meats and on the meat contact surfaces too. The study concluded that, lack of training programs to personnel, poor cleaning status of butcheries, malpractice of meat handlers' hygiene practices, and considerable barriers related to the efficiency and effectiveness of governmental authorized bodies' roles were the contributing factors of poor hygiene conditions of meat markets.

المستخلص

تقييم صحة أسواق اللحوم الحمراء هو موضوع واسع النطاق. يركز على أبعاد متعددة ذات صلة بصحة أسواق اللحوم ، والتي يمكن أن تسهم في جودة اللحوم. هدفت الدراسة الى تقييم صحة أسواق اللحوم الحمراء، وممارسات النظافة الصحية، ومستوى المعارف، والمهارات، وسلوكيات الجزارين، بالإضافة إلى تحديد التحديات المحتملة التي تعيق أدوار الجهات الحكومية ذات الصلة بصحة اللحوم في منطقة الدراسة. تم الحصول على بيانات ثانوية عن جميع الأفراد ذات صلة بموضوع الدراسة من خلال المقابلات مع مدراء إدارات الخدمات البيطرية، و الصحة العامة، و خمسة رؤساء للجان الجزاريين بواقع رئيس لكل سوق. 195 مستجيبا" تم إختيارهم بطريقة أخذ العينة العشوائية الطبقية و تم الحصول على البيانات الأولية بإستخدام الإستبيان. كذلك لإجراء هذه الدراسة استخدم أداة التقييم بالمشاهدة عن عدد 25 جزارة بواقع خمسة لكل سوق عشوائيا" كبيانات مساعدة لبيانات أداة الرئيسة لجمع البيانات (الإستبيان). و قد تمت معالجة بيانات الاستبيان بإستخدام SPSS 24 وتحليلها بالتوزيع التكراري ، و النسب المئوية ، و قيم إختبار كاي بمستوى معنوية (5%).

بينت الدراسة مستوى غير مرضي من التعليم الرسمي لمتداولي اللحوم، **39.6**٪ من المستجيبين كانت مستوى تعليمهم الرسمي اساسي و **48.1%** مستوى ثانوي و لم يتدربوا من قبل على الممارسات الصحية الجيدة. و قد تم ملاحظة أن **56%** من الجزارات تم تشيدها بالقرب من دورات المياه العامة في الأسواق، و **79.2%** من الجزارات وجدت بالقرب من أماكن عرض الفاكهة و الخضروات. و تقريبا" جميع الجزارات تفتقر الى مرافق النظافة مثل مياه نظيفة، الصرف الصحي، و معدات النظافة. و كذلك معظم الجزارات تفتقر الى تراخيص عمل سارية المفعول مع عدم إلتزام الجزارين بإشتراطات الصحية مثل إرتداء ملابس الحماية الشخصية وغسل اليدين. و قد لوحظ أيضا" بعض العادات الضارة مثل التدخين في داخل الجزارات. و كذلك حوالي **88%** من متداولي اللحوم لحظوا يعملون بدون بطاقات صحية شخصية سارية المفعول. ولوحظ الذباب على أسطح اللحوم وعلى أسطح الملامسة للحوم أيضًا. وخلصت الدراسة إلى أن ضعف المعارف والمهارات لدى الجزارين، و ممارسات الجزاريين غير الصحية ، مع العوائق الهيكلية، و المالية، و الفنية المتعلقة بكفاءة وفعالية أدوار الهيئات الحكومية ذات الصلة تعتبر من العوامل التي ساهمت في تدني صحة أسواق اللحوم الحمراء.

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Abbreviations

HACCP	Hazards Analysis and Critical Control Point.
WHO	World Health Organization.
BSE	Bovine Spongiform Encephalopathy
GHPs	Good Hygiene Practices.
FSMS	Food Safety Management System
GCPs	Good Communication Practices
QMS	Quality Management System
PDCA	Plan-Do-Check-Act
FAO	Food and Agriculture Organization
FSC	Food Safety Culture
CCPs	Critical Control Points
CRM	Customer Relationship Management
PRPs	Pre Requisite Programs
SOPs	Standard Operating Procedures
GMPs	Good Manufacturing Practices
GMgmtPs	Good Management Practices
GAPs	Good Agriculture Practices
GVPs	Good Veterinary Practices
FDA	Food and Drug Administration
CLs	Critical Limits
OPRPs	Operational Pre Requisite Programs
AC	Action Criterion
USDA	United States Department of Agriculture

NCAC	National Codex Alimentarius Committee
SSMO	Sudanese Standards and Metrology Organization
SSOPs	sanitation standard operating procedures

Chapter One

Introduction

Introduction

Assessment of meat market hygiene conditions is a subject of wide scope. It focuses on multi-dimensions relevant to hygienic conditions of meat that, contribute to the quality of meat. These dimensions are: butcheries or meat shops and equipment's hygiene and sanitation conditions; operators or handlers' competencies, practices and attitudes; relevant authorities and their roles and responsibilities in introducing and deployment of food safety regulations, laws and hygiene procedures among meat handlers; and challenges that can hinder relevant authorized bodies to play their vital roles in introducing and enforcement of food safety management system requirements and HACCP principles at meat market or butchery point. "food safety is a shared responsibility" Daniel (2018). All these dimensions considered to be one pack which indivisible, non-assignable and any form for compromising can be considered that is an explicit violation of Food Safety Management System's standards and its requirements and thus, consumers' health will be at stake.

Health problems caused by contaminated food with dangerous micro-organisms and /or toxic chemical and even physicals is an ongoing event in every country which termed Food-borne illness or Food-borne diseases. Food-borne illness is a problem in developing and developed countries alike WHO (2007) as cited by Burno (2011).

South Darfur State is located in the western part of the Sudan between Latitudes (30.9^{o} - 13^{o} North) and Longitudes (23.15^{o} -5.27° East), with an area of about 137800 Square Kilometers, it is one of the Largest State in the Sudan. The main activities of the population in the State are agriculture and animal rearing. Accordingly to the annual report of Ministry of Animal Resources, South Darfur State (2007) the livestock off take is estimated at (Cattle: 4796490; Sheep: 4058926; Goat: 3412343; camel: 111 2930 heads).

Above figures play an important role in food securing and income generation activities in the study area and therefore, red meat is the main and most available source of animal protein. Moreover, meat has traditionally being viewed as a vehicle for a significant proportion of human food-borne diseases. In recent years the problem has been well illustrated through surveillance studies of specific meat-borne pathogens such as Escherichia Coli 0150:H7, Salmonella SPP, and Campylobacter SPPs Elniema et al (2016). In addition to existing biological, chemical and physical hazards, new hazards are also identified e.g. the agent of bovine spongiform encephalopathy (BSE), Avian flu and swine fever viruses.

1.1: Problem statement.

After local mass violent conflicts have emerged in all Darfur states since 2003, since then Nyala has become surrounded by various internal displacement camps that had impacted on increasing the size of populations and as a consequence meat consumption for domestic purpose is also increased too. In effect, in response to increased demand, new types of markets appeared on the form of roadside displaying meat on tables to sell direct to consumers. In addition to the individual meat shops (butcheries) distributed randomly at different areas in each market or in the form of more than one butchers share one gable (structured housing). As a researcher is one who working in this field, sufficient evidence of unhygienic practices and conditions noticed in terms of: poor personal hygiene practices and attitudes as bare hands contact with meat without cleaning all day time Muhammad et al (2015), chewing of tobacco, smoking cigarettes, wearing jewelries and rings, freely get inside and outside with the using of the public latrines and toilets in the market, no wearing of facemasks, aprons, hair covers, and gloves; unclean and not sanitized equipment, surfaces such as knives, hooks, cuttings and displaying tables that they use all day long without cleaning and

disinfection. Stems of large trees used for cutting meat as the surface that were left all the day without cleaning and sanitizing, at the end it prone to cats and street dogs at night and thus the possibility of licking is inevitable. Absent of hygiene facilities and materials. Location and internal design of the butcheries Karma (2014) are also not compliant with recommended specifications because some are close to public toilets, fruits and vegetables displaying areas, restaurants, tobacco selling shops as well as dirty and dusty roadsides displaying. Meat while displaying on an open table whether inside the butchery or at out-roadsides it is directly exposed to flies and dirty dusts. As an attempt to control flies they pour insecticides direct to the surface of meat tissues or on the surround objects.

As a consequence interested parties as consumers, community leaders, and other enlightens in the community begun to express their resentment about current meat market's hygienic conditions obviously.

1.2: Questions of the study.

The main question of this study was that, to what extent current red meat markets' hygiene practices and conditions are conforms to the requirements of Food Safety Management System (FSMS) and HACCP approach principles. The subsequent questions that emerging from this main question are as following:

1. To what extent Nyala red meat market’s hygiene practices and hygiene conditions are conforms to the food safety management requirements and HACCP approach principles?
2. To what extent meat handlers’ personal hygiene practices are conformance with good hygiene practices?
3. To what extent attitudes of meat handlers are conformance with good hygiene practices?

4. What are the best governmental roles and mechanisms that should be applied to introduce good hygiene practices and food safety regulations among meat handlers?

5. To what extent related governmental authorized bodies are involved in the deployment and communication of food safety regulations, laws and procedures at butchery level?

6. What are the challenges that facing related governmental authorized bodies when exert efforts to implement food safety management system requirements and HACCP approach principles at meat markets or butcheries level?

1.3: The significance of the study.

This study will contribute to the improvement of hygienic conditions of red meat markets not only in this area but also at a national and world-wide level. I hope that this study will encourage all interested parties involved in this topic to shift thinking from corrective actions as sampling and laboratory testing - applying of fines and penalties in case of non-compliance to preventive actions through bridging the potential gaps related to management systems; raising awareness and capacity building of the business owners, operators and handlers on one side and the consumers on the other side Because the responsibility of food safety is a shared mission.

The outcomes to be considered are consisting of the following:

1 – Focus on highlighting gaps in regard to: compliance with ideal and recommended operational hygiene practices and conditions; competencies level of butchers on food safety knowledge; and awareness levels about food safety laws and regulations requirements. And thus, the outcome is to conclude and recommend about best mechanisms of interventions and management to enhance meat market's hygiene that could contribute to

improve the quality of meat; to prevent or eliminate public health risk; and increase product and productivity.

2 – Emphasis on developing multi-cluster-multi-sectoral coordination culture to act collaborative in a harmony manner for the sake of addressing any other problematic issues in the community if any.

3 –propose high quality level of interaction and cooperation among interested parties.

4 – Contributing in broadening body of knowledge in the high education institutes' libraries.

1.4: Objectives of the study.

This study is aiming to achieve the following objectives:

1. To assess red meat markets' current hygiene practices and hygiene conditions.

2. To assess meat handlers' personal hygiene practices, meat handlers' hygiene attitudes and, level of meat handlers' competencies on (basic food safety knowledge, good hygiene practices, skills) and awareness of food safety regulations among meat handlers.

3. To analyze and identify gaps related to the deployment and communication of food safety regulations, laws, and procedures at butchery level.

4. To determine potential challenges that can face governmental authorized bodies to implement requirements of Food Safety Management System and HACCP principles at meat markets or butcheries level.

1.5: study hypotheses.

To think proactive, based on the risk-based thinking approach, the study assumed the following **hypothesis:**

1. No statistical differences between Nyala red meat market hygiene conditions and food safety management requirements and HACCP principles.

2. No statistical differences between meat handlers' (butchers) personal hygiene practices and good hygiene practices (GHPs).

3. No statistical differences between meat handlers' hygiene attitudes and good hygiene practices (GHPs).

4. No statistical differences between meat handlers' competencies and basic food safety knowledge.

5. No statistical differences between meat handlers' level of awareness on food safety regulations, laws and, the involvement of governmental authorized bodies in the deployment and communication of food safety regulations, laws at butchery level.

6. There are challenges that facing related authorized governmental bodies to introduce and enforcement of Food Safety Management System and HACCP principles at meat markets or butcheries level.

1.6: Scope and limitations of the study.

1. Geographical boundaries.

This study addressed only the red meat market in Nyala Town (five red meat markets). These are: Nyala main market in the centre of the town, sometimes it called the big market; Malaja market and Zariba market are located at the north; Mogafe El-geneina market is at west; and Elshaabi market at south.

2. Interested parties.

The most relevant and concerns of this study are: preventive public health agencies and professionals; veterinary service providers; governmental local authorized bodies; quality managers and services providers; students interested in quality management and business excellence; and the whole interested parties of the State.

3. Product and services boundaries.

This study devoted to meat markets of beef, Camel, sheep, and goat.

4. The core aspects related to the objectives are.

The study seeking for identifying gaps in: current hygiene practices in comparison to best recommended practices; knowledge and basic skills; coordination, deploy regulations and laws, raising awareness and systems of managing, monitoring, verification, and actions taken when non-compliance is occurred.

Chapter Two

Literatures Review and Previous Studies.

2.1:Literatures Review

2.1.1: Food Safety Management System (ISO22000:2018).

Food Safety Management System (FSMS) came into existence under concepts of Quality Management System (QMS). Thus concepts such as process approach, evidence based decision-making or risk-based thinking, and PDCA cycle. Safety and quality play important roles as cornerstones to develop, maintain, and retain any food safety management system whether it to be applied in large food industries, small, or medium food retailers Cac (2003) as cited by Sara (2018). Hartwig (2005) made an argument that the efficiency and effectiveness of food safety management system is determined by to what extent or degree in which aforementioned concepts have been applied technically sound based on scientific backgrounds. Therefore, food Safety Management System is a systematic, integrated and proactive planning approach relies on identifying and determining the effectiveness and efficiency of the practices and procedures applied within the overall areas in which the organization is active. Its purposes are analyzing, identifying potential root-causes of food hazards and set out best control measures with recommended practices to deal with food hazards that can be introduced to food throughout "food chain".

Food safety management system is a systematic approach to analyze, identify, quantify and address organizational and technical issues that could constitutes obstacles to meet needs and expectation of customer and attain food safety objectives depends on assessing risks associated with specific food type and engagement of all food handlers Jouve (2000) as cited by Magda (2014).

According to ISO 22000: 2018 Food Safety Management System is set of interrelated or interacting elements of an organization utilized or can help to develop policies, objectives and processes to achieve those objectives.

These interrelated elements can be fixed assets, financial resources, individuals, knowledge, raw material, statutory and regulations requirements, employees and an external provides product or service requirement, as well as responsibilities and roles for managing or operating.

Edward (2005) stressed that the importance of engagement of all relevant governmental agencies, private sector entities to address food safety issues as well as the need to educate and involve all interested parties in the food chain to achieve food safety management system's goals.

Food safety management system is the system that can prevent food to level "will not cause harm" will not affect the health status of the consumer when consumed as intended to use FAO/WHO (2001) as cited by Abeer (2017). The meaning of intended to use is extends to cover the concept of shelf life (use by date-best before.) It is the specified period of time that the food could be remained safe with its quality features that is edible to consume FAO/WHO (2016a). Therefore, one can state that FSMS is interested in food safety to degree that prevent, eliminate or reduce the potential occurrence or existing of food hazards in the foods by tracing and controlling throughout food chain via optimum preparation, allocation and use of resources, as well as effective and efficient applying of quality and safety concepts.

The European Commission (2016) describes the Food Safety Management System (FSMS) as a comprehensive system of prevention, proactive alertness and ongoing endeavor to manage food safety and hygiene practices in a food business.

Food safety management system follows the process approach Plan-DO-Check and ACT (PDCA) cycle at two level (organizational planning control and operational planning control), where that enables to track its processes in a sequenced manner and understand how are they interrelated

and interconnected in flow diagrams with each other, identifying steps included in each process as well as identifying and allocating resources required to carry out these processes based on previous schedules at planning phases.

Based on ISO 22000:2018 edited version which known as food safety management system that comprises of the following aspects:

- ✓ Core mechanisms that are needed to develop, implement, attain, maintain and continuous improvement of the quality management system such as interactive communication, active participation and networking, and leadership commitment.
- ✓ Main approaches employed to deal with the nature of processes included and risks associated with them. These approaches are process management approach and risk-based decision making approach.
- ✓ Means that the food safety management can depends on to achieve its' goal and objectives such as resources and good practices.
- ✓ Strategic objectives that an organization extremely striving to achieve them as they presents the purpose of existence to it. These are customer focus, customer satisfaction, customer loyalty, customer retention, increase market share and productivity, profits generation and achieve customer value lifetime and thus as a result of all stated business domination in that specified market.

An effective FSMS is the strategic objective and universally recognized as an ideal food safety management system and is one that able to comply with food safety policy and accomplish measurable objectives related to the policy, the system that effectively perform its planned activities by optimum utilization of resources to realize planned results. The system in which adopts recognized managerial procedures in line with customer-driven strategy that aims at continually improving work performance

sustainably. Therefore, effectiveness and efficiency of food safety management system can be achieved through integration of prerequisite programs, required preliminary steps prior to HACCP approach and in a synergistic manner connects with the seven principles of HACCP approach Hema (2017) and malini (2010).

The FSMS' overall goal and objectives are to clearly aware of and to commit to apply best practices that ensure to provide safe and wholesome foods to the consumers by integrating general recognized key elements such as:

- **Interactive communication**
- **System management**

1- Interactive communication

Interactive communication in regard to food safety is about informing all interested parties throughout food chain on food safety risks and hazards, statutory and regulatory requirements. It is an aware raising campaign that aims at investing on two conceptual frameworks such as: well informed consumer on food safety risks and hazards with related food safety regulatory requirements can contribute effectively to enhance systems of food safety through direct influences on business owners and regulators alike. Also adequate trained and educated food handlers on food safety risks and related regulations aspects can exert effective efforts to comply with requirements. FAO/WHO (2016b) defined interactive communication as "effective food safety risk communication" the exchange of information and opinions among people about the risk and risks related factors associated with food safety hazards and risks. The goals of food safety risk communication are to enable people to protect their health from food safety risks by providing information that enable them to make informed food safety decisions, to facilitate an understanding among all interested parties, and to improve the overall effectiveness of risk analysis process.

In relation to what mentioned above, food safety risks communication the WHO (2001) initiated the campaign addressed common non-ideal food handling practices which known worldwide as "Five Keys" to food safety that include "how" and "why". How is for the contents of messages should be followed to assure safety of food. Why is for the "rationale" or inductive reasoning interpreting that if those messages are not followed how the hazard (s) occur in the food as cited in Francoise et al (2019). The five keys are: keep clean, separate raw and cooked, cook thoroughly, keep food at safe temperatures, and use safe water and raw materials.

However, the interactive communication of food safety risks extend to includes two-tail communication or two different levels of communications. First, within those who are influencing or managing based on authority assigned to them from high level of country authority (veterinarian, public health promoters, local authority, knowledge institutes, and community leaders). Second level is broad dialogues with all interested parties (handlers, operators, consumers) to gain how community perceive food safety hazards or how they judge, because this judgment serves as the foundation for their attitudes, intentions, and behaviors FAO/WHO (2016b).

Food safety management system pays sufficient efforts on interactive communication processes at both internal and external levels with all interested parties. Quality polices, quality objectives and processes to achieve them are must be developed, well communicated at internal level and be understood too. The processes flow diagrams, responsibilities and authorities for carrying out these processes must be identified and assigned. Also effective communication about food safety management policy and its quality objectives at external level with related authorities bodies, product or service providers, consumers and society shall be conducted.

Food safety management system as outlined in **ISO standard document 22000:2018** integrates the concept of risk-based thinking with process approach at two level, organizational level and operational level to identify the nature and source of risks, probability of risks occurrence, and its impact or its severity. Bob (2015) claimed that risk-based thinking is a dynamic and routine based thinking; it is part of process approach that employs preventive actions, adopting risk-based thinking can allows enhancing customer satisfaction; to provide customers consistently with goods and services conformed to the requirements; to sustain in business environment.

According to ISO 22000:2108(FSMS), an organization in its journey to plan its food safety system, required to think carefully about risks that could challenge or may shortcoming to accomplish; to achieve; to obtain its planned results as desired outcomes deliverable from activities that planned or to hinder to carry out planned activities. So risk-based thinking concept at organizational level is related to the context of the organization in which includes issues associated with internal and external environment; needs and requirements in relation to regulatory, statutory and customers, and contents of its scope in terms of activities, processes and product or service specifications. On the other extreme, at operational level risks can impose profound impacts on outputs of the food safety system if not analyzed, communicated and managed appropriately. At operational level the organization must establish preliminary steps, necessary programmes and set criteria to control its processes, operations environment, inputs, workers practices and changes in order to produce product and/or service that capable to exceed customer expectation and results in satisfaction.

FAO (2016) has quantified potential benefits that could be gained through including interested parties in food safety interactive communication which summarized as:

-it leads to determine technical barriers about food safety risks.

-understand interested parties how they perceive food safety risks and how they expect its consequences.

-an opportunity to disseminate information regard to regulatory laws, rules and procedures of recommended operations and practices to all interested parties involved in the food chain.

-facilitate active participation which in turn results in sharing information and generating more practical ideas.

-inform interested parties how they can contribute to assure safety of food before and after purchasing.

To sum up, the interactive communication interested in participating with all interested parties to address food safety issues regarding to risks related to specific food product, informing about regulations framework and recommended operational procedures and ideal practices throughout food chain.

2- System management.

Food safety management system is interested in two interrelated management philosophy these are, quality management and food safety. How to understand effectively the interconnections, interdependencies and cause-effect relations of elements of macro environment, their adverse impacts on business internal micro environment that can hurdle organization management system from consistently and continuously provides product and/or service to comply with its customers' and applicable regulatory requirements- this macro level (quality management) philosophy deals with identifying external interested parties, their requirements that compatible with applicable regulations requirements and external issues related to the context and scope boundaries of organization's quality management system while addressing challenges that can hinder its ability to achieve its quality objectives; trying to attain and maintain and

further in long term will lead to protect its corporate images. Corporate image Obasan (2012) has defined it as "the way a company is perceived by all constituencies, often with a strong focus on external constituents". However, corporate image of a company on one hand can be realized through consumer perceptions about product or service features that can contribute to the quality and can determine its innovation attributes, on the other hand corporate image can be assessed by how an organization is excel in leading people by focusing on their needs and requirements, the manner in which managing their relationships as well. On the other side (micro) while management system consistently exert strict monitoring and evaluation activities at all food chain putting managerial considerations on operations; processes; means; mechanisms to implement effective system; and approaches enabling to control that system and its process. This micro level (food safety) is about to what extent an organization's culture is fit to assure food safety because, the culture of an organization will play pivotal role on its practices and performances. Internal culture and its importance have been discussed widely by Donnel and Boyle (2008), Obasan (2012) as a "way in which things are done" is made up of patterns of behavior, symbols, ceremonies, values, assumptions and beliefs. In addition to that the effective organizational culture is one that flexible, relevant to be adopted and adapted appropriate to external and internal factors, leaders are champions in playing their roles; employees are empowered; engaged; trained and oriented to work as a team. It has been suggested by Wade (2009) as cited by Michael et al (2016) that an effective system management has to develop specific, measurable, and realistic objectives capable to achieve within specific period of time (SMART objectives), system that set up standard operation procedures to control operations, documents, monitor continuously, aligns objectives and resources with

staff, communicates results, and build capacity of its' employees through providing training opportunities and technical supports.

Through investigation on literatures review, several studies have been stated Von and Pandya (2003), Laurian and Nancy (2000) that because of the complexity of issues pertained to food safety which requires effective manage and control the whole chain of the food "from farm to table" or "from farm to forge", as well as the nature of overlapping issues due to the fragmented regulatory responsibility among various government institutes WHO (2007) and Grace (2015) as cited by Tracy et al (2018) which classified as the most frequently stated structural problem of the developing countries. For tackling these issues WHO (2006) and FAO (2005) as cited by Grace (2015) and Tracy et al (2018) suggested that there are necessarily growing needs for, first to shift from regulatory approach to more comprehensive framework through adopting mechanisms such as bottom-up that allow interested parties to be in the centre of food safety decision-making process. Second, efforts required to resolve the multi-faceted managerial nature of food safety domain to permits existence of a single unified governmental body, equipped with effective authorities, knowledge, and required skills. To do so, Marian et al (2006), Atif et al (2012), Linhai et al (2018) made arguments that the focus should be transformed to include private sectors based on participatory approach that result in effective coordination and partnership which termed as food safety risks co-governance and which defined as the mechanism that brings all interested stakeholder on a common platform to communicate, understand, carry out action plans in a cooperative manner to establish assurance system for food safety Fearne and Martines (2005). Therefore, the concept of food safety co-governance emphasis on investing public capita of governmental agencies with social capita in synergetic way as an option to overcome structural shortcomings, fragmented responsibilities, resources

scarce, and technical burdens. Role players of multisectoral body are venders' association representatives; government entities' assigned persons; consumer organizations; as well as academia. In line with that, inputs from variety interested parties as well as including benefits of multiple criteria are requirements of best food safety approach which argued that efforts must be made to left organization's own culture and entity individualism "individual mind-set" which termed as the "silo approach" to towards participatory approach FAO (2013).

Galloway et al (2000) stated that system management is ensuring that operations should be seen as systems comprising individual elements which are linked together and which have a purpose or goal. Thus, defects or deficiencies occurred in any one element essentially will cause a problem upon other elements to which it is linked.

This system (FSMS), in order to be guarantee enough to provide safe food must clearly adopts the quality management system's (7) principles (**CLEPIER**) as following:

2.1.1.1: Quality management principles

1- Customer focus.

By adopting customer-driven strategy which represents a cornerstone for both starting and continuous improvement of food safety, an organization has to identify and understand its current and potential employees and other networks personal expectations and needs. Internal customer satisfaction is crucial for producing results that can satisfy those who receive internal works outputs.

Wendt et al (2013) claimed that the excellent organizations in practice often put efforts to obtain information about their current and future customers' expectations and needs. Then translate to technical language to create desired value that can meet and exceed their expectation and satisfy them. In doing so, they provide and support employees with essential

technical and financial resources, communicate vision, mission, values, and policies in openness culture. Also empower and share these work agents for any future change to adapt changes happened in business macro-environment.

***2*- Leadership.**

Hadi (2006) provides an idea that leadership is possessing of unique vision and direction to achieve goal purposively through making others to participate in with leader to accomplish tasks willingly without forcing to do so. The basic role of leader is to inspire and motivate other in mutual respect work environment with mutual beneficial and pay efforts to construct integrated and supportive social unite that able to extract value of existing strengths and capable to transform opportunities to strengths and knowing followers how to deal with possible risk factors such as weaknesses and threats that could be imbedded in the internal or external context of an organization.

James (2007) borrowed the most creative and wonderful definition of leadership which has been done by Packard (1962) that "leadership is the art of getting others to want to do something". Exactly, leadership is a continuous striving for creating the desire to accomplish work tasks right first time in an enthusiastic manner without being under supervision's pressure or in command. This desire can be achieved through motivation, engagement, empowerment, trust-building, inspiring, coaching, ownership and communication in an openness system, with a special interest in satisfying and meet their needs and requirements. These are the most critical tasks of leaders in quality fields.

Schieber (2016) pointed out that leadership constitute a roadmap of business excellence by setting vision, mission, policies, values and transforming culture to achieve desired objectives relying on "how to act professionally, how to integrate business elements and perform innovation

that is adaptive to interested partners. Griffith et al (2010) stated that the key to food safety leadership is about promoting, influencing, directing, coaching, supporting and engagement of staff to perform activities compliance with the requirement for the food safety and consistent with food safety standards. However, the effectiveness and style of leader is influenced by the organization's goals and its culture, employees' level of knowledge and skills. Guldenmund (2010) as cited by Sophia and Derek (2018) has been argued that how well safety procedures and regulations are followed within an organization in considered to be influenced by the reigning food safety culture of the organization.

Consistent with Sophia and Derek (2018) in recent decades styles of leadership such as transactional and transformational have been applied in the context of food safety due to the importance of leaders to lay down the basis of effective food safety culture in an organization. Kumar (2018) highlighted that the concept of food safety culture has emerged from the two related concepts of organizational internal work environment culture and safety culture. Work environment of an organization that support, encourage, empower, and reward employees with a systematic approach to foster performance measure rather than individual appraisal approach. Safety culture is always focusing on root causes of a failure respect to (five Ms) manpower, machine, monetary, material, and method whether complicated with technological gaps or not. Griffith et al (2010) defined food safety culture (FSC) as a component of organizational culture that focuses on developing food safety practices and behaviors at food chain by top committed leader entails to establish mission and vision statements with clear values and ethics to perform tasks in order to achieve desired planned objectives.

To sum up, despite, the fostering either transactional or transformational styles of leadership, the effective leaders are those striving for:

1. Organizing collaboration (focusing on a problem or objective that can be solved or achieved jointly)
2. Leading others by example (don't do it, if not acceptable to you what others have done or going to behave)
3. Reducing transaction costs (effectively and efficiently designing organization, process, systems and tools.
4. Judging objective and value not individual appraising
5. Ensuring on future feasibility (strategy-driven) based on lessons learned from previous tasks.
6. Providing information, supporting resources, and communicating direction.

***3*- Engagement of people (engagement of interested parties).**

Following the concept of food chain, engagement of all interested parties could be more beneficial for all because, it is difficult to, if not impossible for one entity to achieve the safety of food relying on its own capabilities. Thus, inter-dependence on each other is inevitable.

Factors such as technological advances which in turn results in exchanging of information throughout the media platforms, limitations in terms of resources and complexity nature and broaden field of food safety "from farm to fork", as well as involvement of variety parties that hold different interest perspectives and knowledge backgrounds Thomas et al (2005). In order to overcome these discrepancies several sectors take actions jointly to share responsibilities, promote, influence, and exchange information among them is recognized from experts as integration strategy and coordination efforts that is important to ensure the safety of the food Brooks et al (2017) as cited by Minnens et al (2019) and Thomas et al (2005).

The concerns regard interested parties engagement is a philosophy that invites integration of all interested parties in the decision making process.

From the view point of that integration, traditional ways of policies making by accountable agents, often with support of experts, under the assumption that the resulting decisions will be accepted when communicated, and commit to behave as work rules especially in food safety context, probably may led to lack of trust or uncertainty, resistance, lack of ownership and even non-compliance. To facilitate greater engagement numerous mechanisms have been generated to allow public and stakeholder involvement such as consultation for the purpose of informing about decisions decided on behalf of them which named as passive participation, participate on decision making but not allowed to later proceedings, and active engagement which termed as active participation that permits to be from decision making to outcomes of that decision Walls et al (2011). Therefore, the effective participation that constitutes fairness ground can create an opportunity for sharing knowledge, information, and perceptions among partners.

Thomas et al (2005) claimed that there are three steps of stakeholder engagement which termed as "generations of corporate stakeholder engagement". Depends on purpose or objective these three steps have been classified as following:

-1st Generation is problem-based action. Is a strategy to address identified outside business problem has impacted on the satisfaction of stakeholder, so it is for addressing certain issues.

-2nd Generation is about what is so called customer focus. It includes obtaining customer feedback pertaining to product or service previously experienced with other opinions related to business scope for future actions. An idea is that customer can contribute effectively to innovate and improve product or service.

-3rd Generation indicates to integrate business core goals to social, environmental and economic performance that result in attracting

additional resources in terms of competent personnel, financial, technological and materials.

To serve the purposes of this study that, undertaken to assess red meat markets hygiene conditions and practices, and because of the complexity nature of food chain concept, stakeholder engagement is refers to active involvement that permits to participate in hygiene awareness promotion programs that aims at raising awareness of risks associated with meat purchased from poor hygiene conditions under hygiene violated practices, in order to understand how they can support, help, and even assist through actions may contribute positively to improve the situation and influence in changing meat handlers behavior of practice based on assumptions that well mobilized and sound participated community can exert decisive efforts to both sides, formally they can play vital roles through potting sufficient pressure on authorized bodies to bear their responsibilities and roles to act on practices that considered being irresponsible, as well as, through raising voices clearly about the conditions of actual hygiene practices that result in forcing product owners to comply with statutory, regulation and consumer requirements.

Thomas et al (2005) and Walls et al (2011) have argued that the potential benefits from stakeholder engagement can be summarized as:

- trust in policy makers can be regained, efficiency of decision's massage can be achieved, and common understanding about the complexity of issue can be established.
- enable better management of risk and reputation.
- appreciate their roles and responsibilities.

***4*- Process approach.**

A process is a series of steps or activities that takes inputs from customers (internal employees as operators and handlers or from external suppliers as outsourcing) and use them into outputs that can be delivered to consumers.

These steps or activities required to carry out the process are must be defined, and performance measures are continuously monitored in order to prevent occurrence of any unintended, potential deviation Pozo et al (2018). According to Booth (2007) as cited by Mohamed et al (2015) process approach is a mean that enable employees to analyze it works processes that fed with inputs of various interested parties by identifying methods to monitor and validate results of the processes. Moreover, the central element of management is the concept of process. It has been also defined as set of interrelated or interacting activities that if undertaken properly as planed and supported with adequate, effective and free from defects resources, can result in outputs that capable to satisfy determined customer.

Stracke (2006) used the term process orientation instead of process approach and stated that the quality of a process is the main factor that can assure quality of outputs and determine the validity and effectiveness of quality system. The process orientation emphasis on shift business management from static structure based on functions to horizontal business process crossing all functional units Ebel (2003), Schmelzer and Sesselmann (2003) as cited by Stracke (2006).

Next to process approach, the main function of food safety management system can be achieved through adopting of process approach concept in this context, the system of food safety can be considered as a long rang thinking process in which food can be traced throughout the chain while relying on questions such as what, where, when, who, why, how (5Ws&1H methodology) and if not as required then return back to 5Ws+1H methodology.

***5*- Improvement.**

Continual improvement can drives an organization to be both analytical and creative in finding methodologies to become more competitive and

more effective at meeting stakeholder needs and expectations. Chase and Aquilano (1995) as cited by Dalgic et al (2011) and Hoyle (2001) argued that the continuous improvement seeks to improve machinery, labor utilization, materials, product quality and safety and, production methods based on ideas generated by team members. Therefore, food safety management system is based on the process approach which employs the continuous improvements from supplier to the consumer chain by adopting PDCA cycle. Luburic (2015) claimed that the best building blocks for continuous improvement strategy of the organization are customer focus or customer-orientation, engagement of people, leadership, and process approach. Because, in the context of and changeable nature of business environment, hard competition, and instability attitudes of consumers in respect to their needs and expectation as a result of mass media influences, an organization that does not foster continuous improvement objectives will no longer suffer and end up out of competition.

However, when fostering improvement objectives as necessary components of business strategy the main three pillars that must be taken into account are system, process, and product and/or service. PDAC cycle, it is an approach for continuous improvement, every cycle lead to other in a series base, information obtained from check step can be fed into taking corrective action in act step, and then plan to implement preventive actions that prevent reoccurring of deviation.

Baring in mind food safety improvement is questing about the effectiveness and efficiency of food safety management system to deliver safe food from "farm to table". It includes effectiveness of prerequisite programs established and preliminary steps conducted accuracy and consistence of HACCP plan, capability and effectiveness of control measures applied to CCPs.

The need for continuous improvement of food safety management system performance is an everlasting activity as all stage of food production, processing, preparing, packaging and deliver are exposure to food safety hazard Pozo et al (2018).

***6*- evidence-based decision making**

This principle emphasis on value, applicability, credibility and sustainability of a specific decision respect to PRPs, CCPS or control measures such as critical limits and standard operation procedures that established and applied to food safety management system.

Value of decision can be accessed to, from the view of point that to what extent the decision making process is relied on scientific based methodology and well interpreted information.

Applicability of decision refers to the capability of food safety system of an organization to plan, implement, review, and engage in additional courses of action when required and where possible.

Credibility of decision is the same to effectiveness and efficiency to assure food safety and food quality if implemented as planned.

Sustainability of a decision regard to food safety can be apparent if food safety support elements and business context factors have been taken into consideration.

Newborne et al (2007) defined evidence-based decision making as information based interventions that concerns with risk analysis, training and provision of information. Analyzing information obtained from experts and desk review that related to health risk is defined through employing the risk analysis framework FAO (2013). However, although three concepts that usually tied with risk; risk analysis, risk assessment, and risk management, and an attempt to distinguish their relationships with evidence-based decision making concept one may claim that the first two concept risk analysis and risk assessment are interested in identifying the

type of risk, the probability of risk occurrence, nature of root-cause and its severity. Whereas, risk management using these information to decide knowledge-based decisions in dealing with risk. An idea is that Hazard Analysis and Critical Control Points (HACCP) and Prerequisite programs imbedded in risk analysis and risk assessment while critical limits or critical measures are evidence on which judgment can be made during managing food risk. Risk management also deals with other factors while addressing risks (e.g. environmental, social, and economic) FOA and WHO (2006).

***7*- relationship management.**

The seventh principle "relationship management" refers to identifying all company's interested parties and understanding of their needs and expectations for the sake of aligning organizational resources and balance business objectives to generate results that satisfy all interested parties. Interested parties may include direct customer; employees; suppliers; networking partners; regulatory bodies; owners/shareholders; insurance; society; security service providers; national level and local level authorities Shakoor (2018).

Recently, the concept of relationship management has been evolved to various business concepts such as information management and relation marketing Urbanowicz (2008), Subhasish et al (2018). A customer oriented or marketing-oriented business that concentrate on giving customers the priority to be part of the business strategy through obtaining information of customers' needs and expectation, analyze, communicate and design to attain results and add value to satisfy them Deshpande (1999) as cited by Buttle and Francis (2008). Then as a consequence of advanced technology, economy, instability in customer lifestyle of 20^{th} century the concept of relationship management developed to customer relationship management (CRM) Laketa et al (2015).

Razniewska (2018), Fritz and Schiefer (2008) as cited by Leon et al (2017) argued that the CRM is synonymous to buyer-supplier relationship which positively influenced by three dimensions "bottom line", "pillars or triangle" of sustainability, social, economic and environmental performance measures.

Moreover, in the field of food safety relationship management, the flow and form of information among relevant interested parties, takes at different levels with different typology of interests. Nowadays, thanks to progress in technology of communication that has led to appearance of social platforms as a benefit of accessibility and availability of internet with affordability of personal smart cell phones, managing relationship of business interested parties is easier than ever before.

The customer relationship management is focusing on customer acquisition and long-term retention of customer. Furthermore, Abu Kasim and Minai (2009), Mendoza et al (2006), Rahimi and Gunlu (2016) as cited by Rahimi (2017) have defined customer relationship management as a business strategy that aligns business areas relevant to customer and also marketing strategy that integrate technology, process and business activities around the customer. Therefore, areas such as product design, quality and/or safety control, delivery, purchasing, product releasing, and customer care departments must be aligned with customer needs and expectations.

2.1.1.2: Prerequisite Programs and Mechanisms for Strengthening Food Safety.

Prerequisite programs (PRPs) are requirements referred to as good, ideal practices based on scientific knowledge and technical procedures. Scientific knowledge are about the type of product, its production technology combined with the processes involved, whether it imposed to manufacturing or delivered as raw, displaying, preservation and means of transporting and handling. As well as, aware of basic concepts of quality

management, adequate information on food hazards related to specified product, their implications and Knowing how to deal with undesired results. Technical procedures are prescribed standards and previous determined actions that outline how to accomplish steps related to a process in the operation line. They are often termed as Standard Operating Procedures (SOPs). Lombardo (2015) assumed that the (SOPs) will serve as evidence in any evaluation and defined as '…' procedures specific to operation that describes the activities necessary to complete task in accordance with industry regulations, laws and even business own standards. Inference is that documented information about all operations that comply with the set of regulations must be developed, maintained, retained and controlled in order to be able to access to them when required.

Thus prerequisite programs that can be included under these concepts are:

1. "Good Manufacturing Practices" (**GMPs**)

it extend to cover programs such as: location of "premises"-boundaries, outside layout, adjacent buildings, internal and external design, sanitary facilities such as water; utensils; toilets; lights; drainage and waste disposal facilities; transportation and storage; control measure methods; sanitation and pest control means Maria (2002).

2. Good Management practices (**GMgmtPs**)

It includes all operational procedures, instructions and regulatory frameworks as well as quality objectives, identifying resources needed and commitment to provide them as soon as required, building a culture of innovation and creation, providing technical and technology supports programs. Approaches and channels of communications, networking mechanisms and reinforcements, methods to deal with nonconformance shall be in place and effective.

3. Good Agriculture Practices **(GAPs),** Good veterinary Practices **(GVPs),** and Good Hygiene Practices **(GHPs.)**

In the light of "food chain" concept that aiming at tracking food from farm to a point of consuming (ready-to-eat), Good Agriculture practices are knowledge based conditions, processes, positive behavioral practices and attitudes that will lead to produce, manufacture and deliver compatible with adequate information the safe food for human consumption.

GAPs *are also defined as "actions, technologies, and systems that are accepted as most effective for optimal management of soil,* water *and for crop and livestock production, from the point of view of microbiology and chemical safety"* Anne et al (2004).

Applying this concept on the food animals as a general, and in particular those who breeding openly depending on the natural pastures with seasonal countries cross-border nomadism culture that as practices in Sudan specially in the study area, good agriculture practices assumes to play pivotal roles for improvement of meat safety and meat quality. These GAPs and GVPs can be segmented into three levels of prerequisite programs that as following:

- At farm level

Reasonable and responsible practices at farm level may include:

a- Control of transboundary epidemics and infectious diseases of a character of zoonosis in order to prevent risk associated with them. Steps needed for are broad disease surveillances to obtain disease map, communicate information of disease map at all levels nationally and with neighboring countries to collaborate effectively at scheduled time to take appropriate actions to eradicate them.

b- Actions to address risk associated with Veterinary drugs, Pesticides and Herbicides residues in food animals. In regard to control food hazards at national level, Sudan National Codex Alimentarius Committee (2013) provided a set of regulations such as Federal Pesticides and Pest Control Act 1994, Federal Veterinary Health Quarantine for Exported

and Imported Live Animals and Meat Act 2004, Pesticides Residues in Food 1.1 Primary Food Commodities of Animal origin-1.2 Mammalian Products (cattle meat Act) 2005-SDS 3270, Pesticides Residues in Food 1.1 Primary Food Commodities of Animal origin-1.2 Sheep meat Act 2005-SDS4032, Goat meat Act 2005-SDS4031, Contaminants in Meat and Meat Product Act 2007-SDS4144, Maximum levels of residues of Veterinary drugs in foods – CAC/MRL02/2009 SDS 1096 (2010) and maximum levels of Mycotoxin in Cattle feed SDS 3333 (2005). Although the availability of these regulations close to decade since veterinary drug residues Act of 2010 as an example, the problem is still remained challenging food safety of animal origin Seri (2013). Therefore, various types of Veterinary Drug and pesticides residues observed in different tissues of animal slaughtered kidney, liver, muscle tissues, Fat and heart Seri (2013), also Elneima et al (2016) and Taha et al (2013) have reported that residues such as Penicillin, Chloroamphenicol, Nitrofurans, Ivermectin 1B and DDT are the most harmful chemical hazards that need a lot of attention in order not to find a way to be in animal original foods. Although Seri (2013) as an example attributed that to the violation of recommended prescriptions by veterinarians due to lack of information regarding to balance between food safety issues and treating animal suffering from disease or as a consequence of the lack of expertise, but the problem is more complicated than that. The possible justifications can be that, as these veterinary drugs at oftentimes be with the owner of herds that as soon as sold from veterinary pharmaceutical the ownership of the veterinary drugs that solid will be to the owner and then its administration also. As well as phenomenon of non-registered veterinary drug from adjacent countries as border trade issues (transboundary drugs) also have been experienced. In addition to that, variety problems such as resistance

upon extension services of livestock keepers have been shown in regard to awareness programs. There is always resistance. For instance, when they make such statements as "we know we are experimenters" or negative behaviors such as mixing more than one drug and administering as one dose. Resistance and bad behaviors the same also to agro-farmers they abuses herbicides and insecticides too.

To tackle these issues effective communications at different levels, Good Management practices (GMgmtPs), restrictions about veterinary drugs and Agricultural chemicals marketing (GVPs, GAPs). veterinarians and agriculturists must be vigilant while providing Veterinary drugs, pesticides, herbicides and insecticides in kind to the farmers because evidence regarding" abuse" or "extralabel" uses have been obviously observed.

- At slaughterhouse level

At slaughterhouse level the concepts of Good Hygiene Practices (GHPs), (GVPs) and (GMgmtPs) includes:

a. reception of animals to be slaughtered must be subjected to quarantine at least not less than 7 days because of the incubation periods of several microorganisms, free from diarrhea, cough, nasal, vagina and mouse discharges, emaciation and jaundice signs.

b. location of the slaughterhouse must be compatible with good hygiene considerations-its design internal and external, hygiene facilities and equipment, potable water and hot water supply, effective drainage system.

c. Personal hygiene and health compliance

d. sanitation and sterilization materials and equipment.

e. workers awareness and training, monitoring their behaviors and attitudes, enforcement policies, instructions, communication, continuous supervision, measure, control and improvement.

f. transportation and carriers of meat from it to meat markets

- At butchery level (meat market*)*

At butchery points concerns relate to location, internal and external design, type and nature of displaying facilities; storage facilities and their effectiveness; chopping and cutting equipment. Personal hygiene and hygiene facilities, instructions, communication, awareness and training, continuous supervision, measure, control and enforcement and also corrective actions and improvement. Similarities as mentioned above at slaughterhouse level prerequisite programs can play vital roles at butchery level too. However, the most important differences among preconditions as prerequisite programs at slaughterhouse and meat market level are that, always the priority will be at butchery level because these programs represent the most critical control points from view of point it is where that direct interaction between end consumer and business organization will tack place Heywood (2012). Means that it is where a judgment about product quality attributes and service quality dimensions will be happen.

To differentiate, the farm level is concerns with broad umbrella of food safety strategies that often required high level involvement combined with various resources and multi-disciplinary mechanisms.

For prerequisite programs in relation to the aspects of interest for this study, and according to an expression statement that the meat market hygiene is a shared responsibility and it required efforts of multi-cluster with multi-disciplinary team approach in a co-ordinated way, with processes and activities should be conducted using top-down and bottom-up approaches within resources available nationally, locally and in case of inefficiency if possible external resources will be a hard choice. These aspects should be necessary and vital elements that must be in place to reach the ideal state of meat market hygiene through comply with Good Manufacturing practices (GMPs) and Good Hygiene Practices (GHPs) as following:

a. Legislatives frameworks

Legislatives framework needed to be in place are:

- ✓ Butchery or meat market conducting act
- ✓ Labor act specific to this food
- ✓ Enforcement act or enforcement procedures
- ✓ GHPs act and operational procedure
- ✓ Monitoring and measuring procedures

b. Roles and responsibilities of all interested parties must be determined and best mechanisms for building partners must be identified and implemented.

c. Activities and processes such as conducting butchers' training programs for capacity building on GHPs, communications with community for forming alliances to advocate good hygiene practices and participate. As well as providing broad awareness raising programs must be discussed objectively, to agree upon it and to implement.

d. Forming assigned body with high degree of authorities for managing, monitoring and whenever necessary take appropriate actions at different levels to comply with stated, updated regulatory and statutory requirements.

All aspects outlined above contribute effectively to enhance meat market hygiene and as a result improvement of meat quality through assuring on following points:

- ❖ Location of meat market or butcher shop.

Description of place suitable to locate meat market or meat shop shall be based on Butchery or meat market conducting act, and where possible should be away from polluted areas such as landfill, waste containers, public toilets and latrines, hospitals, bus stations, factories and even car washing areas. Considerations also must be taken into account that a butchery or meat shop shall not be adjacent to restaurants, fruits and vegetable selling areas. Environmentally, risk factors such as waterways in

autumn, water stagnant areas, wind directions and seasonally migratory birds' residences especially when there are bigger and highest trees must be thought about. In general, geographic and neighboring boundaries analysis must be taken into account before locating. All mentioned factors have severe impact on meat market hygiene that results in compromising the safety of meat.

- ❖ Construction form and internal and external design

From the perspective of cost effective like easiness to manage, monitor, and cleaning as well, setting and designing one building divided into several separate partitions, each partition specific to one butcher is more practical. However, since it is a private sector needs more efforts to convince to share their resources to build as such as collective work places. Options available for encouraging could be through effective communications, participation and positive reinforcement by reducing taxes and fees. On the other hand, availability and suitability of land will play critical role in creating obstacle in some circumstances but manageable, that the multi-cluster-multi-sector coordination could be beneficial. If not, separated meat shops will be an option but not guarantee cost effectiveness for both sides, for owners and managers or monitors.

For investing on characteristic long term usage duration, resistant to environmental factors, easy cleaning and control, the usage of cementitious material in constructing of meat shop could be beneficial and practical. The exterior paint must be of reflective color not attractive to insects. The internal part designation is the most important one; it is a place where most of processes and operations were take place. Precisely, walls and ground should be built of ceramic or any smooth material enabling for easy cleanliness. Comprehensive description about internal designation must be provided by meat market and meat shop act.

- ❖ Size of the meat shop

The size of meat shop shall be stated by related framework of act and shall be assigned to recognized official body Karma (2014). Moreover, the size of meat shop is mainly depends on the types of carcasses, operations, process intended to carry on, quantity of meat too. The appropriate size is that, just enough to facilitate practicing proper hygiene and capacitate to separate displaying areas from processing or operating. Existence of adequate, suitable space will determine the size of meat shop pre-dominatingly.

- ❖ Equipment and surfaces

Meat contact surfaces and equipment should be made of material resistant to be eroded, resistant to build up dirt, not absorbent to liquids, high temperature tolerance for sterilization. Therefore stainless steel equipment and surfaces will be favorite choice as an argument made by Charles (2014) and Hema (2017). But some equipment like axe which used to cut and segment meat before isolation of bones may introduce meat to physical hazards resulting from pieces of bones remained in meat muscles, referring to this case shifting to electric cutting machine or boning and selling separately according to the quantity ratio required by the consumer. For instance, when ordering a kilogram the proportion of bone will be 25% out of total demand. No frustration, it is a market that stands on mutual value and agreed norms it is better than cheating. Other surfaces such as tables should be replaced to concrete ceramic building surfaces for easiest cleaning and disinfection.

- ❖ Hygiene facilities, materials and tools

Hygiene facilities and hygiene materials play an integral part in practicing GHPs. Without these all efforts have been made were become nonsense. Meat market whatever its form of designation, processes undertaken there and its size, there are no differentiation in terms of what have to be supplied as requirements to practice GHPs. Adequate and appropriate

hygiene facilities and materials required are toilets, washbasins, soft and hard brushers, source of safe water or potable water hot and cold in quantity and under pressure, air compressor for drying and effective linking to the drainage system is very important to be conformed to recommended ideal state of GHPs. For the safety of personnel operating cleaning, cleaning clothes, gloves and boots which made of non-liquids absorbent materials must be provided. Effective cleaning and sanitizing activities required chemical materials such as disinfectants, detergents and soaps. The importance of the view point cited from Hema (2017) confirmed that the selection of these materials, the safety standards for both personal and product (meat) must be taken into consideration, thus not to be toxic, carcinogenic or irritated. In addition to what mentioned above, good equipped washroom with an adequate number of hand washing facilities with hot and cold water, soap, sanitizer, and sanitary hand drying must be available and must be in a good functioning state as stated Maria (2002). The concept indicates the argument of work and work place division is practical, manageable and can be helpful to prevent cross-contamination of meat. For instance, person ordered to clean surfaces and equipment shall not be allowed to do other jobs at least during the same shift of the day.

- ❖ Storage and displaying

Butcher shop must be provided with adequate, functioned and well designated facilities for the storage of:

a. Work equipment, sanitizing and hygiene equipment; material and tools, meat handlers and employees' properties. Separate storage design for any category ensures easy management or accessibility as well as assures the safety of meat and employees through determination of roles and responsibilities among all levels and individuals and thus, value added.

In general, Hema (2017) further advocates the view that considerable attention must be paid when designing and constructing storage facilities in

relation to permit adequate maintenance, cleaning and prevents pest to enter.

b. Adequate number of refrigerators, freezers, and refrigeration containers at a good functioning condition in a movable status for storing and displaying meat must be available. The importance of being movable is that, allowing for maintenance and effective cleaning. Keeping meat in a visualized way to consumer to decide purchasing decision through attraction of customers summoned for creating and designing of the visualized refrigerators, freezers. However, displaying carcasses on hooks have been ignored, carcasses exposed to surrounded environment of the butcher shop, where there is emission of inhalation and exhalation gases of meat handlers and coming customers, flies in case of ineffective control or any casual instantaneous condition. Therefore, the importance of designing vertical refrigerators with hooks that can accommodate whole carcasses can also contribute to the safety of the displayed meat.

Perpetual electric source is essential, if there is difficult access to it due to frequent shutdown, in such case availability of reserve generator could be beneficial.

Monitoring and controlling temperature of refrigerator facility for keeping at degree efficient to obtain wholesome meat is around 4 degree ceileus. Mla (2012) pointed out that identifying and determining the level of refrigerator or freezer temperature that is enough to destroy micro-organisms is the most critical point. As an example, Salmonella, E. coli and staphylococcus aureus cannot grow at level less than 7 degree Celsius. Karma (2014) additionally explains that the temperature range between -18 C to -21 Celsius with timely defrosting and keeping tidy and clean can contribute to ensure maximum operating efficiency of freezer.

For managing meat stored in refrigerator or freezer the principle of first in, first out should be followed.

❖ Personal hygiene and hygiene practices

A high level of sanitation and hygiene shall be practiced in every aspects of meat retailing foundation. Meat handlers as pests contribute to inducing of food poisoning when they behave in not recommended practice as they are subjected to being patients when exposed to zoonotic diseases too.

All individuals involved in processing, operating, retailing and manufacturing food must be trained in the practice of personal hygiene and be provided with related written procedures and instructions as well as statutory and regulatory requirements. Before being part of work environment, prior to employment shall undergo health examination to assure free from contagious diseases which inform their fitness to work, this health certification must be designated in appropriate size as identity cards to be hanged on the neck of handler while working and also can be easily observed for both supervisor and customer. Hiring procedures for new coming food handlers shall be under relevant authorities, during the course of their employment and they shall also be subjected to health examination in a routine base. The Food and Drug Administration (FDA) (2006), and also Karma (2014) have pointed that workers suffering from jaundice, diarrhea, vomiting, typhoid infected or any type of contagious disease shall be excluded from work.

The key aspects in relation to personal hygiene and considered to be the sources of food cross-contamination are:

a. Handwashing

One of the greatest challenges is that creating of motivating, fascinating and practical policies of GHPs as a roadmap to be followed by food handlers without any deviation from what recommended through shifting bad behaviors to positive one that in relation to food safety. As argued by Muhammad et al (2016) and FDA (2006) policies like such that…" no bare hand contact, clean as you go" policy must be administration approach,

understood over all levels work environment and must be applied practically. Accordingly, hands must be clean with soap under warm running water, then wiped and dried and kept on specific gloves appropriate to activity required to be done. Fingernails shall be at level permit to easy cleaning. Finger polish, rings and hand watch as well as artificial nails are prohibited strictly. Wash hands before start and after touching any other item or object not related to work, or after toilet, drinking, eating, smoking, coughing, sneezing and/or nose blowing. According to idea effectiveness of hand washing process, Muhammad et al (2016) suggest that the hand washing must be" from palm-to-palm, between fingers, back of hands, base of thumbs, back of fingers, fingernails, wrists and then drying after rinse".

b. Apron or body gear wearing

Full body covering apron or body gear suitable shall be wearied.

c. Hair

Must be covered with hat cup or using of hair net to prevent falling of hair to meat.

d. Foot

Appropriate footwear or boots must be used.

8. Weighing and packaging.

Meat shall not be in direct contact with the surface of weighing machine. The option is using safe packaging material prior to weighing. Plastic packaging bag not allowed because of its resulting in chemical hazards in form of dioxin, it is carcinogenic material. Also traditional weighing machines preferably should be replaced to electric machine.

- ❖ Disposal procedures and facilities

To carry on GHPs, meat shop must be supported with adequate and appropriate disposal facilities; different color of waste disposal containers must be available; each color specific to pre-determined special type of

waste. For instance, red color with symbol of X letter is for condemned tissues suspected to be inflamed, watery sacs expected to contain contagious micro-organism such as larvae of Echinococcus graneulosis, abscesses and questionable lymph nodes. Disposal of these wastes shall be under control of the assigned supervisor. There various types of waste like bones where called solid waste; liquid waste as blood; or even semi solid or semi liquid. Allocating container for each type of waste shall be mandatory and must be applied; it is managerial and hygienic procedure.

- ❖ Pests and customer control

Pests are flies, cats, dogs and rats. They are far more sources of causing cross-contamination of food if their entrance is not prevented and if their allowed to stay and bread. To control pest holes, crevices and cracks must be sealed; doors and windows shall be screened with insects proofing materials; approved chemical materials with recommended usage practices would be applied. Also coming customers shall not be allowed to be inside operation area, the same to their properties, purchasing of meat will be through specific opens, hands shack between meat handlers and customers also prohibited. Moreover, employees as internal customers who were previously having been excluded from work consequence of illnesses shall not be allowed to inside unless proof their medical report that they are free from diseases.

2.1.1.3: preliminary steps prior to implement HACCP approach

Malini (2010) preliminary steps required to run HACCP approach effectively are encompassing of six steps. These are documented information that covers areas such as:

1. Context and scope of the organization involved in food production.

It includes requirements of internal and external parties, applicable regulatory and statutory requirements; risks associated to macro and micro

environment elements issues. Roles and responsibilities, relationships levels, resources required, timeframe, purposes or quality objectives.

2. Establishment of HACCP team.

HACCP team shall be multi-disciplinary team from various knowledge backgrounds and from different departments. At later on the responsibility of developing, implementing and measuring the efficiency and effectiveness of food safety prerequisite programs would be remained to HACCP team Matua (2017).

3. Product catalogue

This step will provide detailed information about product and intended use. It aims to reveal out its ingredients, procedures of preparation, preservation and delivery, processes included, how it could be consumed, consumers allowed to use and those restricted not to use and why Maria (2002). Therefore, useful information related to red meat market can includes; species, age category and source of slaughtered animal; genus, strains of potential biological hazards and their preferred conditions for activating, growth and multiplying of each bio-organisms; information about standard operating procedures, the "shelf life' or validity and expire date ect.

4. Identify all steps and phases of processes that the production of product can take place, the sequences and interaction relationships of processes. This information should be used to develop a flow diagram that visualizes all businesses processes in a simple constructed map. Maria (2002), Kelly et al (2014) have argued that the flow diagram outlines ingredients or raw materials of the product, packaging materials, cutting or chopping processes and related equipment, and storage. Moreover, it covers premises layout, hygiene systems facilities, product delivery and transportation. In a simple manner it determines the effectiveness of HACCP system. Flow diagram includes all steps from farm to the hand of consumer.

5. Monitoring and verification of flow diagram

Continuous monitoring about constructed flow diagram and verifying to ensure that to what extent it remained functioning. This check out can contribute to prioritize the interventions to modify or re-analyze these steps to conform that the steps are actually related to the specific identified process or stage. This lead to create a reasonable process flow diagram that outlines all steps included.

2.1.1.4: Hazards Analysis and Critical Control Points (HACCP) principles.

In the literatures, HACCP (Hazard Analysis and Critical Control Point) tends to be used to refer as a system that consists of two parts-hazard analyzing and critical control point. It is an objective and scientific assessment of each food chain based on a logical philosophy which that is any production process will inevitably subjected to several paths under diverse and unstable or changeable conditions, contributions of multi-different actors. Originally food is fits for human consumption but factors of surrounded environment and/or irresponsible interventions of processors, handlers, producers, and manufacturers that may contribute to some degree of change adequately being hazardous to consumer health when consumed. The uncertainty or probability of occurrence of food hazards stand behind the rationality of conducting analysis before the food hazards find some ways to intervene into food (preventive system).

In the field of food safety the HACCP concept has been defined by Tompkin (1994), Ropkins and Beck (2000), Maria (2002), Kevin et al (2013), Kelly et al (2014), Prashanti and Arjuna (2014), Joris (2017) as a systematic approach to analyze, identify, measure and control of food hazards through traceability of food chain from "farm to fork" or "farm to table". It aims to prevent food from being inedible or injurious, it is a preventive system.

therefore, there are some important considerations must be taken into account such as occurrence of unintended conditions (changes) in regard with external (macro-environment) issues of the organization's context; processes failure as the consequence of misunderstanding and misinterpreting the requirements of customers and related food safety laws, these are often results of communication gaps, capacity building gaps, as well as gaps regarding inadequate of required resources; and operations deviation due to the lack of commitment and knowledge.

As mentioned above, the hazard analysis part concerns with identifying the type of hazard that a food may be exposed to, in regard to specific step or/and phase of a whole chain. Hazards could be biological (Microorganisms- Bacteria, Parasite, Virus, Virions and toxins); chemicals such as Drugs, pesticides, herbicides, insecticides, disinfectants and sanitizing agents; and physical hazards-fractions of bones, metals, glasses, hair, wood , ect. Anticipating the root causes or factors that could result in food hazardous, plan, and take actions to prevent occurrence of significant food hazards is the core function of HACCP approach. On the other side, critical control point means steps in process, environmental conditions, and operational practices that may cause, or allow occurring food hazards. HCCP is depends on two specific process, analyze then control, analyze the type of hazards depends on the sort of product and processes, sources or factors that permit to be, who is responsible for, how can be prevented, eliminated, or reduce its adverse effect, through what actions required to be taken as appropriate means to ensure that it will no longer be able to occur as long as that processes of analyze and control are planned and implemented soundly base on scientific information and potential changes have been controlled.

HACCP approach includes seven ordinal steps which often referred to them as "HACCP principles". Malini (2010) and Heywood (2012).

Ropkin and Bech (2000) introduced the other view of point and highlighted as steps of "HACCP plan".

1. Hazard analysis

Information regard prerequisite programs PRPs, preliminary HACCP's steps, processes steps and operation procedures would be utilized by HACCP team to carry out hazards analysis Ropkin and Beck (2000). However, hazards analysis may extend to include identifying of type, the nature of components of each hazards, the life cycle (bio-hazard) or duration of efficacy-features of antagonist or synergist, subsequent reactions, intermediate compounds (chemical hazard) and amount or size for physical hazard.

2. Identify critical control points

Critical control point (CCP) can be defined as the most important step or stage in the process or/and procedure considered that if not monitored, managed, and controlled effectively, the occurrence of food hazards will be a matter of a time. The point that may assists, induces, provides conditions; factors or reasons on/through which lead to existence, growing, and/or multiple the hazards of food to an "unacceptable level". Repeated inquiries and investigations have to be conducted about identified process flow diagram in order to understand the impact of potential deviation on specific condition or procedure regard determined step (s) in a process, on occurrence of food hazards as well as the contribution of that impact on providing opportunities for existence, growing and/or multiplication of that hazards.

Julie & Scott (2010) have defined (CCP) that the point "at which" if control measure or control criteria applied at it failed could result in biological, chemical, or physical hazard. Joris (2017) and Maarof et al (2017) have stated that the effective approaches for identifying both of CCPs and hazard associated with that CCP are decision tree and risk matrix. Therefore,

HACCP system's principle two while identifying CCP it aims to help in decision making to critical process step or stage that the food hazard occurrence is more likely, and thus, preventive measures must be in place. Decision tree uses reasoning approach to identify CCP involved in process. Malini (2010) and Oloo (2017) through questions as following blow:

Q1.Is there (step) a likelihood of occurrence of hazard to extent that exceed an acceptable level? No is not a CCP. Yes is mean call for or move to second reasoning.

Q2.Is there possible actions or steps to be taken to prevent, eliminate or reduce that hazard to an acceptable level?

- If the answer of Q2 is No the subsequent two questions are: Q2a. Is control at this step if not achieved the food safety hazard is inevitably take place? Q2a **No** stop is not a CCP, Q2a **yes** modify the step, process, or product.

-If the answer of Q2 is yes this mean further inquiry to Q3.

Q3. Is control at this step necessary to prevent, eliminate, or reduce the risk of the hazard to safety level to consumers? No it means not a CCP. Yes it means a CCP.

Q4. Is, are there possible step (s) can be taken at the last-end point on which termed ready-to-eat that, can eliminate the identified hazard (s) or reduce the probability of happening at an acceptable level? Yes means not a critical control point. If the answer is No it is CCP.

Note, the exchange that has taken place at the last question, always it forms the matter of confusion. The possible criticism or ambiguity that can it faces is that, the last-end point effort (s) even if capable for assuring safety of the food, if the responsibility of that is on the side of consumer, still the food constitutes risk, for the reason that the certainty about following best practices while preparing for consumption is a kind of metaphysic.

3. Define or establish critical limits

Critical limits (CLs) are applicable, measurable conditions and/or factors that the HACCP team can rely on when exerting efforts such as activities or actions on identified CCP to prevent or eliminate food safety hazards or reduce it to a state that cannot cause an adverse effect to the health of consumers. Concisely, action and/or activity taken on specific factor and/or condition to: change surviving, production, reproduction and excreting environment; prohibit or decrease existing opportunities; or reduce the consequences to an acceptable level.

To repeat an earlier point, WHO & FAO (2009) and Frank (1992) highlighted that the critical limits are "specific and validated criteria" which includes measurements of temperature, time, moisture level, PH, color, sensory parameter and texture. In addition to that, viscosity, palpation, aroma, weight, x-rays, and ultra violet detectors can be used. As an example critical limits may include maximum or minimum level of a certain factor, interrupt life cycle of a bio-hazards ect.

4. Establish monitoring procedure

Documented information on critical control points (CCPs), operational prerequisite programmes (OPRPs), critical limits (CLs), and action criterion (AC) must be in place for monitoring procedure establishment. Monitoring actions must be planned when and frequency; who can do that, skills and knowledge required (competencies), to what extent monitoring means are valid. If results obtained from monitoring revealed that there are deviations from target set of CLs and action criterion, do the food organization has efficient capacity to deal with those unintended results.

Maria (2002) and Malini (2010) have argued that the information of monitoring must be documented directly and immediately while monitoring actions carrying out on identified CCPs for the accuracy and also assist in keeping or "bringing back" processes on track. A judgment or an assessment about processes' CCPs against target CLs and OPRP against

action criterion will be executed to inform whether there is deviation or not. This means that the competent authorized personnel have to be available in a constant base in the food organization's establishment for implementation of regular daily catch-up monitoring procedures. In addition to that competencies of authorized personnel have to extend to include utilizing and understanding of records of monitoring equipment.

5. Identify and establish corrective actions

Corrective actions are potential scenarios to cope with an anticipated cause of deviation from critical limits at any identified critical control points (CCPs). Therefore, documented information on hazards analysis, hazards assessment, and hazard communication must be available to provide help to identify the potential root causes of deviation at certain CCP. Also it includes data of cause and effect analysis. Corrective actions are preventive or proactive actions on the basis of an assurance system.

6. Establish verification procedures

The concept of the 6th principle of HACCP system (verification) is focuses on the theoretical base of HACCP plan that aiming to prove that it has efficient and justifiable scientific and technical rationale that on which significant food safety hazards will no longer be exist when developed and ensure that plan is being implemented as intended also. Verification procedures are the activities that ensure the HACCP system is effective and accurately implemented as planned and it operate efficient to prevent, eliminate, or reduce adverse health effect of significant food safety hazards at an acceptable level. The verification process of 6th principle of HACCP system includes activities that form the backbone of HACCP system Pamela and Neves (2003), John (2014), these are:

- Validation.

Validation is an action taken to ensure that all HACCP plan components (hazards analysis, HACCP team composition, CCPs, PRPS, CLs, action

criteria…etc) at designation phase have been subjected to scientific and technical information as well as corrective actions and procedures to deal with potential deviations. Validation is an assurance system "doing the right things to control the hazards" based on " scientific and technical evidence" that a control measure or combination of control measures or the food safety plan if executed as intended is capable of / or effective to control the identified food hazards.

- Verification.

It means to what extent the food organization is committed to what has been written as food safety plan or in particular a HACCP system plan. To answer this question, the HACCP team uses methods, procedures, tests, and other evaluations such as monitoring or observation to determine that a "control measure" or "combination of control measures have been met. Verification activity plan shall demonstrate the purpose, frequency, responsibilities and roles.

Verification is ensuring about deviations or failures in controlling identified hazards at identified CCPs by comparing critical limits that have been established with findings obtained when applied methods or equipment. Robert et al (2013) have mentioned that the verification activities can confirm the HACCP system, plan and its records are established, maintained and critical control points are kept under control.

- Revalidation or reassessment.

Reassessment of HACCP plan is always a result of actual changes happen or identifying new hazards. Changes could be in process, inputs, supports whether technical or technology.

In literature it has been argued that verification and reassessment of HACCP system and plan are an audit processes and that necessarily not being conducted by process or operation owner Robert et al (2013) and USDA (1997).

7. Documentation and document keeping.

Documented information about cause of deviation, corrective actions have been taken to eliminate that cause and their effectiveness to prevent recurrence of deviation, responsibilities have been assigned to implement corrective action and corrections must be obtained, maintained, retained and be accessible when and where is needed.

2.1.1.5*:* Challenges or barriers to attain an effective FSMS

Food safety management system as a system that responsible for ensuring the assurance of food safety with perceived food quality throughout food chain it will inevitably face obstacles. By reviewing literatures on challenges and barriers, it was found that the most critical challenges particularly in developing countries and Sub-Saharan Africa Laurian and Nancy (2002), Von and Pandya (2003), FAO (2005) as cited by Grace (2015), Grace (2015) as cited by Tracy et al (2018), WHO (2007), Tracy et al (2018), Atif et al (2012), WHO/FAO/ and National Codex Alimentarius Committee NCAC-CODEX 50 SD (2013) are summarized as:

1. Structural barriers

Due to the overlapping in terms of responsibilities and roles as a result of the involvement of multi governmental authority bodies and lack of coordination and harmonization efforts among them which could impact on food safety assurance efforts to a level could be said far away behind targeted level or just as a respond to health risk events that have already happened, lack of wide engagement of all interested parties, and system of reporting is not clearly schemed. To resolve this paradox one can propose to adopt multi-sectoral or mutli-disciplinary approach to form an authorized body to play its roles and bear responsibilities respective to food safety as well as engagement of private businesses representatives and society.

2. Technical barriers

Knowledge and skills gaps due to lack of training and education programs to build capacity of food safety supervisors as well as training of food handlers in food safety requirements, ineffective and inefficient measure equipment with lack of expertise to use them.

3. Informational barriers

Information about foodborne disease surveillance are not required to inform public, the health and economic impact of foodborne diseases outbreaks are not available, food safety regulatory and customer requirements, policies, and relevant legislations are not deployed, and gaps in clear determination of roles and responsibilities. All these form informational gaps in regard developing countries and Sub-Saharan Africa alike.

4. Financial barriers

A monetary cost aspect of food safety throughout food chain is certainly affects negatively all above mentioned areas in addition to infrastructures (facilities, water, and electricity, roads), transportation means (vehicles) , dissemination channels of information (TV, Radio) and so on...

2.1.1.6: case study.

1. General overview

Nyala is a capital of the South Darfur State, it is a cosmopolitan town. It comprises of three local administrative entities (units) which named localities, these are municipal of Nyal (Baladia Nyala), Nyal North Locality, and Nyal South Loacality.

2. Population

After mass violent conflicts emerged in all Darfur states since 2003, communities were forced to externally and internally immigration. Internal immigrants fled from their original villages to more secured places mainly the capitals of local states in general. Nyala is the capital of South Darfur state, and as a result, the town has become surrounded by several

displacement camps, as well as informal settlements adjacent to the town boarders. As a consequence this complicated situation has had created serious repercussions at various levels such as population pressure, increased need for public health services and high demand of consumptions, particularly daily consumption of red meat. According to the 2009 census the population of Nyala town was 368,000 individuals.

3. Meat markets and related authorized bodies

there are five main meat market in Nyala where meat is processed, handled and sold to consumer these are: Nyala main market in the centre of the town, sometimes it called the big market; Malaja market and Zariba market are located at the north; Mogafe El-geneina market is at west; and Elshaabi market at south. At all these markets have been noticed that displaying and vending meat openly exposed to worst hygiene conditions and practices whether it sold from streets side meat markets where meat displayed on the tables openly or from butcheries either individually in specific meat shop or collection of butchers in a gable which established by local authorities.

Several government agencies are involved in managing, regulating and controlling of red meat market in study area. Organizing activities such as providing licenses, permitting to establish butchery, issuing health cards and monitoring ongoing hygiene practices, meat markets hygiene conditions fall on the mandate area to public health providing unit which governed as sub-structure units of locality administration under the responsibilities of general executive manager of locality. On the other hand, veterinary public health service provider unit is engaged in monitoring and traceability actions about carcasses to ensure that the carcass is slaughtered at recognized slaughterhouse. The state branch of the Sudanese Standards and Metrology Organization (SSMO) is contributes in validation and verification of weighs.

4. Slaughterhouses

There are five public local slabs with one private modern slaughterhouse. These distributed as following: two slabs with modern slaughterhouse in South Locality, one slab for each both of North Locality and Baladia Nyala.

2.2 Previous Studies and International Journals.

1. Role of Implementation ISO 22000: 2005 on Consumer Satisfaction in Mathew Poultry Company Sudan. Nidal.A. A. Hassan (2019).

An evaluation research adopted using descriptive methodology to find out the effect of implementing FSMS standards on the quality of poultry product, consumer/customer satisfaction and it is role in internal processes. 25 Questionnaires as data collection tool have been administered as total sample size and distributed to quality manager, administrators and employees. The results showed the implementation of ISO 22000 facilitated the Company in carrying out awareness actions on food safety and food quality among customer and consumer alike. The study concluded that the efforts needed are further training for all company staff, building food safety culture through fostering broad awareness campaigns and strategic vision to deal with customer dissatisfaction issues.

2. **The role of Implementation Food Safety Management System on Dairy Products. Maha Yahia Ibrahim (2019).**

A negative hypothetical phrasing research, comprises of two parts to assess, the impact of implementation of FSMS on customer satisfaction, quality of dairy products and internal processes improvement has been conducted using descriptive methods to analyze data obtained via questionnaires. Part one allocated to dairy product and the other part specific to Yoghurt experimental sampling test in two diary companies A and B for physical and microbiological evaluation. 25 questionnaires distributed among the employees. For experiment part 10 random samples

of Yoghurt from each company were tested applying Foss Milo Scan Ft1, PH, and Moister media: Violet red bile agar, yeast extract dextrose chloramphenicol and plate count agar. Results showed that 96% of the employees agree that the implementation of FSMS assist in improving the quality and safety of diary product. 80% agree that the production line stops in case of defect occurrence. At experimental part, differences in terms of fat, protein, and density of milk samples collected from A and B Company have been observed and no evidence on detecting of Coliforms, yeast and Moulds in milk sample from two companies. On the other side, Yoghurt samples have shown variations in terms of physiochemical parameters such as PH, total solid contents, lower PH and higher total solids were for the company A samples. In terms of contaminants high counts of coliforms bacteria 0-125 CfU/M, 40% yeast and count range 0-200 CfU/M moulds are found on Yoghurt samples collected from Company B. the study recommends that the capacity building on FSMS requirements can improve the safety of product.

3. Role of Implementing Hazards Analysis Critical Control Points (HACCP) in Food Safety and Customer Satisfaction – Case study Cofftea Company. Sudan. Hana Abdelbasit Abd Alla Hamid (2018).

An investigation research on the role of HACCP in product safety, its mean and implementation has been carried out to understand challenges facing the implementation of HACCP. A case study research adopted descriptive analytical approach. The total numbers of employees working in the quality unit at Cofftea Company served as population and sample size alike. It revealed that Management commitment affect on HACCP implementation process which in terns effect on food safety and customer satisfaction. The study also appointed that there are some factors challenging implementation of HACCP process namely inadequate training, lack of awareness and documentation related to HACCP. The

study recommended that there are three main pillars for business excellent most be focused on. These are continuous training of employees, customer complaints, and documented information.

4.Role of Implementing ISO22000 of meat product. Aisha Yahia Dafallah, (2017).

It aims to provide a framework for management commitment, communication with suppliers and customers. Hypothesis test approach has been employed to analyze a quantitative data which obtained from meat factory employees as a population of the study. Forty questionnaires were distributed to meat factory employees as the size of the study sample based on the stratified random method. The researcher benefited from Likert Scale in transforming qualitative data into quantitative data by giving a specific weight to each expression from 1 to 5 as example. And data have been coded and entered in computer and processed statistically using SPSS tool. Implementing / operating HACCP in meat factory resulting in increasing and improving safety and quality of meat products which 72.5% of the respondents have agreed totally. Where, 32.5% of the respondents have agreed totally that the training is very important for the staff and new personnel which present the most important implementing cost lead to food safety improvement. Also the study reflected that 52.5% of employees are aware of ISO22000 and its importance in the factory. The study recommended that staffs continuous training on ISO22000 and HACCP principles, top management commitment on every decision and engagement of employees in it and more focusing on customers' complaint could play the positive and essential role in improving meat safety in meat factory.

5.The impact of implementation Hazard analysis & critical control points (HACCP) on meat processing. Hashim Abdelrahim Mustafa Elsheik (2017).

A study in Al – Goussi meat factory aimed at understanding of the impact of implementation Hazard analysis and critical points approach through comparing between HACCP implemented and non-implemented companies on securing food production process in food chain to produce safety food. All employees and worker considered to be the study population, divided into two categories. Labors consist of 541.Where the rest around 222 were professionals, random 61 samples formed total size of sample. HACCP implemented organizations had shown that effective process flow which impact on enhancing food safety and quality through implementing quality assurance systems including HACCP. Moreover HACCP implemented organizations have measurement schemes as well as specific sanitation standard operating procedures (SSOPs). However, some confusions on terms as validation and verification reported among professionals working on AL-Goussi meat factory where attributed to the phrase of (HACCP) hazard analysis and critical control points. The outcomes of study showed a necessity for existing independent mandatory body for setting up regulations & legislations frameworks which is related to HACCP system and institutes for all food business firms. Also it reported that gaps in training and HACCP awareness among handlers.

6. Assessment of Food Safety Knowledge, Attitudes and Practices among Slaughterhouses workers in Khartoum State – Sudan. ABEER ISMAIL TOM ABLAH (2017).

A study carried out on assessing the workers knowledge and attitudes through comparing actual work hygiene conditions with ideal state of food safety and hygiene to understand status of compliance with safety standards of meat in Sudan. All workers of two export slaughterhouse in Khartoum State (60) considered to be the population and sample size of this study. Thus, 60 questionnaires administered randomly. The data obtained imported into SPSS to analyze comparatively, descriptively and hypothesis

test. The study demonstrated that there are a strong relation between knowledge, learning, education, training and applying and commitment to good hygiene practices in the export slaughterhouse in the Khartoum. In contrast, another Dilemma came in the surface that the attitudes towards commitment to food safety requirements is not depend only on workers knowledge but other factors may have impact on it as the author expressed.

7.Assessment *of* Hygiene Practices used by Small Butchers and slaughter Slabs in Beef Value Chain in Juba Town-south Sudan. Peter A.S. Aburi (2012)**.**

The study aimed at assessing hygiene practices of small butchers and slaughter slabs; and understanding of possible causes of unhygienic beef handling practices in six markets of the town. Structural questionnaires, key informants interviews, and observational assessment used to obtain data and analyzed employing SPSS. Results obtained highlighted that, majority of butchers are young. Their age ranged between 25-35 years old. 47.5 of responded butchers were belonged to primary education level. Above fifty percent of butchers were not have health cards. Nearly all butcheries not issued with valid licenses and above eighty percent of butchers were not trained on good hygiene practices.

The study was recommending that, existence of policy and legal framework is needed urgently, Awareness efforts should be implemented, effective monitoring and control to ensure compliance with laws requirements, and cooperation and coordination is needed between beef chain interested parties.

8.Bacteriological Quality of Export Sheep Meat in Khartoum Slaughtered House. Omnia Hassan Abdelrahman Ali (2003).

This study was carried out to achieve several objectives these are evaluating quality of sheep meat for export which slaughtered in Khartoum state through isolation of Escherichia Coli and Staphylococcus as well as

assessing meat hygiene conditions in Khartoum Slaughterhouse. To do that, 255 swabs samples were taken from different sites of Lambs carcasses (Neck, Shoulder, back), workers hands, and knives through. The outcome was that, the most dominant isolated organisms were gram – negative as well as the most critical sources of contamination are processing stages such as the skinning and washing. In comparing workers hands with knives also the study revealed that the highest contaminated levels of gram – positive bacteria was the workers hands, while in contrast knives have shown high contamination level with gram – negative bacteria. The study concludes that implementing HACCP system and food safety management system (FSMS) in Slaughterhouse with providing effective training programs to workers can improve hygiene aspects as sanitation, washing, sterilization in Slaughterhouse and equipment.

9. Journal of Agricultural Science, Vol.10, No.8.Published by Canadian Centre of Science and Education (2018). Hygienic conditions in Butcher shops at the city of Navirai, Brazil – An Applied case study. Femendal et al (2018).

The study was undertaken to evaluate the hygienic and sanitary status of Butcher shops in terms of facilities, employees, and operational processes of two model establishments in order to gain full insight about problematic issues in relation to meat market hygiene and sanitary. It is a case study, employed observation method through a checklist tool prepared previously to cover whole study boundaries which divided to group A & B. the study highlighted evidence of non-compliance to the ideal state related to food hygienic – sanitary conditions in terms of inadequate water supply 37.5% for butcher A and 53.8% for butcher B; waste disposal 66.7% for butcher A and 83.3% for butcher B; meat was contained in plastic boxes and kept on the floor of freezer; both shop did not use recommended chemical for sanitation and 30.7 % of handlers working in butcher shops were not

trained before on best practices of hygiene. The study ended up to state that the multi – disciplinary multi – functions responsible body is in need with owner behaviors and attitudes changing mechanisms either by conscientiousness or by enforcement.

10.Current Journal of Applied Science and Technology.Vol.*23, No.3, (*2017*).* Meat hygiene and Associated Health hazards Awareness among Consumers of Jammu District *of* Jammu and Kashmir. Sheikh et al (2017).

A study to outline the capacity building and knowledge gaps in relation to meat hygiene and associated health hazards among consumers on the basis that the consumers comprising the cornerstone in any business when putting the concept customer driving business in concern. The methodology followed to conduct this study was through survey using structured interview schedule to collect data. a population lists prepared from three (3) meat market consumers, ten (10) shops for each market and four (4) consumers per a shop then, population total number was 120 consumer. 21 consumers were selected randomly to serve sample size of the study. The data was coded, classified and analyzed using statistical package for social science (SPSS16.0). The fact that obtained was consumers were less aware of health status and good hygiene practices. Lesson learned from it is an awareness raising campaign among meat consumers would be the most recommended tasks in future.

11.Journal of Preventive Medicine and Hygiene (2017); 58:E320E327 Food safety knowledge, attitude and practices of meat handler in abattoir and retail meat shops of Jigjia Town, Ethopia, Tegegne et al (20017).

A cross sectional survey study was conducted among eat handler from a municipal abattoir and ten retail eat shops. Ninety two meat handlers were interviewed by using structured questionnaire to determine the food safety

knowledge, attitudes and practices. Results obtained were 78% of respondents have unsatisfactory knowledge level; almost, all meat handlers aware of how to clean and sanitize food contact surfaces 95.6%; 89% said people with open skin injury should be excluded from work; 41.8% had least knowledge about the importance of using gloves; 64% have good attitudes about food safety; almost, all respondents said washing hands before and during food preparation is mandatory; 91.2% of respondents aware of keeping working surfaces and utensils clean reduces the occurrence of diseases; 80.2% of meat handlers aware of the importance of cleaning the surfaces and equipment before using; 87.9% of respondents recognized that knives and cutting board must be cleaned and sanitized to avoid cross contamination; 78% of meat handlers emphasized that wearing of protective clothes and shoes could guarantee the safety of workers and hygiene practices; 68.1% of respondents agree that hair cover is within good practices in food firm; 78% declared using potable water to clean meat contact surfaces and utensils; 71.4% of respondents aware of sneezing and coughing direct to meat is unhealthy; 69.2% eat and drink inside work place; 98.9% of eat handlers use gloves all day work; 55% do not use apron; 62.6% do not use cap and 89.9% also do not use ask. The study recommends that training on food safety and personal hygiene education should be continued.

12.Journal of FOODBORNE and ZOONOTIC DISEASE. Vol.4,issue1. (2016). Studies on the prevalence, Risk Factors, Public Health Implications and Antibiogram of Listeria monocytogenes in sheep meat Collected from Municipal Abattoir and Butcher shops in Addis Ababa, Mulu and Pal.**(**2016).

The aim behind the study was determining the presence of Listeria monocytogenes in raw meat of market and abattoir as well as antibiotic

resistances characters of the isolates. A cross – sectional study was carried out during sex month (October 2013 to April 2014). Sawb samples of sheeps' meat taken equally from abattoir and butcher shops, 384 per each which a sum of all were be 768 Swabs, in addition to 105 Swabs from equipment. So, the total sample size was 873 Swabs. Also a questionnaire survey was conducted to assess the hygienic practices of meat production including meat market and abattoir. The results derived from this study was 4.1% of the prevalence of the organism mentioned from total sampling (873) examined Laboratory. However, as a comparison the prevalence is higher in butcher shops than abattoir. Where 105 equipment Swabs collected from butcher shops and abattoir equally, showed no significant differences. The more interesting one was that, multi – drug resistances isolates expressed their unique characters obviously. A need for effective and efficient storage facilities, hazards analysis and plans, addressing communication, risk perceptions, strengthen of hygiene practices. For scientific resolutions of antibiotic resistances further studies on genetic engineering is the choice.

13.International Research Journal of Biological Science. A comparative Study of Hygienic status of Butcher and Identify bacteria among the Slaughters of Meat, Chicken and fishmongers markets of the Jagdapur city, Chhattisgrah, India.(2014).Vol.4, No.1. Khelkar & Tiwari.

An assessment of the hygienic status of the Slaughter workers (men) through inspecting, using laboratory tools and methods conducted to detect the amount and species of microorganisms on the body and tools of slaughter men. All men who were working in chicken markets, goat slaughterhouse, and fishmongers were forming the study population which the sample size derived from it. Also a total of 5 slaughterhouses, and 5 fish shops workers were interviewed. Samples taken from the water on the

hands of goat, chicken meat slaughters along with fishmonger during the night and morning as well as other samples from hands of normal men at the same time. The result was considerable numbers and types of organisms at the night and in the morning. But the higher records were at night period. Via Biochemical tests Staphylococcus. aureus; Corynebacterium diptherae; Staphylococcus epidermidis; Shigells species; kleibsiella species; Proteus valgaris were obtained from hands of chicken slaughter men, goat slaughter men and fish shops men. However, in comparing with what have been isolated from hands of normal men were non-pathogenic organisms such as Staphylococcus epidermidis and corynebacterium diptheriae. Thus, the hands of workers were critical control points as a result of lack of related knowledge and training.

14.African Journal of Food Agriculture, Nutrition and Development.Vol.10, No.11, 4379-4397 (2010). FOOD SAFETY and QUALITY MANAGEMENT IN KENYA: AN OVERVIEW OF THE ROLES PLAYED BY VARIOUS INTERESTED PARTIES. Jasper Oloo (2010).

The study aimed at highlighting the accumulated roles of different players involved in the food supply chain to promote safety, quality of export and import food. And legislations regulate this business. A desk top review of literatures review was carried out. Results obtained divided into two categories: Strengths as; availability and distributed regulations at all levels of food chain, legislations for enforcement was in place, existence of competent personnel, certification services were in place, recognition of need to improve coordination of food safety and control activities were mentioned; weakness as: lack of coordination; poor harmonization among regulations; inadequate protection of local consumers; inadequate laboratory services; inadequate surveillance system and lack of consumer awareness program. The study ended up in recommending that Continuing

efforts are needed to make training courses, monitoring and evidence based evaluation actions from technical, professional, and competent institutes.

Chapter Three

Study Methodology.

Introduction

As this title indicates, this chapter includes the research methodology of the study. In more details this part of the study will illustrate the study strategy, the study method, the study approach, methods of data collection, selection of the samples, the study process, the type of data analysis and the ethical considerations.

3.1: The study strategy.

This case study is based on the descriptive, statistical analytical approach which can be classified on the category of objectives driven basis. It was an applied one, but not new. Rather numerous pieces of previous academic studies exist regarding the hygienic issues related to meat which described as one of the greatest nutritionist food products which that derived from animals and at the same time it can plays more dangerous roles to the human health if not dealt with it on the scientific manner.

In general, as such the proposed study took its unique features or the form of a new from focusing on more than one dimension as complimentary pillars contributes positively or undesirably negative to the meat market hygiene conditions. Also from its study area context and on the basis of some statements such as proactive thinking and food safety is a shared responsibility which indicating a need of various mechanisms of participation, collaboration, and co-ordination. As well as judging about whether the duality functions of related government authorities may impact negatively on managing, monitoring, and verifying systems they undertake, in addition to actions taken in case of occurrence of non-conformity.

3.2: Study methods.

Study methods adopted to carry out this study is qualitative and quantitative (multi- method). The rationale to stick on that is depending upon the nature of the study questions which cited before in chapter one of this. Where Ulrika et al (2011) quoted from Creswell (2003) that the mixed methods … "can be particularly used in the healthcare field as the complexity of the phenomena that includes a broad range of perspectives". On the same path Roslyn et al (2015) confirmed in reference to Creswell and Plano (2007) that the core or principal goal for adopting more than one method in a study is for obtaining more considerable, meaningful, and feasible results which reflect better understanding about the nature of study problem, that the capability to generate practical and satisfied solutions that contributing in tackling all shortcomings related to included dimensions.

The emphasis of mixed methods is that, the quantitative method leads to obtaining numerical data; it concentrates on measuring the scale, range, mean, medium, standard divisions; to name but not limits of a problem or phenomena; and the study can be highly constructed and result can be easily collated and presented statistically. On the other hand, qualitative method involves examining and reflecting on the less tangible aspects related to the study problem as perceptions, attitudes, feelings, or even difficult to express publicly issues. On other words it is a social platform for revealing what were hidden and left in respective period of times that in its turn accumulated and contributed on observable study problem.

3.3: The study approach.

The research approach that followed for the purpose of this study was descriptive, statistical analytical approach which utilizes Hypothetico-Deductive reasoning for inquiring knowledge. This idea was created by Karl Popper in the beginning of 1960s, who was considerably being the father of Hypothetic-Deductive approach. That the intention was that, to overcome the

shortcomings aspects related to each type of reasoning (inductive reasoning or deductive reasoning) was led to appearance of Hypothetico-Deductive approach which named also scientific approach Nicholas (2011). For more highlighting on this approach and for more broad and an accurate understanding, one may or must wonder what inductive and deductive reasoning are? First of all, inductive reasoning was advocated by Aristotle and deductive reasoning was Plato since the ancient Greeks Nicholas (2011).

Inductive reasoning, also called empirical reasoning; the cornerstone of this approach depend mainly on the power of sense and mind. Therefore, observation about evidences surrounding specific situation, phenomena and/or problem is will be the first step which followed by questioning mentally to develop common sense. Furthermore, the arguments generated from Nicholas (2011) and Agile (2008) illustrated that the inductive reasoning begins from specific observations or sensory experiences which lead to some inquiries as why; what; when and how. Efforts made for answering these inquiries lead to borne general conclusions. Thus specific observations led to generalization this generalization led to theory. Where, Martin (2008) confirmed that as cited from Peirce (1905); Santaella (2005); Fann (1963) and Madden (1960) … Induction is the experimental testing of a theory.

The central point of the induction is the specific "premises" or "statements" this premise is the outcome of close observing of specific problem thus through reasoning we come up with that conclusion. However, the validity of conclusion which comes out of the premises depend basically on the numbers and quality of the observations, so as long as, it is an action of human beings it probably can end up with some variations which lead to false conclusion Nicholas (2011) and Kristina (2012). Indeed, probability is the fundamental motive which encourages us to enquire and gaining knowledge. However, the

problems with inductive are as "how many observations are required to get a true conclusions, how many situations and under what conditions should the observations be made so that true conclusions can be made" Nicholas (2011). This mean before conducting inductive reasoning one have to think about criteria of sampling and features of sample against population to examine where that the sample represents the population under studying.

Deductive reasoning also called the rationalist approach, it is in contrast to what mentioned above (inductive). It begins with general statement to specific conclusion. To apply this approach there is a need for medium step before reaching to conclude, this medium step is the establishing of hypothesis Nicholas (2011). Hypothesis would be exposed to test observationally and experimentally to generate conclusion possibly be true. At the same point Kristina (2012) debated that" a valid deductive (…) is necessarily truth-preserving and validity is all-or-nothing type of property, if does not came in degrees". Again the validity of reasoning deductively has arises to be a considerable challenge, because it depends on the acceptability of the premises or statements which related to the subject of a study, and thus the truth of the conclusions depend extremely on the truth of the premises on which it is based.

The most astonishing and clear depict was that when the process of reasoning start from observation up to invent a theory through hypothesis testing is an inductive reasoning and vice-versa is deductive reasoning, this was what cited by Agile (2008) when claimed that inductive reasoning is "a bottom-up or hill climbing and the other is a top-down or waterfall".

Being back to what we adopted as approach to carry on this study (Hypothetico-Deductive). As mentioned by Nicholas (2011). The hypothetco-deductive reasoning begins firstly with clear statement of the study problem,

second developing of testable hypothesis inductively from arising questions of the problem, then obtaining of data and analysis deductively by using statistical method, and at last practically or theoretically testing through falsification or skepticism which lead to refutation or accept according to results obtained. From the view point of Karl Popper one may stress that the logic of hypothetico-deductive contributes to our conceptual understanding of the study problem.

3.4: Data collection method and tools.

Data collection means gathering information to address those critical research questions of the study. These are primary and secondary data.

3.4.1 Data collection methods.

In this study two method of data collection were adopted:

1. Qualitative data collection
2. Quantitative data collection

The qualitative data collection relies on an interviewing and it is structured.

The quantitative data collection method play an important role in assessing red meat market hygiene conditions by providing information useful to understand the current status of the problem behind observed result and assess challenges facing in regard to related parties involved.

Both qualitative and quantitative data are selected for this study.

3.4.2 Tools of data collection

1. Questionnaires

This was the main data collection tool. Data obtained through this tool are basically quantitative derived carefully from study questions and hypotheses, each question considered to be independent statement which stance alone as a theme; any theme consists of several points that address issues regard to meat market hygiene; these questions are treated through five-point degree rating of the Likert scale from 1 (strongly agree) to- 5 (strongly disagree). Equally it has been mentioned that qualitative data can be converted to quantitative

through rating to dimensions or numbering Osang et al (2013). Every sheet of questionnaire divided into two sections; section one is denote to address issues related to meat handlers hygiene knowledge and skills, level of awareness among them, the extent that highlights their understanding of food safety and related regulation and statutory requirements. section two is specific to veterinary service provider and public health provider that involved in inspection, monitoring, and/or managing of meat markets, butchers and/or meat handlers in their meat displaying area (shops or openly beside roads on tables). There are (five red meat markets). These are: Nyala main market in the centre of the town, sometimes it called the big market; Malaja market and Zariba market are located at the north; Mogafe El-geneina market is at west; and El-shaabi market at south in addition to related authorities (veterinary and public health services providers at the study area.

Respondents were selected at random basis. This field work will be achieved through structured questionnaires. Distribution of the questionnaires to respondents was done face-to-face basis, its language translated direct in Arabic language by researcher in order to enable all participants to communicate and understand. This process leads to gather primary data. Questionnaire divided into two distinct sections. Section one devoted to meat handlers at butchery points, it covers; demographic information such as names of the market, age, education level, and fifth pivots that includes research questions related to hypothetical statements as meat market hygiene conditions and meat handlers (butchers) personal hygiene practices and attitudes; The level of basic hygiene knowledge and awareness on good hygiene practices among the butchers; deployment and communication of food safety regulations, laws, and hygiene procedures among meat chain interested parties to address issues like: personal hygiene and sanitation practices, organizing markets in terms of obtaining ratifications, health cards, offering capacity building programs to butchers

on the Food Safety Management System's requirements and basic hygiene knowledge, deployment and communication of statutory and regulations framework which governs and regulates meat markets, in addition to collaboration and co-ordination mechanisms with authorized governmental bodies. The second section specific for veterinary services and public health providers which comprised of one pivots or axis allocated to assess: the best governmental roles, mechanisms that should be applied to introduce hygiene regulation and enforcement at butcheries points; potential challenges that can inhibit related governmental authorized bodies to introduce and enforcement of food safety management requirements and HACCP principles at meat market and butcheries point; in addition to basic demographic information such as age, gender, education level, and occupation.

2. Checklist

This is an appraisal tool as supportive means to obtain qualitative data. This was carried on with observation of butcher shop during operations course action of day time; observation and checklist tools covered aspects such as general requirements; managing requirement; health and hygiene requirements; sanitizing and maintenance; cleanliness ; hand washing facilities; and medical check-up or healthy cards. Observational checklist supported by images taken from butcher shop or displaying tables as spoken evidences that could demonstrate and reveal out the hygiene conditions of butcheries and personal hygiene operations undertaken. According to Warnock (2007) has developed a food hygiene checklist as observational tool partner with local community in Combedia and Loas which benefits from concept of WHO's that named "Five Keys to Safer Food Message" and applied it in rural communities, results found out that the critical food safety issue is about unhygienic behaviors and practices as cited by Woldt and Moy (2015). In addition, Mugenda (2008) as cited by Monica (2016) claimed that observation was the most powerful and widely recognized research tool for

obtaining data in the social science as well as food handling knowledge, practices, and hygienic conditions of facility. In line with that Monica (2016) advocated that using observation checklist can be benefited from shortcoming aspects of other data collection tools through minimizing the confidential matters of data, because it outlines the differences between what have been said by participants and what actually going on in the field, thus, using it assist in collecting data about "quality" and quantity of physical facilities, determining and assessing the existence, functionality, accuracy and performance equipment.

In a study of Campbell (2011) "Yes" and "No" observational checklist was used to identify existence and usability of hygiene facility and hygiene practice equipment and made an argument that the despite of effectiveness of checklist as an observational research tool has limitations if used as a main tool for "gathering data" and made a recommendation that these data if needed to be more accurate have to be supplemented with other techniques such as questionnaires, group discussions, key informants and photos or images.

Ana et al (2017) have stated that by using checklist tool one can reveal out to what extent meat handlers hygiene practices and hygiene maintenance of the facilities are conform to GHPs and named it "the main visual inspection tool". Non-conformance of food handling practices due to ignorance of GHPs or lack of food handler commitment as results of a study used checklist tool have been mentioned and reported as the most food safety critical problem that caused food borne diseases Chigozie et al (2014).

Moreover, checklist as a tool for assessing hygiene, wash and sanitation in humanitarian field also has been used widely and included early in Sphere Project Handbooks as an effective tool, The Sphere Handbook (2018).

Finally, Food safety and Standards authority of India has launched a project under logo of Hygiene Rating and Right place to eat for food service establishments and provided unique, unity and agree upon checklist within all country as a recognized

tool and guidance document for evaluating safety of foods via assessing hygiene conditions of foods delivered in India Heena (2019).

In a conclusion and for accomplishment of this study we adopted the notion of Campbell (2011) that mentioned above. So we could use checklist which supported with images to obtain data regarding to aspects in interest of the study. In doing that 25 checklist sheets have been administered randomly basis on 5 sheets for each market.

3. Desk study.

To conduct this study, data from secondary sources is used such as books, journals, periodic or annual reports of pertinent authorities and searching engine (Google search).with the aim to get detailed information about literature on good hygiene practices used worldwide and locally in food safety issues especially in meat markets.

3.5: Population and Sample selection procedures.

3.5.1: Target population

Target population consists of interested parties involved in this field who sharing specific work environment (slaughterhouses, meat market) and the same product (meat). They are exposed to or subjected to hazardous of animal derived food-borne diseases according to their day- to-day contact basis. Therefore their health will be constantly at risk. Furthermore, consumers' health depends on extent to which they act in that work environment. Wikipedia offered a statistical definition when stated that" in statistics a population is a set of similar items or event which is of interest for some question or experience". Scheaffer et al (2006) have provided more comprehensive definition when stated that "a population is a collection of elements about which we wish to make an inference". But these elements are necessarily should not be contradicted to degree that can create a kind of felony to the logic, we mean that there must be common characteristics or

properties shared within population individuals and these properties would be acceptable to the logic.

Briefly we can say that all individuals working in five meat markets including Nyala main market in the centre of the town sometimes it named by the big market; Malaja market and Zariba market are located at the north; Mogafe El-geneina market is at west; and Elshaabi market at south; veterinary services provider unit and public health provider unit. All these workers are representing the target population of this study.

Prior to carry out this study and due to lack of prerecords about total number of butchers, handlers, operators and butcher shops owners in all these mentioned markets, the study process will take into account possible actions to obtain accurate lists. However, there are some respective bodies which forms patterns of organizing under what so-called a committee of butchers for every market with an individual pointed from both related authorities involved in this field who is supposed to be a focal point (the head of butchers) or a reference body for any decision in relation to that. In the other hand records of two other entities involved in this field (veterinary & public health services provider) can easily be obtained from mangers' desks.

Total individuals of these three sections encompass the whole study population. Through interviewing with managers of two governmental authorized bodies and head of butchers for each market the total population of the study is obtained as following:

Total numbers of butchers and meat handlers at five meat markets are = 411 individuals.

Total numbers of veterinary services providers are = 91 individuals.

Total numbers of public health providers are = 48 individuals.

So the total population is the sum of these three categories equal 550 individuals.

3.5.2: Sample and sampling technique

The emphasis on a sample is that the scarcity of financial and moral resources for studying whole population as the census study can play a hinder factor for a great deal of researchers, so invest on some representatives of total population can lead to save money, time and efforts for doing so. Sample can be defined as" a subset" or "a fraction" or "a part" derived from a study population under defined set of criteria Lawal et al (2018). Bering in mind the previous point that the sample is a strict subset of the population or a group of relatively smaller number of individual selected from a population for gathering data could be helpful for solving problem of the study.

1. Sampling technique

The method of randomly sampling was used to develop the sample of the study under discussing according to this technique, will be stratified random sampling which belong to the category of probability sampling. Putting in consideration that the population consists of different non-homogenous sections regarding to the level of interests; income; education; expertise; personal perspectives; or even their interactions and interrelationships to name but a few. All these considerations will contribute to determine and selection of appropriate type of sampling. In a current study sampling members who were selected had specific relationship with the study area, topic, relevant work environment, and the questioning about their roles and responsibility in the interest of supreme authority.

There are many scholars on similar studies stressed that stratified random sampling is the most practical, capable, unique technique when population of the study shows inter-differences, non-homogenous. Prabhat and Meenu (2015) Heterogeneity of population for some is a challenge but one can invest on diversity features of population to generate most reliable solutions. Moreover, it is difficult to find pure harmony population in some study topics for its complicated nature, several patterns of interactions with multi sections

impact on it in a regular base. A prerequisite procedure for obtaining representative samples from heterogeneity population of the study lawal et al (2018), Prabhat and Meenu (2015) Proposed that any sector, fraction, unite or section can be considered as sub-independent homogenous population through dividing based on the shared features or characteristics to respective level which ensuring the homogeneity, this sub population termed as strata or stratum and its process was stratification. For doing so and depends on the nature of the study topic proposed, this study was adopted the stratified random sampling technique (method).

2. Sample size

Total sample size of the study comprised of 195. So, 195 questionnaires administered randomly through face- to –face interviews. There is no invalid questionnaire because, the researcher is one who translates the language of the tool to participant and help to tick on preferred answer to him/or her.

Equation:

$$n_0 = \frac{z_{\propto}{}^2 * p * q}{e^2}$$

$$n = \frac{n_0}{1+\frac{n_0}{N}}$$

$$n_0 = \frac{1.96^2 * 0.10 * 0.9}{0.05^2} = 138$$

$$n = \frac{138}{1+\frac{138}{411}} = 106$$

Table (1) illustrates the numbers of butchers and meat handlers of each market.

Name of the market		Numbers of butchers and meat handlers/market			Total
		Camel	Cattle or cow	Sheep and Goat	
Big Market	Population	9	46	20	75
	Sample	**2**	**12**	**5**	**19**
Malaja Market	Population	3	32	22	57
	Sample	**1**	**8**	**6**	**15**
Zariba Market	Population	38	37	30	105
	Sample	**10**	**9**	**8**	**27**
Mogafe El-geneina Market	Population	2	36	30	68
	Sample	**1**	**9**	**8**	**18**
EL-shaabi Market	Population	6	60	40	106
	Sample	**1**	**16**	**10**	**27**
Total	Population	58	211	142	411
	Sample	**15**	**54**	**37**	**106**

Source: done by researcher

$$n_0 = \frac{z_{\propto}^2 * p * q}{e^2}$$

$$n = \frac{n_0}{1+\frac{n_0}{N}}$$

$$n_0 = \frac{1.96^2 * 0.10 * 0.9}{0.05^2} = 138$$

$$n = \frac{138}{1+\frac{138}{91}} = 53$$

Table (2) illustrates the veterinary services provider individuals responsible for meat safety.

Occupation	Number	Sample
Veterinarian	42	**25**
Technician	4	**2**
Technologist	29	**17**
Workers and veterinarian nurses	16	**9**
Total	91	**53**

Source: done by researcher

$$n_0 = \frac{z_{\propto}{}^2 * p * q}{e^2}$$

$$n = \frac{n_0}{1+\frac{n_0}{N}}$$

$$n_0 = \frac{1.96^2 * 0.10 * 0.9}{0.05^2} = 138$$

$$n = \frac{138}{1+\frac{138}{48}} = 36$$

Table (3) illustrates the public health providers who work at meat markets.

Occupation	Number	Sample
Public health inspectors	8	**6**
Public health observers	32	**24**
Public health observer assistants	8	**6**
Total	48	**36**

Source: done by researcher

3.6: study process

To conduct this study, there is a need to take several steps as following:

First, is obtaining of accurate, well estimated lists of members of each sub-population through conducting meetings with heads of butchers committee and managers of related authorities.

Second, informing of all participants about nature, objectives and scope of the study, sorts of data required and types of data collection tools being used.

At last, selection of participants of each sub population randomly based on their proportion to the total of the sample size.

3.7: data analysis

Data analysis is a process of enabling to convert raw data to meaningful sets of patterns called findings, these serve as a road map towards generating best recommendations and conclusions. The purpose of data analysis in relation to this study is to support decision making, install best practices and bridge gaps in terms of hygiene awareness, mechanisms of practice on the mutual benefits concepts and its efficiency. Ways of data analysis employed in this study are:

1. narrative- descriptive analysis

Data obtained through observation (checklists and photos) are qualitative so that, can be analyzed narrative and descriptive.

2. Statistical analysis

Data that gathered through closed-ended questionnaires are quantitative; its analysis is through utilization of Excel and Statistical Package for the Social Sciences (SPSS) through coding rating from 1 to 5. Data respect to the pivots of the study will be analyzed using Chi-square test of every statement included in the main statement of the pivot independently, and Cronbach'sAlpha coefficient for testing or verifying consistency and reliability on statements of every pivot, validity coefficient, as well as frequencies and percentages. Basic demographic information for both respondents of meat handlers and governmental authorized bodies' individuals such as Age, market name, and educational level, gender, occupation were be treated also applying frequencies and percentages. Results of analysis for discussions were presented on tables and graphs.

3. reliability and validity of the questionnaire

a. section one data validity and reliability

Cranach's alpha method: -

Where reliability was calculated using Cranach's alpha equation shown below:

$$\text{Reliability coefficient} = \frac{n}{n-1} * \frac{1 - \text{Total variations questions}}{\text{variation total grades}}$$

$$\text{Validity} = \sqrt{\frac{n}{n-1} * \frac{1 - \text{Total variations questions}}{\text{variation total grades}}}$$

Cranach alpha coefficient = (0.96), a reliability coefficient is high and it indicates the stability of the scale and the validity of the study

Validity coefficient is the square of the islands so reliability coefficient is (0.98), and this shows that there is a high sincerity of the scale and that the benefit of the study.

Table (4) illustrates the Cranbach's alpha method

No	Value	reliability	Validity
1	meat market hygiene conditions	0.89	0.94
2	meat handlers (butchers) hygiene practices	0.91	0.95
3	meat handler's hygiene attitudes	0.97	0.98
4	The level of basic hygiene knowledge and awareness on good hygiene practices among the butchers	0.95	0.97
5	Deployment and communication of food safety regulations, laws, and hygiene procedures among meat chain interested parties	0.98	0.99
Total		0.96	0.98

Source: done by researcher

b. data validity and reliability of section two.

Cranbach's alpha method: -

Where reliability was calculated using Cranach's alpha equation shown below:

$$\text{Reliability coefficient} = \frac{n}{n-1} * \frac{1 - \text{Total variations questions}}{\text{variation total grades}}$$

$$\text{Validity} = \sqrt{\frac{n}{n-1} * \frac{1 - \text{Total variations questions}}{\text{variation total grades}}}$$

Cranbach's alpha coefficient = (0.91), a reliability coefficient is high and it indicates the stability of the scale and the validity of the study

Validity coefficient is the square of the islands so reliability coefficient is (0.95), and this shows that there is a high sincerity of the scale and that the benefit of the study.

3.8: Ethical considerations

Conduction of this study was made under certain ethical issues which of them are:

-participants were informed previously about the purpose and aims of the study, their answers were used only for that and cannot be used/ or transformed to any institutes or authority. Also their names or addresses are not included so they were free to participate.

-Except of the above, participants were treated with respect manner without any form dissonance or abuse physically or psychologically.

-Their busy day time will be taken into consideration, and creating climate of mutual interest is on the top of priorities.

Chapter Four

Data Analysis and Results

4.1: Results of section one of questionnaire which specific for butcheries and meat handlers.

Table (5) illustrates the frequency and percentage for the Name of the market.

Name of the market	Frequencies	Percentage
Big market	20	18.9%
El-Malaja market	15	14.2%
El-Shaabi market	27	25.5%
Mogafe El-geneina market	16	15.1%
El-Zariba market	28	26.4%
Total	106	100.0%

Source: done by researcher

Table (5) illustrates the views of the distribution of the Name of the market sample by Big market by (%18.9) and El-Malaja market by (%14.2) and El-Shaabi market by (%25.5) and Mogafe El-geneina market by (%15.1) and El-Zariba market by (%26.4).

Table (6) illustrates the frequency and percentage for the age.

Age	Frequencies	Percentage
Less than 18 year	2	1.9%
19-39 year	39	36.8%
40-59 year	58	54.7%
more than 60 year	7	6.6%
Total	106	100.0%

Source: done by researcher

Table (6) illustrates the views of the distribution of the age sample by less than 18 years by (%1.9) and 19-39 year by (%36.8) and 40-59 year by (%54.7) and more than 60 years by (%6.6).

Table (7) illustrates the frequency and percentage for the Education level.

Education level	Frequencies	Percentage
Illiterate	10	9.4%
Basic	42	39.6%
Secondary	51	48.1%
Graduate	3	2.8%
Post graduate	0	0.0%
Total	106	100.0%

Source: done by researcher

Table (7) illustrates the views of the distribution of the Education level sample by Illiterate by (%9.4) and basic by (%39.6) and Secondary by (%48.1) and graduate by (%2.8) and Post graduate by (%0.0).

Table (8) illustrates the frequency and percentage for the meat market hygiene conditions.

No	Items	Strongly agree	Agree	undecided	Disagree	Strongly disagree
1	The place of butchery is close to public toilet	33	3	0	44	26
		31.1	2.8	0.0	41.5	24.5
0	The place of butchery is close to fruits and vegetable selling place	85	21	0	1	0
		79.2	19.8	0.0	0.9	0.0
3	The place of butchery is close to tobacco selling place	15	2	1	65	23
		14.2	1.9	0.9	61.3	21.7
4	The place of butchery is close	49	11	0	24	22

	to wastes gathering place	46.2	10.4	0.0	2.6	20.8
5	Meat shop or butchery is not supplied with potable water source	98	6	0	1	1
		92.5	5.7	0.0	0.9	0.9
6	Meat shop or butchery is not connected to drainage system	94	6	0	1	5
		88.7	5.7	0.0	0.9	4.7
7	Meat is displaying on tables outside near to street	50	4	0	32	20
		47.2	3.8	0.0	30.2	18.9
8	Meat is displaying inside butchery open on the tables and hooks	52	2	0	32	20
		49.1	1.9	0.0	30.2	18.9

Source: done by researcher

From the above table result shows:

The place of butchery is close to public toilet by the strongly agree (%31.1) and agree by (%2.8) and undecided by (%0.0) and disagree by (%41.5) and strongly disagree by (%24.5).

The place of butchery is close to fruits and vegetable selling place by the strongly agree (%79.2) and agree by (%19.8) and undecided by (%0.0) and disagree by (%0.9) and strongly disagree by (%0.0).

The place of butchery is close to tobacco selling place by the strongly agree (%14.2) and agree by (%1.9) and undecided by (%0.9) and disagree by (%61.3) and strongly disagree by (%21.7).

The place of butchery is close to wastes gathering place by the strongly agree (%46.2) and agree by (%10.4) and undecided by (%0.0) and disagree by (%22.6) and strongly disagree by (%20.8).

Meat shop or butchery is not supplied with potable water source by the strongly agree (%92.5) and agree by (%5.7) and undecided by (%0.0) and disagree by (%0.9) and strongly disagree by (%0.9).

Meat shop or butchery is not connected to drainage system by the strongly agree (%88.7) and agree by (%5.7) and undecided by (%0.0) and disagree by (%0.9) and strongly disagree by (%4.7).

Meat is displaying on tables outside near to street by the strongly agree (%47.2) and agree by (%3.8) and undecided by (%0.0) and disagree by (%30.2) and strongly disagree by (%18.9).

Meat is displaying inside butchery open on the tables and hooks by the strongly agree (%49.1) and agree by (%1.9) and undecided by (%0.0) and disagree by (%30.2) and strongly disagree by (%18.9).

Table (9) illustrates chi-square test results for the meat market hygiene conditions.

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	The place of butchery is close to public toilet	34.00	3	0.000	2.00	Disagree
2	The place of butchery is close to fruits and vegetable selling place	106.20	2	0.000	5.00	Strongly agree
3	The place of butchery is close to tobacco selling place	129.09	4	0.000	2.00	Disagree
4	The place of butchery is close to wastes gathering place	29.17	3	0.000	4.00	Agree
5	Meat shop or butchery is not supplied with potable water source	257.84	3	0.000	5.00	Strongly agree
6	Meat shop or butchery is not connected to drainage system	229.77	3	0.000	5.00	Strongly agree
7	Meat is displaying on tables outside near to street	42.67	3	0.000	4.00	Agree
8	Meat is displaying inside butchery	49.92	3	0.000	4.00	Agree

	open on the tables and hooks					

Source: done by researcher

The results of table (9) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the place of butchery is close to public toilet was (34.00) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
2. The value of chi – square calculated to signify the differences between the place of butchery is close to fruits and vegetable selling place was (106.20) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
3. The value of chi – square calculated to signify the differences between the place of butchery is close to tobacco selling place was (129.09) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
4. The value of chi – square calculated to signify the differences between the place of butchery is close to wastes gathering place was (29.17) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
5. The value of chi – square calculated to signify the differences between the Meat shop or butchery is not supplied with potable water source was (257.84) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
6. The value of chi – square calculated to signify the differences between the Meat shop or butchery is not connected to drainage system was (229.77) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
7. The value of chi – square calculated to signify the differences between the Meat is displaying on tables outside near to street was (42.67) with

P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

8. The value of chi – square calculated to signify the differences between the Meat is displaying inside butchery open on the tables and hooks was (49.92) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

Table (10) illustrates the frequency and percentage for the meat handlers (butchers) hygiene practices.

No	Items	Strongly agree	Agree	undecided	Disagree	Strongly disagree
1	wash our hands before and after handling meat	1	2	3	76	24
		0.9	1.9	2.8	71.7	22.6
2	wash our hands after handling waste	7	17	9	47	26
		6.6	16.0	8.5	44.3	24.5
3	wash and sanitize our hands after using toilet	3	1	7	59	36
		2.8	0.9	6.6	55.7	34.0
4	wash our hands after smocking or chewing tobacco	3	1	7	51	44
		2.8	0.9	6.6	48.1	41.5
5	wash our hands after sneezing	6	2	1	50	47
		5.7	1.9	0.9	47.2	44.3
6	Wash our hands only if we want to eat	54	39	1	5	7
		50.9	36.8	0.9	4.7	6.6
7	wear gloves while we are working	0	1	5	60	40
		0.0	0.9	4.7	56.6	37.7
8	wear cap at all day time working	3	1	3	54	45
		2.8	0.9	2.8	50.9	42.5
9	Wear apron while working	34	26	5	28	13
		32.1	24.5	4.7	26.4	12.3

10	Wash apron after each day working	24	21	9	38	14
		22.6	19.8	8.5	35.8	13.2
11	We wear mask while working	8	5	3	56	34
		7.5	4.7	2.8	52.8	32.1
12	Do not clean the surface and walls of the butchery	43	28	8	20	7
		40.6	26.4	7.5	18.9	6.6
13	Surfaces and walls of butchery would be cleaned twice before and after finishing work	14	7	17	54	14
		13.2	6.6	16.0	50.9	13.2
14	Knives, surface of tables, hooks, and weighing machines we kept without cleaning unless they are not touch the soil	62	40	0	2	2
		58.5	37.7	0.0	1.9	1.9
15	We clean knives, surface of tables, hooks and weighing machine by smearing with clothes	80	25	0	1	0
		75.5	23.6	0.0	0.9	0.0
16	We eat and drink inside the butchery	76	20	3	4	3
		71.7	18.9	2.8	3.8	2.8
17	The person who serve the customer is one that who catch money with bare hands	83	23	0	0	0
		78.3	21.7	0.0	0.0	0.0
18	Use stem of large tree as cutting surface and don not wash it	77	25	0	3	1
		72.6	23.6	0.0	2.8	0.9
19	Use stem of large tree and left it open at night after day work	60	19	4	17	6
		56.6	17.9	3.8	16.0	5.7
20	Use insecticides direct to meat surface to control or kill flies	27	12	24	32	11
		25.5	11.3	22.6	30.	10.4
21	Butchers use public toilets in the market with their same clothes	88	18	0	0	0
		83.0	17.0	0.0	0.0	0.0

	and shoes					
22	Rings and watches are not replaced while working	75	22	3	3	3
		70.8	20.8	2.8	2.8	2.8
23	In case of communicable disease such as diarrhea, flu, typhoid fever, and even open wounds a butcher may keep working if able to work	74	23	6	1	2
		69.8	21.7	5.7	0.9	1.9

Source: done by researcher

From the above table result shows:

Wash our hands before and after handling meat by the strongly agree (%0.9) and agree by (%1.9) and undecided by (%2.8) and disagree by (%71.7) and strongly disagree by (%22.6).

Wash our hands after handling waste by the strongly agree (%6.6) and agree by (%16.0) and undecided by (%8.5) and disagree by (%44.3) and strongly disagree by (%24.5).

Wash and sanitize our hands after using toilet by the strongly agree (%2.8) and agree by (%0.9) and undecided by (%6.6) and disagree by (%55.7) and strongly disagree by (%34.0).

Wash our hands after smocking or chewing tobacco by the strongly agree (%2.8) and agree by (%0.9) and undecided by (%6.6) and disagree by (%48.1) and strongly disagree by (%41.5).

Wash our hands after sneezing by the strongly agree (%5.7) and agree by (%1.9) and undecided by (%0.9) and disagree by (%47.2) and strongly disagree by (%44.3).

Wash our hands only if we want to eat by the strongly agree (%50.9) and agree by (%36.8) and undecided by (%0.9) and disagree by (%4.7) and strongly disagree by (%6.6).

Wear gloves while we are working by the strongly agree (%0.0) and agree by (%0.9) and undecided by (%4.7) and disagree by (%56.6) and strongly disagree by (%37.7).

Wear cap at all day time working by the strongly agree (%2.8) and agree by (%0.9) and undecided by (%2.8) and disagree by (%50.9) and strongly disagree by (%42.5).

Wear apron while working by the strongly agree (%32.1) and agree by (%24.5) and undecided by (%4.7) and disagree by (%26.4) and strongly disagree by (%12.3).

Wash apron after each day working by the strongly agree (%22.6) and agree by (%19.8) and undecided by (%8.5) and disagree by (%38.5) and strongly disagree by (%13.2).

We wear mask while working by the strongly agree (%7.5) and agree by (%4.7) and undecided by (%2.8) and disagree by (%52.8) and strongly disagree by (%32.1).

Do not clean the surface and walls of the butchery by the strongly agree (%40.6) and agree by (%26.4) and undecided by (%7.5) and disagree by (%18.9) and strongly disagree by (%6.6).

Surfaces and walls of butchery would be cleaned twice before and after finishing work by the strongly agree (%13.2) and agree by (%6.6) and undecided by (%16.0) and disagree by (%50.9) and strongly disagree by (%13.2).

Knives, surface of tables, hooks, and weighing machines we kept without cleaning unless they are not touch the soil by the strongly agree (%58.5) and agree by (%37.7) and undecided by (%0.0) and disagree by (%1.9) and strongly disagree by (%1.9).

We clean knives, surface of tables, hooks and weighing machine by smearing with clothes by the strongly agree (%75.5) and agree by (%23.6) and undecided by (%0.0) and disagree by (%0.9) and strongly disagree by (%0.0).

We eat and drink inside the butchery by the strongly agree (%71.7) and agree by (%18.9) and undecided by (%2.8) and disagree by (%3.8) and strongly disagree by (%2.8).

The person who serve the customer is one that who catch money with bare hands by the strongly agree (%78.3) and agree by (%21.7) and undecided by (%0.0) and disagree by (%0.0) and strongly disagree by (%0.0).

Use stem of large tree as cutting surface and don not wash it by the strongly agree (%72.6) and agree by (%23.6) and undecided by (%0.0) and disagree by (%0.0) and strongly disagree by (%0.0).

Use stem of large tree and left it open at night after day work by the strongly agree (%56.6) and agree by (%17.9) and undecided by (%3.8) and disagree by (%16.0) and strongly disagree by (%5.7).

Use insecticides direct to meat surface to control or kill flies by the strongly agree (%22.5) and agree by (%11.3) and undecided by (%22.6) and disagree by (%30.2) and strongly disagree by (%10.4).

Butchers use public toilets in the market with their same clothes and shoes by the strongly agree (%83.0) and agree by (%17.0) and undecided by (%0.0) and disagree by (%0.0) and strongly disagree by (%0.0).

Rings and watches are not replaced while working by the strongly agree (%70.8) and agree by (%20.8) and undecided by (%2.8) and disagree by (%2.8) and strongly disagree by (%2.8).

In case of communicable disease such as diarrhea, flu, typhoid fever, and even open wounds a butcher may keep working if able to work by the strongly agree (%69.8) and agree by (%21.7) and undecided by (%5.7) and disagree by (%0.9) and strongly disagree by (%1.9).

Table (11) illustrates chi-square test results for the meat handlers (butchers) hygiene practices.

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	wash our hands before and after handling meat	194.28	4	0.000	2.00	Disagree
2	wash our hands after handling waste	49.84	4	0.000	2.00	Disagree
3	wash and sanitize our hands after using toilet	122.11	4	0.000	2.00	Disagree
4	wash our hands after smocking or chewing tobacco	110.79	4	0.000	2.00	Disagree
5	wash our hands after sneezing	118.05	4	0.000	2.00	Disagree
6	Wash our hands only if we want to eat	106.83	4	0.000	5.00	Strongly agree
7	wear gloves while we are working	91.20	3	0.000	2.00	Disagree
8	wear cap at all day time working	127.96	4	0.000	2.00	Disagree
9	Wear apron while working	26.54	4	0.000	4.00	Agree
10	Wash apron after each day working	23.15	4	0.000	3.00	undecided
11	We wear mask while working	101.07	4	0.000	2.00	Disagree
12	Do not clean the surface and walls of the butchery	42.39	4	0.000	4.00	Agree
13	Surfaces and walls of butchery would be cleaned twice before and after finishing work	65.98	4	0.000	2.00	Disagree
14	Knives, surface of tables, hooks, and weighing machines we kept without cleaning unless they are not touch the soil	99.73	3	0.000	5.00	Strongly agree

15	We clean knives, surface of tables, hooks and weighing machine by smearing with clothes	92.84	2	0.000	5.00	Strongly agree
16	We eat and drink inside the butchery	186.92	4	0.000	5.00	Strongly agree
17	The person who serve the customer is one that who catch money with bare hands	33.96	1	0.000	5.00	Strongly agree
18	Use stem of large tree as cutting surface and don not wash it	141.69	3	0.000	5.00	Strongly agree
19	Use stem of large tree and left it open at night after day work	96.92	4	0.000	5.00	Strongly agree
20	Use insecticides direct to meat surface to control or kill flies	16.35	4	0.000	3.00	undecided
21	Butchers use public toilets in the market with their same clothes and shoes	46.22	1	0.000	5.00	Strongly agree
22	Rings and watches are not replaced while working	183.43	4	0.000	5.00	Strongly agree
23	In case of communicable disease such as diarrhoea, flu, typhoid fever, and even open wounds a butcher may keep working if able to work	179.18	4	0.000	5.00	Strongly agree

Source: done by researcher

The results of table (11) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the wash our hands before and after handling meat was (194.28) with

P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

2. The value of chi – square calculated to signify the differences between the wash our hands after handling waste was (49.84) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
3. The value of chi – square calculated to signify the differences between the wash and sanitize our hands after using toilet was (122.11) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
4. The value of chi – square calculated to signify the differences between the wash our hands after smocking or chewing tobacco was (110.79) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
5. The value of chi – square calculated to signify the differences between the wash our hands after sneezing was (118.05) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
6. The value of chi – square calculated to signify the differences between the Wash our hands only if we want to eat was (106.83) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
7. The value of chi – square calculated to signify the differences between the wear gloves while we are working was (91.20) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
8. The value of chi – square calculated to signify the differences between the wear cap at all day time working was (127.96) with P-value (0.000)

which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

9. The value of chi – square calculated to signify the differences between the Wear apron while working was (26.54) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
10. The value of chi – square calculated to signify the differences between the Wash apron after each day working was (23.15) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
11. The value of chi – square calculated to signify the differences between the We wear mask while working was (101.07) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
12. The value of chi – square calculated to signify the differences between the Do not clean the surface and walls of the butchery was (42.39) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
13. The value of chi – square calculated to signify the differences between the Surfaces and walls of butchery would be cleaned twice before and after finishing work was (65.98) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
14. The value of chi – square calculated to signify the differences between the Knives, surface of tables, hooks, and weighing machines we kept without cleaning unless they are not touch the soil was (99.73) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

15. The value of chi – square calculated to signify the differences between the We clean knives, surface of tables, hooks and weighing machine by smearing with clothes was (92.84) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
16. The value of chi – square calculated to signify the differences between the We eat and drink inside the butchery was (186.92) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
17. The value of chi – square calculated to signify the differences between the person who serve the customer is one that who catch money with bare hands was (33.96) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
18. The value of chi – square calculated to signify the differences between the Use stem of large tree as cutting surface and don not wash it was (141.69) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
19. The value of chi – square calculated to signify the differences between the Use stem of large tree and left it open at night after day work was (96.92) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
20. The value of chi – square calculated to signify the differences between the Use insecticides direct to meat surface to control or kill flies was (16.35) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
21. The value of chi – square calculated to signify the differences between the Butchers use public toilets in the market with their same clothes and

shoes was (46.22) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

22. The value of chi – square calculated to signify the differences between the Rings and watches are not replaced while working was (183.43) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
23. The value of chi – square calculated to signify the differences between the in case of communicable disease such as diarrhea, flu, typhoid fever, and even open wounds a butcher may keep working if able to work was (179.18) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

Table (12) illustrates the frequency and percentage for the meat handler's hygiene attitudes.

No	**Items**	**Strongly agree**	**Agree**	**undecided**	**Disagree**	**Strongly disagree**
1	Meat is handled with bare hands	97	8	0	1	0
		91.5	7.5	0.0	0.9	0.0
2	Butcher can let consumer to be inside the butchery and can shake hands as greeting	83	12	3	8	0
		78.3	11.3	2.8	7.5	75
3	Safe meat handling in the butchery is the job responsibility of butchers	35	30	29	12	0
		33.0	28.3	27.4	11.3	0.0
4	Butcher can works without wearing apron	43	25	6	30	2
		40.6	23.6	5.7	28.3	1.9
5	Butcher replace ring or watch on	7	2	13	71	12

	the hands while working	6.6	1.9	12.3	66.9	11.3
6	Washing hands before and after handling meat can reduce cross-contamination with hazards	9	10	68	17	2
		8.5	9.	64.2	16.0	1.9
7	Keeping work place, equipment and surfaces clean is reduces the risk of safety hazards	13	16	54	22	1
		12.3	15.1	50.9	20.8	0.9
8	Cutting boards, hooks and knives should be clean before and reusing	6	4	44	45	7
		5.7	3.8	41.5	42.5	6.6
9	Using cap is important to prevent risk of contamination	8	3	37	49	9
		7.5	2.8	34.9	46.	8.5
10	In case of hands' injuries or wounds handler stop working until healing	16	8	9	29	8
		15.1	7.5	8.5	58.5	10.4
11	Usually blow the air of our mouth to open plastic bags for packaging meat	33	27	9	29	8
		31.1	25.5	8.5	27.4	7.5
12	Smoking and chewing tobacco are common inside the butchery	46	28	4	25	3
		43.4	26.4	3.8	23.6	2.8
13	Butchers throw inedible parts of carcasses such as genital organs, abscesses and watery sacks direct to dogs and cats	33	21	16	26	10
		31.1	19.8	15.1	24.5	9.4

Source: done by researcher

From the above table result shows:

Meat is handled with bare hands by the strongly agree (%91.5) and agree by (%7.5) and undecided by (%0.0) and disagree by (%0.9) and strongly disagree by (%0.0).

Butcher can let consumer to be inside the butchery and can shake hands as greeting by the strongly agree (%78.3) and agree by (%11.3) and undecided by (%2.8) and disagree by (%7.5) and strongly disagree by (%0.0).

Safe meat handling in the butchery is the job responsibility of butchers by the strongly agree (%33.0) and agree by (%28.3) and undecided by (%27.4) and disagree by (%11.3) and strongly disagree by (%0.0).

Butcher can work without wearing apron by the strongly agree (%40.6) and agree by (%23.6) and undecided by (%5.7) and disagree by (%28.3) and strongly disagree by (%1.9).

Butcher replace ring or watch on the hands while working by the strongly agree (%6.6) and agree by (%1.9) and undecided by (%12.3) and disagree by (%66.9) and strongly disagree by (%11.3).

Washing hands before and after handling meat can reduce cross-contamination with hazards by the strongly agree (%8.5) and agree by (%9.4) and undecided by (%64.2) and disagree by (%16.0) and strongly disagree by (%1.9).

Keeping work place, equipment and surfaces clean is reducing the risk of safety hazards by the strongly agree (%12.3) and agree by (%15.1) and undecided by (%50.9) and disagree by (%20.8) and strongly disagree by (%0.9).

Cutting boards, hooks and knives should be clean before and reusing by the strongly agree (%5.7) and agree by (%3.8) and undecided by (%41.5) and disagree by (%42.5) and strongly disagree by (%6.6).

Using cap is important to prevent risk of contamination by the strongly agree (%7.5) and agree by (%2.8) and undecided by (%34.9) and disagree by (%46.2) and strongly disagree by (%8.5).

In case of hands' injuries or wounds handler stop working until healing by the strongly agree (%15.1) and agree by (%7.5) and undecided by (%8.5) and disagree by (%58.5) and strongly disagree by (%10.4).

Usually blow the air of our mouth to open plastic bags for packaging meat by the strongly agree (%31.1) and agree by (%25.5) and undecided by (%8.5) and disagree by (%27.4) and strongly disagree by (%7.5).

Smoking and chewing tobacco are common inside the butchery by the strongly agree (%43.9) and agree by (%26.4) and undecided by (%3.8) and disagree by (%23.6) and strongly disagree by (%2.8).

Butchers throw inedible parts of carcasses such as genital organs, abscesses and watery sacks direct to dogs and cat's by the strongly agree (%31.1) and agree by (%19.8) and undecided by (%15.1) and disagree by (%24.5) and strongly disagree by (%9.4).

Table (13) illustrates chi-square test results for the meat handler's hygiene attitudes.

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	Meat is handled with bare hands	162.13	2	0.000	5.00	Strongly agree
2	Butcher can let consumer to be inside the butchery and can shake hands as greeting	162.15	3	0.000	5.00	Strongly agree
3	Safe meat handling in the butchery is the job responsibility of butchers	11.35	3	0.000	4.00	Agree
4	Butcher can works without wearing apron	55.03	4	0.000	4.00	Agree
5	Butcher replace ring or watch on the hands while working	195.97	4	0.000	2.00	Disagree
6	Washing hands before and after handling meat can reduce cross-contamination with hazards	134.47	4	0.000	3.00	undecided

7	Keeping work place, equipment and surfaces clean is reduces the risk of safety hazards	74.47	4	0.000	3.00	undecided
8	Cutting boards, hooks and knives should be clean before and reusing	85.60	4	0.000	3.00	undecided
9	Using cap is important to prevent risk of contamination	81.04	4	0.000	2.00	Disagree
10	In case of hands' injuries or wounds handler stop working until healing	99.94	4	0.000	2.00	Disagree
11	Usually blow the air of our mouth to open plastic bags for packaging meat	26.26	4	0.000	4.00	Agree
12	Smoking and chewing tobacco are common inside the butchery	61.45	4	0.000	4.00	Agree
13	Butchers throw inedible parts of carcasses such as genital organs, abscesses and watery sacks direct to dogs and cats	14.84	4	0.000	4.00	Agree

Source: done by researcher

The results of table (13) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the Meat is handled with bare hands was (162.13) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
2. The value of chi – square calculated to signify the differences between the Butcher can let consumer to be inside the butchery and can shake hands as greeting was (162.15) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

3. The value of chi – square calculated to signify the differences between the Safe meat handling in the butchery is the job responsibility of butchers was (11.35) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
4. The value of chi – square calculated to signify the differences between the Butcher can works without wearing apron was (55.03) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
5. The value of chi – square calculated to signify the differences between the Butcher replace ring or watch on the hands while working was (195.97) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
6. The value of chi – square calculated to signify the differences between the Washing hands before and after handling meat can reduce cross-contamination with hazards was (134.47) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
7. The value of chi – square calculated to signify the differences between the Keeping work place, equipment and surfaces clean is reducing the risk of safety hazards was (74.47) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
8. The value of chi – square calculated to signify the differences between the Cutting boards, hooks and knives should be clean before and reusing was (85.60) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

9. The value of chi – square calculated to signify the differences between the Using cap is important to prevent risk of contamination was (81.04) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
10. The value of chi – square calculated to signify the differences between the in case of hands' injuries or wounds handler stop working until healing was (99.94) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
11. The value of chi – square calculated to signify the differences between the usually blow the air of our mouth to open plastic bags for packaging meat was (26.26) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
12. The value of chi – square calculated to signify the differences between the Smoking and chewing tobacco are common inside the butchery was (61.45) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
13. The value of chi – square calculated to signify the differences between the Butchers throw inedible parts of carcasses such as genital organs, abscesses and watery sacks direct to dogs and cats was (14.84) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

Table (14) illustrates the frequency and percentage for the level of meat handlers' competencies on basic food safety knowledge.

No	Items	Strongly agree	Agree	undecided	Disagree	Strongly disagree
1	Meat is a high-risk food and if not handled careful can cause dangerous diseases to consumer	14	15	55	21	1
		13.2	14.2	51.9	19.8	0.9
2	Food hygiene means prevent food from cross-contamination with germs	1	6	1	84	14
		0.9	5.7	0.9	79.2	13.2
3	HACCP is a preventive approach to attain meat safety	3	1	73	20	9
		2.8	0.9	68.9	18.9	8.5
4	Bare hands of butchers can be source of meat contamination and may cause Typhoid fever to consumers	9	4	60	58	5
		8.5	3.8	28.3	54.7	4.7
5	Regular washing of hands during meat handling and processing reduce risks of contamination	6	7	64	5	4
		5.7	6.6	60.4	23.6	3.8
6	Washing hands with warm water and phenol carbolic soap can reduce risks of meat contamination by germs	17	28	47	8	6
		16.0	26.4	44.3	7.5	5.7

7	Tall fingers can contain germs that can contaminate meat and cause food poisoning or diarrhea	26	44	17	17	2
		24.5	41.5	16.0	16.0	1.9
8	Displaying meat openly at room temperature is prone to contaminate with health risks factors	13	2	26	58	7
		12.3	1.9	24.5	54.7	6.6
9	Existence of dog, cat, or rats inside the butchery is danger for you and customer alike	11	4	41	43	7
		10.4	3.8	38.7	40.6	6.6
10	Flies, mouse and cockroaches are victors of foodborne disease	21	8	60	14	3
		19.8	7.5	56.6	13.	2.8
11	Butcher suffering from cough, diarrhea and skin wounds can contaminate meat with pathogenic organism	16	10	36	42	2
		15.1	9.4	34.0	39.6	1.9
12	Knives, surface of table, hooks and axe can cause cross-contamination of meat with pathogenic	11	7	28	58	2
		10.4	6.6	26.4	54.7	1.9
13	Keeping animal by-products such as blood, pieces of bones, inedible	8	2	25	63	8
		7.5	1.9	23.6	59.4	7.5

	tissues inside the butchery can expose to safety risks					
14	Spitting, sneezing and coughing inside the butchery can contaminate meat with pathogenic organisms	12	1	24	65	4
		11.3	0.9	22.6	61.3	3.6
15	Cleaning as you go is a key to meat safety	4	2	11	47	41
		3.8	1.9	10.4	44.3	38.7

Source: done by researcher

From the above table result shows:

Meat is a high-risk food and if not handled careful can cause dangerous diseases to consumer by the strongly agree (%13.2) and agree by (%14.2) and undecided by (%51.9) and disagree by (%19.8) and strongly disagree by (%0.9).

Food hygiene means prevent food from cross-contamination with germs by the strongly agree (%0.9) and agree by (%5.7) and undecided by (%0.9) and disagree by (%79.2) and strongly disagree by (%13.2).

HACCP is a preventive approach to attain meat safety by the strongly agree (%2.8) and agree by (%0.9) and undecided by (%68.9) and disagree by (%18.9) and strongly disagree by (%8.5).

Bare hands of butchers can be source of meat contamination and may cause Typhoid fever to consumers by the strongly agree (%8.5) and agree by (%3.8) and undecided by (%28.3) and disagree by (%54.7) and strongly disagree by (%4.7).

Regular washing of hands during meat handling and processing reduce risks of contamination by the strongly agree (%5.7) and agree by (%6.6)

and undecided by (%60.4) and disagree by (%23.6) and strongly disagree by (%3.8).

Washing hands with warm water and phenol carbolic soap can reduce risks of meat contamination by germs by the strongly agree (%16.0) and agree by (%26.4) and undecided by (%44.3) and disagree by (%7.5) and strongly disagree by (%5.7).

Tall fingers can contain germs that can contaminate meat and cause food poisoning or diarrhea by the strongly agree (%24.5) and agree by (%41.5) and undecided by (%16.0) and disagree by (%16.0) and strongly disagree by (%1.9).

Displaying meat openly at room temperature is prone to contaminate with health risks factors by the strongly agree (%12.3) and agree by (%1.9) and undecided by (%24.5) and disagree by (%54.7) and strongly disagree by (%6.6).

Existence of dog, cat, or rats inside the butchery is danger for you and customer alike by the strongly agree (%10.4) and agree by (%3.8) and undecided by (%38.7) and disagree by (%40.6) and strongly disagree by (%6.6).

Flies, mouse and cockroaches are victors of foodborne disease by the strongly agree (%19.8) and agree by (%7.5) and undecided by (%56.6) and disagree by (%13.2) and strongly disagree by (%2.8).

Butcher suffering from cough, diarrhea and skin wounds can contaminate meat with pathogenic organism by the strongly agree (%15.1) and agree by (%9.4) and undecided by (%34.0) and disagree by (%39.6) and strongly disagree by (%1.9).

Knives, surface of table, hooks and axe can cause cross-contamination of meat with pathogenic by the strongly agree (%10.4) and agree by (%6.6) and undecided by (%26.4) and disagree by (%54.7) and strongly disagree by (%1.9).

Keeping animal by-products such as blood, pieces of bones, inedible tissues inside the butchery can expose to safety risks by the strongly agree (%7.5) and agree by (%1.9) and undecided by (%23.6) and disagree by (%59.4) and strongly disagree by (%7.5).

Spitting, sneezing and coughing inside the butchery can contaminate meat with pathogenic organisms by the strongly agree (%11.3) and agree by (%0.9) and undecided by (%22.6) and disagree by (%61.3) and strongly disagree by (%3.6).

Cleaning as you go is a key to meat safety by the strongly agree (%3.8) and agree by (%1.9) and undecided by (%10.4) and disagree by (%44.3) and strongly disagree by (%38.7).

Table (15) illustrates chi-square test results for the level of meat handlers' competencies on basic food safety knowledge.

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	Meat is a high-risk food and if not handled careful can cause dangerous diseases to consumer	77.39	4	0.000	3.00	undecided
2	Food hygiene means prevent food from cross-contamination with germs	237.86	4	0.000	3.00	undecided
3	HACCP is a preventive approach to attain meat safety	168.52	4	0.000	3.00	undecided
4	Bare hands of butchers can be source of meat contamination and may cause Typhoid fever to consumers	100.88	4	0.000	2.00	Disagree
5	Regular washing of hands during	121.45	4	0.000	3.00	undecide

	meat handling and processing reduce risks of contamination					d
6	Washing hands with warm water and phenol carbolic soap can reduce risks of meat contamination by germs	53.52	4	0.000	3.00	undecide d
7	Tall nail of fingers can contain germs that can contaminate meat and cause food poisoning or diarrhea	44.66	4	0.000	4.00	Agree
8	Displaying meat openly at room temperature is prone to contaminate with health risks factors	95.03	4	0.000	2.00	Disagree
9	Existence of dog, cat, or rats inside the butchery is danger for you and customer alike	69.28	4	0.000	3.00	undecide d
10	Flies, mouse and cockroaches are victors of foodborne disease	97.30	4	0.000	3.00	undecide d
11	Butcher suffering from cough, diarrhea and skin wounds can contaminate meat with pathogenic organism	55.32	4	0.000	3.00	undecide d
12	Knives, surface of table, hooks and axe can cause cross-contamination of meat with pathogenic	97.86	4	0.000	2.00	Disagree
13	Keeping animal by-products such as blood, pieces of bones, inedible	116.92	4	0.000	2.00	Disagree

	tissues inside the butchery can expose to safety risks					
14	Spitting, sneezing and coughing inside the butchery can contaminate meat with pathogenic organisms	128.05	4	0.000	2.00	Disagree
15	Cleaning as you go is a key to meat safety	175.22	4	0.000	3.00	undecided

Source: done by researcher

The results of table (15) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the Meat is a high-risk food and if not handled careful can cause dangerous diseases to consumer was (77.39) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
2. The value of chi – square calculated to signify the differences between the Food hygiene means prevent food from cross-contamination with germs was (237.86) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
3. The value of chi – square calculated to signify the differences between the HACCP is a preventive approach to attain meat safety was (168.52) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
4. The value of chi – square calculated to signify the differences between the Bare hands of butchers can be source of meat contamination and may cause Typhoid fever to consumers was (100.88) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

5. The value of chi – square calculated to signify the differences between the Regular washing of hands during meat handling and processing reduce risks of contamination was (121.45) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
6. The value of chi – square calculated to signify the differences between the Washing hands with warm water and phenol carbolic soap can reduce risks of meat contamination by germs was (53.52) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
7. The value of chi – square calculated to signify the differences between the Tall nail of fingers can contain germs that can contaminate meat and cause food poisoning or diarrhea was (44.66) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
8. The value of chi – square calculated to signify the differences between the Displaying meat openly at room temperature is prone to contaminate with health risks factors was (95.03) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
9. The value of chi – square calculated to signify the differences between the Existence of dog, cat, or rats inside the butchery is danger for you and customer alike was (69.28) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
10. The value of chi – square calculated to signify the differences between the Flies, mouse and cockroaches are victors of foodborne disease was (97.30) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

11. The value of chi – square calculated to signify the differences between the Butcher suffering from cough, diarrhea and skin wounds can contaminate meat with pathogenic organism was (55.32) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
12. The value of chi – square calculated to signify the differences between the Knives, surface of table, hooks and axe can cause cross-contamination of meat with pathogenic organisms was (97.86) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
13. The value of chi – square calculated to signify the differences between the Keeping animal by-products such as blood, pieces of bones, inedible tissues inside the butchery can expose to safety risks was (116.92) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
14. The value of chi – square calculated to signify the differences between the Spitting, sneezing and coughing inside the butchery can contaminate meat with pathogenic organisms was (128.05) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
15. The value of chi – square calculated to signify the differences between the Cleaning as you go is a key to meat safety was (175.22) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

Table (16) illustrates the frequency and percentage for meat handlers' level of awareness on food safety regulations, laws and, the involvement of governmental authorized bodies in the deployment and communication of food safety regulations, laws at butchery level.

No	**Items**	**Strongly agree**	**Agree**	**undecided**	**Disagree**	**Strongly disagree**
1	Relevant authorities provide us training opportunities in food safety requirements aspects	4	3	11	47	41
		3.8	2.8	10.4	44.3	38.7
2	Relevant authorities inform us best hygiene practices and food safety regulations and related laws through meetings	25	15	7	30	29
		23.6	14.2	6.6	28.3	27.4
3	Relevant authorities provides us with manual, leaflets and instructions as knowledge materials containing hygienic operations and practices	2	3	0	54	47
		1.	2.8	0.0	50.9	44.3
4	I have attended basic hygiene training course certification and certified	2	0	0	49	55
		1.9	0.0	0.0	46.2	51.8
5	I have attended advance hygiene training course and certified	8	5	0	39	54
		7.5	4.7	0.0	36.8	50.9
6	I have never been trained on good hygiene practices	54	35	1	4	12
		50.	33.0	0.9	3.8	11.3
7	The official authorities did not specify a specific description as pre-hygiene requirements for establishment of butcheries to us	42	18	3	26	17
		39.6	17.0	2.8	24.5	16.0
8	Obtaining license is always	62	19	0	15	10

	after work start at butchery	58.5	17.9	0.0	14.2	9.4
9	There are no preconditions that identify an appropriate equipment and hygiene facilities that must be in place to obtain license	73	21	0	6	6
		68.9	19.8	0.0	5.7	5.7
10	Having a license is always associated with collection of government fees while visiting the relevant authorities	88	11	1	5	1
		83.0	10.4	0.9	4.7	0.9
11	Butchers can work without possessing health card	64	21	2	15	4
		60.4	19.8	1.9	14.2	3.8
12	Butchers may start work even at the first time without prior medical examination	67	21	1	11	5
		63.2	20.8	0.9	10.4	4.7
13	There is no requirement about periodic medical examination to butchers	58	21	2	18	7
		54.7	19.8	1.9	17.0	6.6
14	We often subjected to penalties without informing us what was legal and what was not illegal	75	23	2	2	4
		70.8	21.7	1.9	1.9	3.8
15	There is no coordination or meetings in regular base between relevant authorities and butchers	82	20	0	1	3
		77.4	18.9	0.0	0.9	2.8

Source: done by researcher

From the above table result shows:

Relevant authorities provide us training opportunities in food safety requirements aspects by the strongly agree (%3.8) and agree by (%2.8) and

undecided by (%10.4) and disagree by (%44.3) and strongly disagree by (%38.7).

Relevant authorities inform us best hygiene practices and food safety regulations and related laws through meetings by the strongly agree (%23.6) and agree by (%14.2) and undecided by (%6.6) and disagree by (%28.3) and strongly disagree by (%27.4).

Relevant authorities provide us with manual, leaflets and instructions as knowledge materials containing hygienic operations and practices by the strongly agree (%1.9) and agree by (%2.8) and undecided by (%0.0) and disagree by (%50.9) and strongly disagree by (%44.3).

I have attended basic hygiene training course certification and certified by the strongly agree (%1.9) and agree by (%0.0) and undecided by (%0.0) and disagree by (%46.2) and strongly disagree by (%51.8).

I have attended advance hygiene training course and certified by the strongly agree (%7.5) and agree by (%4.7) and undecided by (%0.0) and disagree by (%36.8) and strongly disagree by (%50.9).

I have never been trained on good hygiene practices by the strongly agree (%50.9) and agree by (%33.0) and undecided by (%0.9) and disagree by (%3.8) and strongly disagree by (%11.3).

The official authorities did not specify a specific description as pre-hygiene requirements for establishment of butcheries to us by the strongly agree (%39.6) and agree by (%17.0) and undecided by (%2.8) and disagree by (%24.5) and strongly disagree by (%16.0).

Obtaining license is always after work start at butchery by the strongly agree (%58.5) and agree by (%17.6) and undecided by (%0.0) and disagree by (%14.2) and strongly disagree by (%9.4).

There are no preconditions that identify an appropriate equipment and hygiene facilities that must be in place to obtain license by the strongly

agree (%68.9) and agree by (%19.8) and undecided by (%0.0) and disagree by (%5.7) and strongly disagree by (%5.7).

Having a license is always associated with collection of government fees while visiting the relevant authorities by the strongly agree (%83.0) and agree by (%10.4) and undecided by (%0.9) and disagree by (%4.7) and strongly disagree by (%0.9).

Butchers can work without possessing health card by the strongly agree (%60.4) and agree by (%19.8) and undecided by (%1.9) and disagree by (%14.2) and strongly disagree by (%3.8).

Butchers may start work even at the first time without prior medical examination by the strongly agree (%63.2) and agree by (%20.8) and undecided by (%0.9) and disagree by (%10.4) and strongly disagree by (%4.7).

There is no requirement about periodic medical examination to butchers by the strongly agree (%54.7) and agree by (%19.8) and undecided by (%1.9) and disagree by (%17.0) and strongly disagree by (%6.6).

We often subjected to penalties without informing us what was legal and what was not illegal by the strongly agree (%70.8) and agree by (%21.7) and undecided by (%1.9) and disagree by (%1.9) and strongly disagree by (%3.8).

There is no coordination or meetings in regular base between relevant authorities and butchers by the strongly agree (%77.4) and agree by (%18.9) and undecided by (%0.0) and disagree by (%0.9) and strongly disagree by (%2.8).

Table (17) illustrates chi-square test results for: the meat handlers' level of awareness on food safety regulations, laws and, the involvement of governmental authorized bodies in the deployment and communication of food safety regulations, laws at butchery level.

No	Phrases	Chi-square	df	Sig.	Media	Interpretation

		value			n	
1	Relevant authorities provide us training opportunities in food safety requirements aspects	84.37	4	0.000	2.00	Disagree
2	Relevant authorities inform us best hygiene practices and food safety regulations and related laws through meetings	18.52	4	0.000	2.00	Disagree
3	Relevant authorities provides us with manual, leaflets and instructions as knowledge materials containing hygienic operations and practices	87.88	3	0.000	2.00	Disagree
4	I have attended basic hygiene training course certification and certified	47.02	2	0.000	1.00	Strongly disagree
5	I have attended advance hygiene training course and certified	64.79	3	0.000	1.00	Strongly disagree
6	I have never been trained on good hygiene practices	96.92	4	0.000	5.00	Strongly agree
7	The official authorities did not specify a specific description as pre-hygiene requirements for establishment of butcheries to us	38.43	4	0.000	4.00	Agree
8	Obtaining license is always after work start at butchery	64.94	3	0.000	5.00	Strongly agree
9	There are no preconditions that identify an appropriate	114.45	3	0.000	5.00	Strongly agree

	equipment and hygiene facilities that must be in place to obtain license					
10	Having a license is always associated with collection of government fees while visiting the relevant authorities	266.26	4	0.000	5.00	Strongly agree
11	Butchers can work without possessing health card	119.56	4	0.000	5.00	Strongly agree
12	Butchers may start work even at the first time without prior medical examination	135.50	4	0.000	5.00	Strongly agree
13	There is no requirement about periodic medical examination to butchers	91.26	4	0.000	5.00	Strongly agree
14	We often subjected to penalties without informing us what was legal and what was not illegal	185.41	4	0.000	5.00	Strongly agree
15	There is no coordination or meetings in regular base between relevant authorities and butchers	166.58	3	0.000	5.00	Strongly agree

Source: done by researcher

The results of table (17) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the Relevant authorities provide us training opportunities in food safety requirements aspects was (84.37) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

2. The value of chi – square calculated to signify the differences between the Relevant authorities inform us best hygiene practices and food safety regulations and related laws through meetings was (18.52) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
3. The value of chi – square calculated to signify the differences between the Relevant authorities provides us with manual, leaflets and instructions as knowledge materials containing hygienic operations and practices was (87.88) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
4. The value of chi – square calculated to signify the differences between the I have attended basic hygiene training course certification and certified was (47.02) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
5. The value of chi – square calculated to signify the differences between the I have attended advance hygiene training course and certified was (64.79) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
6. The value of chi – square calculated to signify the differences between the I have never been trained on good hygiene practices was (96.92) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
7. The value of chi – square calculated to signify the differences between the official authorities did not specify a specific description as pre-hygiene requirements for establishment of butcheries to us was (38.43) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

8. The value of chi – square calculated to signify the differences between the Obtaining license is always after work start at butchery was (64.94) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
9. The value of chi – square calculated to signify the differences between the There are no preconditions that identify an appropriate equipment and hygiene facilities that must be in place to obtain license was (114.45) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
10. The value of chi – square calculated to signify the differences between the having a license is always associated with collection of government fees while visiting the relevant authorities was (266.26) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
11. The value of chi – square calculated to signify the differences between the Butchers can work without possessing health card was (119.56) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
12. The value of chi – square calculated to signify the differences between the Butchers may start work even at the first time without prior medical examination was (135.50) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
13. The value of chi – square calculated to signify the differences between the There is no requirement about periodic medical examination to butchers was (91.26) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

14. The value of chi – square calculated to signify the differences between the We often subjected to penalties without informing us what was legal and what was not illegal was (185.41) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
15. The value of chi – square calculated to signify the differences between the There is no coordination or meetings in regular base between relevant authorities and butchers was (166.58) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

4.2: results of section two of questionnaire which specific to relevant authorities.

Table (18) illustrates the frequency and percentage for the age.

Age	Frequencies	Percentage
Less than 18 yea	0	0.0%
19-39 year	49	53.8%
40-59 year	39	42.9%
More than 60 year	3	3.3%
Total	91	100.0%

Source: done by researcher

Table (18) illustrates the views of the distribution of the age sample by less than 18 years by (%0.0) and 19-39 year by (%53.8) and 40-59 year by (%42.9) and More than 60 years by (%3.3).

Table (19) illustrates the frequency and percentage for the gender.

gender	Frequencies	Percentage
Male	48	52.7%
Female	43	47.3%
Total	91	100.0%

Source: done by researcher

Table (19) illustrates the views of the distribution of the age sample by male by (%52.7) and female by (%47.3).

Table (20) illustrates the frequency and percentage for the Education level.

Education level	Frequencies	Percentage
Illiterate	0	0.0%
basic	2	2.2%
Secondary	30	33.0%
graduate	55	60.4%
Post graduate	4	4.4%
Total	91	100.0%

Source: done by researcher

Table (20) illustrates the views of the distribution of the Education level sample by Illiterate by (%0.0) and basic by (%2.2) and Secondary by (%33.0) and graduate by (%60.4) and Post graduate by (%4.4).

Table (21) illustrates the frequency and percentage for the Occupation.

Name of the market	Frequencies	Percentage
Public health professional	6	6.6%
veterinarian	27	29.7%
technician	2	2.2%
Public health observer	24	26.4%
employee	8	8.8%
technologist	17	18.7%
other	1	1.1%
worker	6	6.6%
Total	91	100.0%

Source: done by researcher

Table (21) illustrates the views of the distribution of the Occupation sample by Public health professional by (%6.6) and veterinarian by (%29.7) and technician by (%2.2) and Public health observer by (%26.4)

and employee by (%8.8) and technologist by (%18.7) and other by (%1.1) and worker by (%6.6).

Table (22) illustrates the frequency and percentage for the potential challenges that can inhibit related governmental authorized bodies to introduce and enforcement of food safety management requirements and HACCP principles at meat market and butcheries point.

No	**Items**	**Strongly agree**	**Agree**	**undecided**	**Disagree**	**Strongly disagree**
1	There is overlapping between relevant authorities in terms of responsibilities and roles regard to meat markets	64	27	0	0	0
		70.3	29.7	0.0	0.0	0.0
2	There is lack of coordination and collaboration between relevant authorities to deal with meat market hygiene conditions	62	23	0	5	1
		68.0	25.3	0.0	5.5	1.1
3	Public are not aware of food borne diseases and their consequences	62	27	1	0	1
		68.2	29.7	1.1	0.0	1.1
4	There is lack of training programs to personnel who work in meat markets as inspector or supervisor	59	32	0	0	0
		64.8	35.2	0.0	0.0	0.0
5	There is lack of financial resources that challenges governmental authorized bodies to play effective and	65	20	2	4	0
		71.4	22.0	2.2	4.4	0.0

	efficient roles					
6	There is no well-equipped and competent laboratory specific for food safety	63	25	3	0	0
		69.2	27.5	3.3	0.0	0.0
7	There are abuse use of veterinary drugs and pesticides at farm level	56	23	11	1	0
		61.5	25.3	12.1	1.1	0.0
8	Unity food safety authorized body can be an option to address overlapping issue	58	29	4	0	0
		63.7	31.9	4.4	0.0	0.0

Source: done by researcher

From the above table result shows:

There is overlapping between relevant authorities in terms of responsibilities and roles regard to meat markets by the strongly agree (%70.3) and agree by (%29.7) and undecided by (%0.0) and disagree by (%0.0) and strongly disagree by (%0.0).

There is lack of coordination and collaboration between relevant authorities to deal with meat market hygiene conditions by the strongly agree (%68.1) and agree by (%25.3) and undecided by (%0.0) and disagree by (%5.5) and strongly disagree by (%1.1).

Public are not aware of food borne diseases and their consequences by the strongly agree (%68.1) and agree by (%29.7) and undecided by (%1.1) and disagree by (%0.0) and strongly disagree by (%1.1).

There is lack of training programs to personnel who work in meat markets as inspector or supervisor by the strongly agree (%64.8) and agree by (%35.2) and undecided by (%0.0) and disagree by (%0.0) and strongly disagree by (%0.0).

There is lack of financial resources that challenges governmental authorized bodies to play effective and efficient roles by the strongly agree

(%71.4) and agree by (%22.0) and undecided by (%2.2) and disagree by (%4.4) and strongly disagree by (%0.0).

There is no well-equipped and competent laboratory specific for food safety by the strongly agree (%69.2) and agree by (%27.5) and undecided by (%3.3) and disagree by (0.0%) and strongly disagree by (%0.0).

There are abuse use of veterinary drugs and pesticides at farm level by the strongly agree (%61.5) and agree by (%25.3) and undecided by (%12.1) and disagree by (%1.1) and strongly disagree by (%0.0).

Unity food safety authorized body can be an option to address overlapping issue by the strongly agree (%63.7) and agree by (%31.9) and undecided by (%4.4) and disagree by (%0.0) and strongly disagree by (%0.0).

Table (23) illustrates chi-square test results for the potential challenges that can inhibit related governmental authorized bodies to introduce and deployment and enforcement of food safety management requirements and HACCP principles at meat market and butcheries point.

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	There is overlapping between relevant authorities in terms of responsibilities and roles regard to meat markets	15.04	1	0.000	5.00	Strongly agree
2	There is lack of coordination and collaboration between relevant authorities to deal with meat market hygiene conditions	102.36	3	0.000	5.00	Strongly agree
3	Public are not aware of food borne diseases and their consequences	110.09	3	0.000	5.00	Strongly agree

4	There is lack of training programs to personnel who work in meat markets as inspector or supervisor	8.01	1	0.000	5.00	Strongly agree
5	There is lack of financial resources that challenges governmental authorized bodies to play effective and efficient roles	113.17	3	0.000	5.00	Strongly agree
6	There is no well-equipped and competent laboratory specific for food safety	60.74	2	0.000	5.00	Strongly agree
7	There are abuse use of veterinary drugs and pesticides at farm level	75.46	3	0.000	5.00	Strongly agree
8	Unity food safety authorized body can be an option to address overlapping issue	48.154	2	0.000	5.00	Strongly agree

Source: done by researcher

The results of table (23) Interpreted as follows:

1. The value of chi – square calculated to signify the differences between the There is overlapping between relevant authorities in terms of responsibilities and roles regard to meat markets was (15.04) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
2. The value of chi – square calculated to signify the differences between the There is lack of coordination and collaboration between relevant authorities to deal with meat market hygiene conditions was (102.36) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
3. The value of chi – square calculated to signify the differences between the Public are not aware of food borne diseases and their consequences

was (110.09) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

4. The value of chi – square calculated to signify the differences between the There is lack of training programs to personnel who work in meat markets as inspector or supervisor was (8.01) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
5. The value of chi – square calculated to signify the differences between the There is lack of financial resources that challenges governmental authorized bodies to play effective and efficient roles was (113.17) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
6. The value of chi – square calculated to signify the differences between the There is no well-equipped and competent laboratory specific for food safety was (60.74) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
7. The value of chi – square calculated to signify the differences between the Three are abuse use of veterinary drugs and pesticides at farm level was (75.46) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.
8. The value of chi – square calculated to signify the differences between the Unity food safety authorized body can be an option to address overlapping issue was (48.154) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically.

4.3: Test of hypotheses

Table (24) illustrates chi-square test results: No statistical differences between Nyala red meat market hygiene conditions and food safety management requirements and HACCP principles.

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
106	65.28	3	0.000	4.0	Agree	Significant

Source: done by researcher

Table (24) shows that The value of chi – square calculated to signify the differences between the Nyala red meat market hygiene conditions and food safety management requirements and HACCP principles was (65.28) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically for the Agree.

Table (25) illustrates chi-square test results: No statistical differences between meat handlers' (butchers) personal hygiene practices and good hygiene practices (GHPs).

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
106	54.07	1	0.000	3.0	undecided	Significant

Source: done by researcher

Table (25) shows that the value of chi – square calculated to signify the differences between the Meat handlers' (butchers) personal hygiene practices and good hygiene practices (GHPs) was (54.07) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically for the undecided.

Table (26) illustrates chi-square test results of: No statistical differences between meat handlers' hygiene attitudes and good hygiene practices (GHPs).

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
106	44.56	2	0.000	4.0	Agree	Significant

Source: done by researcher

Table (26) shows that The value of chi – square calculated to signify the differences between the Meat handlers' hygiene attitudes and good hygiene practices (GHPs) was (44.56) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically for the Agree.

Table (27) illustrates chi-square test results of: No statistical differences between meat handlers' competencies and basic food safety knowledge.

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
106	94.26	4	0.000	3.0	undecided	Significant

Source: done by researcher

Table (27) shows that The value of chi – square calculated to signify the differences between the meat handlers competencies and basic food safety knowledge was (94.26) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically for the undecided.

Table (28) illustrates chi-square test results of: No statistical differences between meat handlers' level of awareness on food safety regulations, laws and, the involvement of governmental authorized bodies in the deployment and communication of food safety regulations, laws at butchery level.

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
106	52.13	3	0.000	4.0	Agree	Significant

Source: done by researcher

Table (28) shows that The value of chi – square calculated to signify the differences between meat handlers' level of awareness on food safety regulations, laws and, the involvement of governmental authorized bodies in the deployment and communication of food safety regulations, laws at butchery level was (52.13) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically for the Agree.

Table (29) illustrates chi-square test results of: there are challenges that facing related authorized governmental bodies to introduce and enforcement of Food Safety Management System and HACCP principles at meat markets or butcheries level.

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
106	68.14	3	0.000	4.0	Agree	Significant

Source: done by researcher

Table (29) shows that The value of chi – square calculated to signify the differences between there are challenges that facing related authorized governmental bodies to introduce and enforcement of Food Safety Management System and HACCP principles at meat market or butcheries level was (68.14) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically for the Agree.

Hypotheses discussion:

Discussion of first hypothesis: (No statistical differences between Nyala red meat market hygiene conditions and food safety management requirements and HACCP principles). Results in the table **(24)** shows that The value of chi – square calculated to signify the differences between the Nyala red meat market hygiene conditions and food safety management requirements and HACCP principles was (65.28) with P-value (0.000)

which is lower than the level of significant value (5%) These refer to the existence of differences statistically for the Agree. Thus, these results have reflected that Nyala red meat market hygiene conditions is not conformance with food safety management requirements and HACCP principles in terms of infrastructure design, it is boundaries, hygiene facilities and equipment, unavailability of potable water, butcheries were not connected to drainage system, and forms of displaying meats.

Discussion of second hypothesis: (No statistical differences between meat handlers' (butchers) personal hygiene practices and good hygiene practices (GHPs). Results obtained in the table (**11**) and table (**25**) shows that the value of chi – square calculated to signify the differences was (54.07) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically for agrees. According to these data one can infer that, meat handlers (butchers) personal's hygiene practices are far behind what recommended by concept of good hygiene practices (GHPs).

Discussion of third hypothesis: (No statistical differences between meat handlers' hygiene attitudes and good hygiene practices (GHPs). Results in the table (**13)** shows that the value of chi – square calculated to signify the differences was (44.56) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically for the Agree. Therefore, it is apparent that, these findings show that meat handlers' hygiene attitudes are not conformance with good hygiene practices (GHPs).

Discussion of forth hypothesis: (No statistical differences between meat handlers' competencies and basic food safety knowledge). Even though results from table (**15)** shows that the value of chi – square calculated to signify the differences was (94.26) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically for the undecided. But, in comparing with results of the statements in the table **(27)** one can emphasize that, this is due to lack of training and awareness of food safety knowledge.

Discussion of fifth hypothesis: (No statistical differences between meat handlers' level of awareness on food safety regulations, laws and, the involvement of governmental authorized bodies in the deployment and communication of food safety regulations, laws at butchery level). According to results in the table (**17**) shows that the value of chi – square calculated to signify the differences was (52.13) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically for the Agree. Thus, researcher can conclude distinctly that, governmental authorized bodies are not involved in the deployment and communication of food safety regulations, laws and procedures at butchery level so; there is lack of deployment and communication of food safety regulations, laws and procedures throughout meat handlers.

Discussion of sixth hypothesis: (There are challenges that facing related authorized governmental bodies to introduce and enforcement of Food Safety Management System and HACCP principles at meat markets or butcheries level). Adhering to results from **(29)** shows that the value of chi – square calculated to signify the differences was (52.13) with P-value (0.000) which is lower than the level of significant value (5%) These refer to the existence of differences statistically for the Agree. The researcher can stress that, these results highly prove the hypothesis that, there are structural, technical, informational, and financial challenges that facing related authorized governmental bodies to introduce and enforcement of Food Safety Management System and HACCP principles at meat market or at butcheries level**.**

4.4: Observational assessment of meat markets

4.4.1: Checklist sheet data analysis and results.

Table (30) Location, boundaries, internal and external design and license of butchery or meat shop.

No.	Statement	Yes	%	No	%	Any additional comments	%
1	Does the location of the butchery is close to public toilet	14	56.0	11	44.0	0	0.00

2	Does the location of butchery is close to fruits and vegetable selling place	24	96.0	1	4.0	0	0.00
3	Does the location of butchery is close to tobacco selling shop	11	44.0	14	56.0	0	0.00
4	Does the location of selling meat close to waste collection garbage	8	32.0	17	68.0	0	0.00
5	Does the internal design of the butchery facilitate cleaning and sanitation	1	4.0	24	96.0	0	0.00
6	Meat is displaying open on the tables at roadside	11	44.0	14	56.0	0	0.00
7	Does the layout of the butchery facilitate cleaning and sanitation	1	4.0	24	96.0	0	0.00
8	Does the butchery has valid license	1	4.0	24	96.0	0	0.00

Table (31) Hygiene facilities, cleaning equipment's, sanitation and disinfectant agents.

No.	Statement	**Yes**	**%**	**No**	**%**	Any additional comments	**%**
1	Are there toilets and washbasins	0	0.00	25	100.0	0	0.00
2	Are there hard and soft brushes	2	8.0	23	92.0	0	0.00
3	Are there air pump and dust removable	0	0.00	25	100.0	0	0.00
4	Does the butchery supplied	0	0.00	25	100.0	0	0.00

	with potable water source						
5	Does the butchery connected to drainage system	0	0.00	25	100.0	0	0.00
6	Are there liquid or solid soap	1	4.0	24	96.0	0	0.00
7	Are there sanitary and disinfectant agents	0	0.00	25	100.0	0	0.00

Table (32) Processing areas and equipment.

No.	Statement	Yes	%	No	%	Any additional comments	%
1	Is the tables and equipment are made of iron	13	52.0	12	48.0	0	0.00
2	the surfaces of tables are rough and have cracks	11	44.0	14	56.0	0	0.00
3	Are there peeling of paints of the meat contact surfaces and/or walls	7	28.0	18	72.0	0	0.00
4	Do the cleaning status of table surfaces can assure meat safety	3	12.0	22	88.0	0	0.00
5	Do the cleaning status of hooks, knives and axes are conform to good hygiene practices	0	0.00	25	100.0	0	0.00
6	Do the status and cleanliness of cutting boards or woods assure meat safety	0	0.00	25	100.0	0	0.00
7	Is there water boilers	0	0.00	25	100.0	0	0.00

Table (33) Meat storage and displaying.

No.	Statement	Yes	%	No	%	Any additional comments	%
1	Is there a refrigerator	3	12.0	22	88.0	0	0.00
2	Is there reserve source of electricity	1	4.0	24	96.0	0	0.00
3	Do they display meat on table and open to flies and winds	23	92.0	2	8.0	0	0.00

Table (34) Personal hygiene and meat handling hygiene practices.

No.	Statement	Yes	%	No	%	Any additional comments	%
1	Do the meat handlers have valid personal health card	3	12.0	22	88.0	0	0.00
2	Do butchers wear ring or watch	21	84.0	4	16.0	0	0.00
3	Do butchers work with bare hands	25	100.0	0	0.00	0	0.00
4	Do butchers wear head caps	1	4.0	24	96.0	0	0.00
5	Is butchers wear aprons	14	56.0	11	44.0	0	0.00
6	Do butchers clothes are dirty	16	64.0	9	36.0	0	0.00
7	Do butcher smoke while serving consumer	6	24.0	19	76.0	0	0.00
8	Do butcher chewing tobacco while serving consumer	6	24.0	19	76.0	0	0.00
9	Do butcher handle meat and	23	92.0	2	8.0	0	0.00

	catch money with bar hand at the same time						
10	Are there wounded or sick butcher and still keep working	5	20.0	20	80.0	0	0.00
11	Do the butchers smear knives, table surfaces and weighing machine with piece of clothes	22	88.0	3	12.0	0	0.00
12	Do butchers wash their hands regularly after serving the last customer	6	24.0	19	76.0	0	0.00
13	Do the butcher work with the same clothes after being back from public toilets	18	72.0	7	28.0	0	0.00
14	Do butchers eat inside the butchery	14	56.0	11	44.0	0	0.00

Table (35) Pest control.

No.	Statement	**Yes**	**%**	**No**	**%**	Any additional comments	**%**
1	Are there flies seen on the meat, surfaces, or even inside the butchery	20	80.0	5	20.0	0	0.00
2	Is there any chemical agent or any tool to control flies	4	16.0	21	84.0	0	0.00
3	Is there dog or cat inside or nearby the butchery	2	80.0	23	92.0	0	0.00

Table (36) **Wastes control**.

No.	Statement	**Yes**	**%**	**No**	**%**	Any additional comments	**%**
1	Is there waste containers	5	20.0	20	80.0	0	0.00
2	Are there solid wastes container	7	28.0	18	72.0	0	0.00
3	Is there liquid wastes container	2	8.0	23	92.0	0	0.00
4	Do the waste containers kept open to pests	7	28.0	18	72.0	0	0.00
5	Do the waste containers are kept nearby to meat displaying or processing area	5	20.0	20	80.0	0	0.00
6	Is there bones, bloods, leather or parts of leather, hairs are abandon on the ground or at meat contact surfaces	19	76.0	6	24.0	0	0.00
7	Are there any signs or written rules to deal with wastes	0	00.0	25	100	0	0.00

4.5: The main results.

1. Demographic profiles:

Depends on education level of meat handlers (butchers), results achieved from the table (**7**) showed low level of formal education which found under category of basic 42 by (39.6%) and secondary 51 by (48.1%).

2. Meat market hygiene conditions.

With respect to meat markets hygiene conditions, referring to results on table (**8)** and table (**9**) of questionnaire, majority of participants by 85

(79.2%) strongly agree and by 21 (19.8) agree that the place of butchery is close to fruits and vegetable selling place; about 49 (46.2%) of respondents strongly agree and 11 (10.4%) agree that the place of butchery is close to wastes gathering place; almost all participants 98 (92.5%) strongly agree that the meat shop or butchery is not supplied with potable water source; and by 94(88.7%) also strongly agree that the meat shop or butchery is not connected to drainage system; As well as, it showed that about 50 (47.2%) of respondents strongly agree that meat is displaying on tables outside near to street while, 52 (49.1%) of them strongly agree that meat is displaying inside butchery open on the tables and hooks. According to results of observational tool on tables (1 to 4 and 6-7) allocated to cover other aspects related to meat market hygiene conditions, it found that nearly all (96.0%) of butcheries were not issued with valid licenses. Totally 25 (100%) observed butcheries were not equipped with wash basins, air pumps and water boilers. Nearly in all 23 (92.0%) assessed butcheries reported the absence of hard and soft brushes. And about 24 (96.0%) of butcheries did not use either liquid or solid soap.

Hygiene conditions of processing areas and equipment were also assessed by using observation tool. Results in the table (**32**) describing in detail the worsening conditions of working tables and equipment. Approximate 13 (52.0%) of tables, knives, hooks and axe were made of iron. Where, about 22 (88.0%) of observed tables their cleaning status were not assure the safety of meat as clarified by picture (**14**) in annex 1. In all 25 (100%) butcheries observed show that the cleaning status of knives, hooks and axe were not conform to good hygiene practices. And the same for cutting boards or woods (Gorma) as showed by picture (**9**) in the annex 1.

In verifying hygiene conditions of meat markets, issues like meat storage facilities, meat displaying patterns, pests control and wastes control methods that undertaken by butchers were assessed through adopting

observational tool. Results obtained in the tables (**33, 35** and **36)** about 22 (88.0%) of butcheries assessed, the refrigerators were not found. Instead of that, meats stored in baskets made of local materials as appeared by pictures (**9**) and (**18**) in the annex 1. Nearly all 24 (96.0%) butcheries did not supplied with reserve source of electricity. Unprecedented evidences of displaying meat on tables open to flies and winds also observed as manifested in pictures (**6**, **7**, **8**, **10**, and **13**) in the annex 1. And flies were observed on meats surfaces. Chemical agents were not seen. Only 5 (20%) of butcheries illustrated that the availability of solid waste container. However, it kept close to meat processing or displaying area. Written rules or any demarcation signs were not noticed too.

3. Meat handler's personal (butchers) hygiene practices

In this study the most remarkable results that indicate unhygienic practices of meat handlers were obtained as outlined in the tables (**10**), (**11**) and table (**34**) of checklist sheet where, almost, all respondents their responses ranged between disagree and strongly disagree when responded to positive statements such as, wash our hands before and after handling meat disagree 76 (71.7%) and strongly disagree 24 (22.6%). Wash our hands after handling waste disagree by 47 (44.3%) and strongly disagree by 26 (24.5%). Wash our hands and sanitize after using toilets disagree by 59 (55.7%) and strongly disagree by 26 (34.0%). Wash our hands after smocking or chewing tobacco disagree by 51 (%48.1) and strongly disagree by 44 (41.5%). Wash our hands after sneezing disagree by 50 (47.2%) and strongly disagree by 47 (44.3%). These results indicate that washing hands is absolutely not practiced. On the other hands, the only cleaning practice applied to clean knives, surface of tables, hooks and weighing machine was smearing with pieces clothes as interviewed meat handlers reported that about 80 (75.5%) strongly agree and agree by 25 (23.6%).

On the issue of bare hands of meat handlers influence the safety of meat, majority of respondent 83 (78.3%) strongly agree and 23 (21.7%) agree that the person who serve the customer is one that who catch money with bare hands as confirmed by picture **(11**) at annex 1.

The stem of large tree which locally known (Gorma) as showed by pictures (**9**) and (**15**) of annex 1, it was used to cut bones and they left it open at night and use a next day without washing as interviewed meat handlers reported strongly agree by 77 (72.6%) and agree by 25 (23.6%).Then, the probability of licking by dogs, cats and rats is possible.

The most striking result to emerge from the data is that butchers use public toilets in the market with their same clothes and shoes. Where, about 88 (83.0%) responded meat handlers strongly agree that this is happen.

In case of communicable disease such as diarrhea, flu, typhoid fever, and even open wounds majority of participated butchers, 74 (69.8%) strongly agree that they continue working if able to work.

The only positive result obtained in regard to hygiene practice of butcher is that, they wear apron while working but, washing apron after work is also not practiced.

Other, strong evidences of poor personal hygiene status and hygiene practices of meat handlers were observed by using checklist tool. Results on table (**34**) was stipulate that, approximately, 22 (88.0%) of meat handlers did not have valid personal health cards. About 21(84.0%) meat handlers saw wearing rings and watches at work time as described by picture (**7**) in the annex 1. All, (100%) of butchers work without using gloves or head caps.

Only about 5 (20.0%) butchers among 25 butcheries assessed with checklist tool, found working even though they were suffering from wounds on their hands.

Thus, one can concludes that, the overall hygiene practices of meat handlers that highlighted by this study were far behind the requirements of GHPs.

4. Meat handlers' hygiene attitudes.

Results in the table (**12**) and table (**13**) elucidate that, nearly all meat handlers when asked about whether they allow customer to get into the butchery or shake hands with as greetings, they responded by strongly agree (78.3%) and agree by (11.3%). Also, in regard to negative attitudes when inquired about the possibility of working without wearing apron they strongly agree by (40.6%) and agree by (23.6%). About two-third of respondents either disagree or strongly disagree that the butcher is have to replace watches and rings during work time. Above fifty percent of the respondents proof strongly agree (31.1%) and agree (25.5%) that they usually blow the air of their mouth to open plastic bags for packaging meat. In this study, above two-third of the respondents either disagree (58.5%) or strongly disagree (10.4%) to stop working in case of hands injuries or wounds. Using cap is important to prevent probability of occurrence cross contamination of food with physical hazards such as hair of food workers. In this regard, results showed that no commitment to wear head caps during work time as denoted from their perspective towards the importance of putting head caps. Negative attitudes related to a statement, smoking and chewing tobacco are common inside the butchery, nearly about (43.9%) of respondents strongly agrees and about (26.4) agree that this attitude is common habit inside the. About fifty percent of meat handlers responded that, they throw such tissues direct to dogs and cat’s by the strongly agree (31.1%) and agree by (19.8%). In this study, the only positive attitude obtained was that, safe meat handling in the butchery is the job responsibility of the butchers, where, (33.0%) of the respondents strongly agree and (28.3%) of them said agree.

5. The level of basic hygiene knowledge and awareness on good hygiene practices among the butchers.

Results in the table (**14**) and table (**15**) revealed unacceptable levels of basic hygiene knowledge and lack of awareness on good hygiene practices among the butchers. Regarding to a statement that, meat is a high-risk food and if not handled careful can cause dangerous diseases to consumer. Almost, 51.9% of the respondents reported neutral (undecided). This denotes that, they were not aware about the nature and diseases related to this product. In respond to a statement that, food hygiene means prevent food from cross-contamination with germs. Approximately, the highest percentages of responses of the respondents ranged between (79.2%) disagree and (13.2%) strongly disagree. Washing hands with warm water and phenol carbolic soap can reduce risks of meat contamination by germs, and flies, mouse and cockroaches are victors of foodborne disease. Where, their responses was under the undecided option by (68.9%), (60.4%), (44.3%), and (56.6%) respectively.

Almost, above fifty percent of respondents disagree that, the hands of butchers can play critical role in contaminating meat if bare hands contact occur and the probability of typhoid fever transmission can be in case if butchers suspected for carrying that disease. Furthermore, butchers were not aware of acceptable level of temperature to store meat. Nearly, sixty percent of respondents disagree that, displaying meat openly at room temperature is prone to contaminate with health risks factors. In relation to a statement the existence of dog, cat, or rats inside the butchery is danger for you and customer alike, approximately, (40.6%) of respondents disagree and by (6.6%) strongly disagree that, it is a matter of health for them and customers. in addition to what mentioned above, gaps in basic hygiene knowledge and awareness on good hygiene practices related to: medical fitness of butcher to work, the role of work equipment and surfaces

such as Knives, surface of table, hooks and axe in contaminating meat, ignorance of risk by retaining animal by-products such as blood, pieces of bones, inedible tissues inside the butchery all the day, and unhealthy habits such as spitting, sneezing and coughing inside the butchery remarkably detected.

6. Deployment and communication of food safety regulations, laws, and hygiene procedures among meat handlers (butchers).

Results attained in the table (**16**) and (**17**) highlighted tremendous gaps in regard managerial aspects of related authorized bodies.

Approximately, in response to a statement that, relevant authorities provide us training opportunity on safety requirements aspect, respondents replied that (44.3%) disagree and (38.7%) strongly disagree. And nearly all meat handlers responded they were not attended even basic hygiene training course.

Participated meat handlers, about (28.3%) disagree and (27.4%) strongly disagree that, relevant authorities informed them about best hygiene practices and food safety regulations and related laws through meetings. Also provisions of information can be through providing knowledge materials such as manual, leaflets and instructions that containing hygienic operations and practices. Nearly all respondents disagree that relevant authorities had involved about doing so. In addition to that, above fifty percent of respondents agree that the official authorities did not specify to them safety requirements prior to establishing the butchery. These results indicate the limitations of the meat safety authorized bodies in regard of sharing information with meat handlers.

Considerable numbers of respondents by (58.5%) strongly agree and (17.6%) agree that obtaining license is always being after work start at butchery. Dismally, about all respondents strongly agree that having a license is always associated with collection of government fees while

visiting the relevant authorities. Interestingly, above eighty percent of participated meat handlers strongly agree that there are no preconditions that identify an appropriate equipment and hygiene facilities required to be in place to obtain license.

In this study, powerful evidences of deficiencies in compliance with health standards of meat handlers were validated. Above seventy percent of respondents strongly agree that butchers can work without possessing health card and butchers may start work even at the first time without prior medical examination. Nearly, above two-third of the participants strongly agree the statement that, there is no requirement about periodic medical examination to be competent to work. And, above ninety percent of respondents strongly agree that the absence of coordination and meetings in regular base between them and relevant authorities.

7. The potential challenges that can inhibit related governmental authorized bodies to introduce and enforcement of food safety management requirements and HACCP principles at meat market (butcheries point).

Curiously, for the sake of full understanding of potential barriers that could restrain related governmental authorized bodies to play their roles and responsibilities to introduce and enforcement of food safety management requirements and HACCP principles at meat markets. 91 participants from various occupation categories that belonged to public health services providers and veterinary services providers were interviewed by using 8 statements. Results in the table (**22**) and table (**23**) pointed out that indisputable evidence of structural, technical, informational, and financial barriers. It was found that almost all respondents strongly agree that there is overlapping between relevant authorities in terms of responsibilities and roles in regard to meat markets, there is lack of coordination and collaboration between relevant authorities to deal with meat market hygiene conditions, public are not aware of food borne diseases and their

consequences, there is lack of training programs to personnel who work in meat markets as inspector or supervisor, there is lack of financial resources that challenges governmental authorized bodies to play effective and efficient roles, and there is no well-equipped and competent laboratory specific for food safety.

Furthermore, nearly over eighty percent of respondents were strongly agree that there are abuse of veterinary drugs and pesticides at farm level. And about (100%) of the respondents though that a unity food safety authorized body can be an option to address overlapping.

4.6: Some images obtained while conducting observational assessment.

Picture1: describes structured gable established by Nyala municipal authority at big market which Showed plastic tanks for keeping water and waste gathering Container nearby work place.

Picture2: structured gable established by Nyala municipal authority at Malaja market. But it was refused by butchers. They claimed that the place where built not facilitate coming of customer and not capacitate for all butchers and as a result other butchers displayed meat at street side and this more accessible for customer. This underlines the

Picture3:structured gable established by Nyala municipal authority at Shaabi market. This is also abandoned due to wastes built up as an indicator for lack of daily cleaning which that clearly reflected by condition of ground.

Chapter Five

Discussion, Conclusions and Recommendations.

5.1: Discussion.

1. Demographic information.

The assessment results on the education level of meat handlers, showed low level of formal education which found under category of basic 42 by (39.6%) and secondary 51 by (48.1%). these results reflect warrant that if and only if butchers were not trained well and also not monitored continuously meat will be hazardous due to technical barriers relevant to meat safety.

2. Meat market hygiene practices and hygiene conditions.

As reported by Karma (2014), the place of butchery, internal and external design, and extent to which is equipped with necessary facilities that ensure good hygiene conditions of premises could play critical role for meat safety. In this study, with respect to meat markets hygiene conditions, among 8 statements assessed, the results obtained describe poor hygiene conditions of meat markets.

Assessment of place where the butchery was built, results indicate strong evidence of inappropriate place where, the majority of butcheries located close to fruits and vegetable selling place or nearby wastes gathering area. That, an indication for the lacking of instructions that can entail butchers to comply with safety standards of premises' place. Places like that contribute on offering significant opportunities for flies to contaminate meat with biological health hazards.

In this study, through observational assessment, lack of hygiene facilities was found to cause unhygienic conditions of meat market. Totally all 25 (100%) observed butcheries were not equipped with wash basins, air pumps and water boilers, hard and soft brushes, either liquid or solid soap and not connected to either source of potable water or effective drainage system. This may be the cause of dirt build-up which resulted in seeing

particles of bones, heaps, and other wastes in some butcheries as showed by pictures (2), (3) of observational assessment images and, pictures (15) and (18) in the annex 1.

The study results also elucidated that displaying meats on tables and hooks open to flies and wind is a common feature in all patterns of meat marketing as manifested by pictures (6, 7, 8, 10, and 13) in the annex 1.

What is surprising is that, all butcheries were not issued with valid licenses. A possible explanation for this result may be due to managerial shortcomings of authorized bodies. This finding has important implication for developing criteria and policies for acquiring legal permissions that outline all safety requirements of the butchery.

Tables, knives, hooks and axe as meat contact surfaces were made of iron. This indicates that the probability of occurring iron rust is given as long as carcasses' fluids humidity and temperature are available. Thus, environmentally, it provides efficient conditions for growing micro-organisms if continuous cleaning and sanitation is not practiced.

Surprisingly, storing meats at room temperature on baskets made of local material and open to flies instead of refrigerators was detected. In fact, this exposes meat to contamination and spoilage.

The result represented for availability of waste containers in the butchery, found only solid waste container. However, this result was not very encouraging because it kept close to meat processing or displaying area. This finding suggests the importance of availability of well-designed and separate waste container may reduce contaminating of meat with biological health hazards resulted in transmission of germs by flies.

These results imply that the overall meat markets' hygiene conditions are very poor and consequently, meats purchased from these markets could compromise the consumer health.

3. Meat handler's personal (butchers) hygiene practices.

The hands of meat handlers can considerably contribute to cause cross-contamination of meat, as highlighted by Kelkor & Tiwari (2014), as critical control points must be controlled. Muhammad et al (2016) and FDA (2006) pointed that, policies like no bare hands contact and clean as you go if not administered and practiced the food inevitably become hazardous. WHO (2001) among the five keys to safer food, keep clean is represents the building block for food to be safe and interested in hand washing. In this study, except when going to eat, a hand washing is not practiced. This offer great opportunity for occurrence of what is widely recognized the Feacal-Oral route of infection with biological health hazards for consumers. According to this we can infer that, butchers were not aware of the importance of hand washing.

With respect to personal hygiene practices of butchers, it was found that, no commitment on wearing self-protecting units such as apron, gloves or facemask and head caps during work time. These results are likely to be related to lack of awareness on GHPs, lack of enforcement and monitoring of safety criteria that could assure the safety of meat at butchery. So, could lead to contaminating meat with biological and physical health hazards.

Contrary to expectations, cleaning of meat contact surfaces such as tables, knives, hooks, weighing machines, and cutting boards (Gorma) was not practiced by meat handlers. Instead of that, participated meat handlers reported that they smear with pieces of clothes as means of cleaning. This is an indicator for lack of commitment towards cleanliness of work environment and which in turn creates opportunities for existence and multiplication of microbes due to the availability of encouraging conditions such as humidity and temperature. This also creates another health dilemma that, smearing could not guarantee the absenteeism of microbes in the meat. The stem of large tree which locally known (Gorma) was used to cut bones

and they left it open at night and use a next day without washing. Then, the probability of licking by dogs, cats and rats is given. Hence, could result in pets related health hazards.

One unanticipated finding was that, the person who serves the customer is one that who catch money with bare hands. This may result in contaminating meat with health hazards because; money can also be the way through which occurs cross-contamination.

It is interesting to note that, evidence of unhygienic behaviors and malpractices such as eating or drinking inside the butchery, butchers use the same clothes and shoes after return from public toilets in the market, and wearing rings and watches while working were obtained. This explicates great overreaching of GHP.

Despite, less frequent evidences (24.0%) of butcher who smoking and chewing tobacco while serving customer was detected but, this result is also suffice to infer that the safety of meat is under incompetent handlers.

Other, strong evidences of poor personal hygiene status and hygiene practices of meat handlers were observed by using checklist tool. Meat handlers did not have valid personal health cards which imply that, they were not subjected to screening tests against communicable diseases such as Typhoid Fever, Tuberculosis as an example, but not limited. This result is in agreement with that obtained by Aburi (2012) in the literature review when reported that above fifty percent of butchers were failed to prove personal health cards.

In previous study of Tegegne et al (2017) very similar aspects of hygiene practices have been assessed. However, results achieved (except butcher: eat and drink in their work place by 69.2%, do not use caps by 62.6%, and do not use mask by 89.9%) in contrast to results showed by this study.

Thus, one can concludes that, the overall hygiene practices of meat handlers that highlighted by this study were far behind the requirements of GHPs.

4. Meat handlers' hygiene attitudes.

Generally, attitude of food handlers on accomplishing a good hygiene practices is an important aspect that result in reduction of food hazards to acceptable point that can assure the safety of food. Ablah (2017) reported that the interesting elements that may have an impact on food handler's attitudes may be the level of knowledge, learning, education and training of food handlers. The most striking findings of food handlers' hygiene attitudes elucidated in this study were classified as negative attitudes. Where, majority of respondents reported that, meat is handled with bare hands, allow customers to get into the butchery or shake hands with as greetings. Therefore, hands of meat handler and customer as an outsider can carry food hazards from-to meat shop. Also, in regard to negative attitudes of working without wearing apron, wearing watches and rings during work time, blow the air of their mouth to open plastic bags for packaging meat, and working without wearing head caps were detected.

Optimally, based on scientific base, in case of hands' injuries or wounds, food handler should have to stop working until healing in order not to contribute for existence of biological hazards in the food. In this study, in such cases some butchers found continue with.

The most disturbing finding is that, butchers throw inedible parts of carcasses such as genital organs, abscesses and watery sacks direct to dogs and cats instead of managing through collecting in specific wastes containers and at the end of work should be discarded scientifically. Because of, the probability that, these inedible tissues contain biological health hazards is given. Moreover, neutral responses for meat handlers' attitudes were obtained when meat handlers respond to statements such as;

washing hands before and after handling meat can reduce cross-contamination with hazards; keeping work place, equipment and surfaces clean can reduce the risk of safety hazards; and cutting boards, hooks and knives should be clean before and reusing. A possible explanation for this could be argued that, butchers were not aware of meat safety knowledge.

In this study, the only positive attitude obtained was that, safe meat handling in the butchery is the job responsibility of the butchers, where, (33.0%) of the respondents strongly agree and (28.3%) of them said agree.

In this study, in regard to meat handlers' attitudes, contradictory results were found in comparison to a previous study of Tegegne et al (2017).

5. The level of basic hygiene knowledge and awareness on good hygiene practices among the butchers.

The level of basic hygiene knowledge and awareness on good hygiene practices of butchers until nowadays represent continuous pursuits and the goal that has not been achieved yet. Because, without the capacity buildings on hygiene knowledge and good hygiene practices. Butchers may find technical difficulties to comply with good hygiene practices.

Among 15 statements used to assess the level of basic hygiene knowledge and awareness on good hygiene practices of butchers, except the statement that, the tall nails of the fingers can contain germs that can contaminate meat and cause food poisoning or diarrhea, results related to other statements revealed that, unacceptable levels of basic hygiene knowledge and lack of awareness on good hygiene practices among the butchers. Thus, causes for concern are that, considerable numbers of meat handlers were failed to perceive real meanings behind the statements that dedicated to cover knowledge about good handling practices, how can butcher contributes to unintended occurrence of cross-contamination of meat, occupational health hazards and awareness of diseases vectors. In this study, unsatisfactory levels of basic hygiene knowledge and hygiene

awareness among butchers were that, not aware about the nature and diseases related to meat which need safety handling. Because, meat is by nature considered a high risk food as highlighted by Elniema et al (2016) that, recently, specific types of pathogenic organisms such as E.coli 150:H7, Salmonella spp, and Combylobacter SPP were detected with samples taken from raw meat.

In fact, uncertainty about something due to the lacking of information related to, individuals might face difficulties on making the right decision or perspective. Results showed that, in varying proportions, respondents failed on making the appropriate / compatible decision or perspectives upon HACCP is a preventive approach to attain meat safety, regular washing of hands during meat handling and processing reduce risks of contamination, washing hands with warm water and phenol carbolic soap can reduce risks of meat contamination by germs, and flies, mouse and cockroaches are victors of foodborne disease. A possible explanation for this is that, most of the statements were phrased with pure scientific meanings related to food safety which requires level of understanding about knowledge and concepts related to food safety. This can be acquired through training and education. Therefore, it might be the rationale behind that.

Almost, above fifty percent of respondents disagree that, the hands of butchers can play critical role in contaminating meat if bare hands contact occur and the probability of typhoid fever transmission can be in case if butchers suspected for carrying that disease. The possible explanation for this is that, meat handlers were not aware of possible root causes of meat's contaminations and types of contaminants. Furthermore, butchers were not aware of acceptable level of temperature to store meat.

Pets such as dogs, cats and rats should not be allowed to exist in side butchery because they are carrier for some pathogenic organisms. In

relation to a statement the existence of dog, cat, or rats inside the butchery is danger for you and customer alike approximately, (40.6%) of respondents disagree and by (6.6%) strongly disagree that, it is a matter of health for them and customers. This result pointed out that, butchers were not armed with necessary information about pest related diseases. Butchers must be medically fit for food safety requirements in order not to contribute to contaminate meat with biological hazards. in addition to what mentioned above, gaps in basic hygiene knowledge and awareness on good hygiene practices related to: medical fitness of butcher to work, the role of work equipment and surfaces such as Knives, surface of table, hooks and axe in contaminating meat, ignorance of risk by retaining animal by-products such as blood, pieces of bones, inedible tissues inside the butchery all the day, and unhealthy habits such as spitting, sneezing and coughing inside the butchery remarkably detected.

6. Deployment and communication of food safety regulations, laws, and hygiene procedures among meat handlers (butchers).

If hygiene practices of butchers are to be improved, relevant authorities should exert efforts to keep butchers informed with food safety regulations, laws, and hygiene procedures. This can be achieved through the deployment and communication of food safety related concepts, statutory and regulatory requirements, roles and responsibilities of the butchers. To assess to what extend the authorized bodies involved in deployment and communication of food safety requirements and laws among meat handlers, the study adopted 15 statements and benefited from feedback mechanisms of butchers. The results of this study show that, tremendous gaps related to managerial aspects of related authorized bodies.

Generally, training as a mechanism of acquiring knowledge must be launched by food safety authorized bodies to meat handlers, because without capacity building of meat handlers it is hard to questioning about

safety handling, processing or manufacturing of meats. In literatures review Wade (2009) reported that training is an important feature of effective system management including the others. Hana (20018) claimed that inadequate training and lack of awareness can form hard challenges to business excellent. In this study, significant results that describe lack of training programs were noticed. Approximately, all meat handlers responded were not attended even basic hygiene training course.

Availability and accessibility of Information to food handlers represents a corner stone to comply with the requirements' of food safety. Newborne et al (2007) considered as an important inputs for any decision for improving interventions when defined evidence-based decision making as information based intervention that concerns with risk analysis, training and provision of information. Lacking of information about food safety requirements among butchers as part of meat chain actors was identified. Results highlighted that, relevant authorities were not involved in informing butchers about best hygiene practices and food safety regulations and related laws through meetings or through providing knowledge materials such as manual, leaflets and instructions that containing hygienic operations and practices, descriptions as pre-hygiene requirements for establishment of butcheries which specify internal and external design, location boundaries, surfaces, and required hygiene facilities. These results indicate the limitations of the meat safety authorized bodies in regard of sharing information with meat handlers.

The current study found out overwhelming evidences of managerial pitfalls pertained to obtaining licenses, preconditions that identifying appropriate equipment and required hygiene facilities, possessing of health cards, requirement of screening tests against contagious diseases at first before involving at work and periodic medical examinations, and coordination or communication platforms. Considerable numbers of

respondents by (58.5%) strongly agree and (17.6%) agree that obtaining license is always be after work start at butchery and always associated with collection of government fees while visiting the relevant authorities' representatives.

Meat handlers must be healthy competent before entering to the business and must be examined periodically to ensure that they were free from communicable diseases. These instructions should be strictly managed by related governmental authorized bodies that responsible for the safety of foods of animal origin. In this study, powerful evidences of deficiencies in compliance with health standards of meat handlers were validated.

Monetary penalties as a form of intervention to get butchers compliant with meat safety requirements could be ineffective unless accompanied with provision of information about what is legal or illegal. Reasonable explanation is that, in spite of butchers being subjected to penalties more than once, compliance with good hygiene practices still remained at worst.

It is important to note that, assessing whether the food safety authorized bodies involved in deployment and communication of food safety requirements and laws among meat handlers by using feedback mechanism from butchers is not found in the literatures review.

7. The potential challenges that can inhibit related governmental authorized bodies to introduce and enforcement of food safety management requirements and HACCP principles at meat market (butcheries point).

Curiously, for the sake of full understanding of potential barriers that could restrain related governmental authorized bodies to play their roles and responsibilities to introduce and enforcement of food safety management requirements and HACCP principles at meat markets. 89 participants from various occupation categories that belonged to public health services providers and veterinary services providers were interviewed by using 8 statements. Findings pointed out that indisputable evidence of structural,

technical, informational, and financial barriers. It was found that almost all respondents strongly agree that there is overlapping between relevant authorities in terms of responsibilities and roles in regard to meat markets, there is lack of coordination and collaboration between relevant authorities to deal with meat market hygiene conditions, public are not aware of food borne diseases and their consequences, there is lack of training programs to personnel who work in meat markets as inspector or supervisor, there is lack of financial resources that challenges governmental authorized bodies to play effective and efficient roles, and there is no well-equipped and competent laboratory specific for food safety.

These results have a number of similarities with Laurian & Nancy (2002), Von & Pandya (2003), FAO (2005), Grace (2015), WHO (2007), Tracy et al (2018), Atif et al (2012), WHO/FAO/ and National Codex Alimentarius Committee NCAC-CODEX 50 SD (2013) where reported that as a case of many developing countries and sub-Saharan Africa were challenged by several barriers which named structural, technical, informational, and financial.

5.2: Conclusions.

The purpose of the current study was to assess hygiene practices and hygiene conditions of meat markets.

This study concludes that, formal education level of butchers was either basic or secondary. This finding suggests the importance of building capacity of butchers through training is a necessary need.

The most obvious findings to emerge from this study are that, meats' markets hygiene conditions are deviant in comparing with the food safety management requirements and HACCP principles. Where, sufficient numbers of butcheries found close to fruits and vegetable displaying areas. Moreover, butcheries were not issued with valid licenses, and designating forms of butcheries did not facilitate hygiene practices.

The study has also shown that, butcheries was not supplied with potable water sources or connected to effective drainage system, lack of hygiene facilities, cleaning equipment and sanitation or disinfectants agents. These finding suggest that efforts are needed to facilitate butchers to be able to afford to necessary and safe guarded hygiene facilities.

The assessments of hygiene practices have shown that, malpractice evidences of hygiene practices; hands did not wash all day time even when returned from public toilets; bare hands allowed to contact meat and money at the same time; the only cleaning practice undertaken by butchers was smearing surfaces of tables, knives, hooks, and weighing machines using pieces of clothes; butchers eat and drink inside butchery; wearing watches and rings during work time; used woods (Gorma) as cutting wood and self-protective gear were not used.

One of the more significant finding to emerge from this study is that, majority of butchers did not have valid personal health cards. Taken together, these findings suggest the role of authorized bodies in promoting good hygiene practices among meat handlers, effective enforcement of food safety regulations and laws among butchers, day-to-day monitoring and control.

In addition to what concluded above, following conclusions can be drawn from the current study negative attitudes of meat handlers towards: allowing customer to be inside the butchery and touch meat; in case of injury butcher continue working; wearing of self-gear clothes, smoking and chewing tobacco habits inside the butchery; safe controlling of inedible parts of carcasses; and cleaning and sanitation attitudes. Butchers were not technically competent to play critical roles to safe meat. Because they were not aware of root causes of cross-contamination, the role of vectors to contaminate meat, and types of food safety hazards. These findings suggest the necessity of awareness campaign among meat handlers.

The study also concludes that for the time being authorized bodies were not involved in deployment and awareness of food safety regulation, laws and hygiene procedures to butchers.

In the end, the study was revealed that, there were various barriers to authorized bodies that summarized as structural constrictions resulted from overlapping of different roles and responsibilities, informational barriers due to lack of training, technical barriers in terms of unavailability of competent laboratory specific to food safety, and financial barriers to solve issues such as inaccessibility of potable water; appropriate lands for establishing butchers; costs of trainings courses or monitoring and control, and lack of coordination.

This study provides a comprehensive assessment of meat markets' hygiene conditions by adopting interview with different actors and multi-dimensions of hygiene conditions and hygiene practices as well as possible challenges that could hinder authorized bodies in case of need mandatory interventions to keep butchers on track of doing required actions to safe meats.

The current study was limited by the absence of assessment of customers' level of awareness and knowledge on food safety and perspectives of customers towards purchasing meat from these investigated markets and the scope of product (raw red meat markets of Cattle, Camel, Sheep and Goat).

The main strength of this study is the inclusion of observational data supported by images (pictures) with main interview data of questionnaire that obtained from three category individuals namely meat handlers, veterinary, and public health services providers.

5.3: Recommendations.

Tremendous efforts by various parties are needed to tackle meat markets hygiene issues. Required interventions should extend to include different dimensions. Thus, if the hygiene conditions of meat markets, meat handlers' hygiene practice and attitudes are to be improved to an acceptable level that result in the safety of meats. The study recommends possible promising projects that, if implemented well may lead to achieve desired changes in:

1. Infrastructures establishment.

Greater efforts are needed from high level state official bodies in provision of appropriate land. Since, the place where the butchery is located significantly impact on the meat markets hygiene conditions. Appropriateness of place can be viewed that has not to be close to public toilets, fruits and vegetable purchasing areas, nearby roads, tobacco selling areas. And not adjacent to wastes gathering areas, restaurants or environmentally polluted areas. Also, internal and external design of butchery has to be described clearly as prerequisite criteria prior to establishing of it. Availability of permanent potable water source and drainage system connection is important for the purpose of hygiene practices.

2. Strengthening of legislations.

Key policies priority should therefore be to plan for the long-term care of meat hygiene through strengthening of existed acts. These contributions can be made by policy makers, regulators, veterinary, and public health bodies.

3. Capacity building.

Unless governmental authorized bodies adopt effective training and education of meat handlers on concepts related to food safety such as

HACCP approach and hygiene operation standards, meat safety will not be attained. The study suggests that, at least attendance of two weeks in training and certification have to be mandatory for any individual intended to work as a butcher. Training programs also need to include veterinary and public health services providers in order to be competent to deal with meat hygiene issues. In doing so, education institutes such as University of Nyala and other capacity building centers contributions are urgent appeal.

4. Comprehensive awareness raising campaigns.

There are a number of important changes which need to be made by implementation of broad awareness raising campaigns. At meat handler level, speed up changes in hygiene practices, attitudes and personal hygiene status as required by food safety laws and regulations that should be practice without any exceptions and relation between customer satisfaction, retention, profits increase and good hygiene practices. Butchers also need to be aware of occupational health hazards and their economic consequences. At consumer level, diseases related to the consumption of meat (meat borne-diseases), unhealthy-economic costs, and the right for procuration of healthy foods as entitled within the human rights. Moreover, this awareness campaigns have to contribute to changes in some habits of meat consumption especially, eating of half cooked viscera which known locally (Marrara). This required effective communication throughout meat chain. To do so, useful communication channels possible to rely on are State Radio and T.V stations.

5. Availability and accessibility of hygiene facilities.

All essential hygiene facilities should be made available to butchers with enabling their purchases power. This monetary facilitation can be conducted through participatory approach with financial institutes such as

banks and non-governmental organizations (NGOs) which active in the area of public health services and community development.

6. Safety - profits perspective.

This concept addresses the cause-effect relationships between safety perspectives of meat vended from the butchers comply with GHPs and food safety regulations requirements and customer satisfaction that can result in profit increasing. This idea contributes to influence the buying decision of customers through informing where to buy or not. This can be done through advertisement process. The logic beyond this is that, as recognized widely in the marketing field the word of mouth can impact effectively on the purchasing decision of customer.

7. Rehabilitation of governmental authorized bodies.

As study findings highlighted that, governmental authorized bodies were facing various challenges that need to be addressed through targeted interventions aimed at improvement in their technical, physical, and financial capabilities in order to be able to play their roles and responsibilities in the food safety.

8. Future study works.

Further studies need to be carried out will include the following area:

- Assessment of community epidemiological perspective of meat borne diseases and socio-economic consequences.
- Assessment of customer satisfaction rates regard to meat vended from the same studied markets.

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Annexes

ANNEX 1

Additional Observation Images.

Picture 4: demonstrates that flies were seen on liver of cattle that displayed open inside the butchery.

Picture 5: shows parts of carcasses putted on the floor of the butchery open to flies.

Picture 6: points to parts of leather close to meat and also some flies were noticed on meat. Moreover, meat was putted on cartons.

Picture7: points to the movable shelter used as butchery and Butchers work wearing watches.

Picture 8: elucidates flies on meat and parts of stomach at the same place to red meat. Furthermore, meat is displayed on absorbable surface.

Picture 9: presents patterns of storing meat. Baskets made from local materials and Axe left with meat or putted on the top of Gorma.

Picture 10: stipulates that meat is displayed at road side, also indicates that butchers eat and drink and that why a cup of tea and water were found there.

Picture 11: shows butcher catch money with bare hands.

Picture 12: describes more than one butchers displayed meat on movable shelters open to flies and wind.

Picture 13: clarifies that meat and vegetable were displayed close to each other open to flies and wind.

Picture 14: highlights the buildup of waste which indicates daily cleaning of the surfaces and floor was not practiced as required.

Picture 15: shows the stems of large trees (Gorma) used as cutting board, accumulation of parts of bones were observed, it is an indicator of lack of gathering and discharge of wastes after each operation.

Picture 16: shows meat and fruits displayed open close to each other, in addition to bare hands of butchers contact meat.

Picture 17: describes remarkable evidence that the meat was left to flies.

Picture 18: shows wastes and meat close to each other, and meat is stored in local material basket open inside the butchery.

Picture 19: shows meat is putted on absorbed surface and displayed close to fruits, bare hands of butcher holding two knives and plastic packages.

Picture 20: shows plastic tanks with water for cleaning of the stomach contents. So flies can easily find ways to meat.

ANNEX 2

Structured questionnaire as main data collection tool.

Questionnaire

Sudan University of Science & technology

College of Post Graduate Studies

Master of Total Quality Management and Business Excellence.

Assessment of Red Meat Market Hygiene based on the Food Safety Management System and HACCP approach Principles. South Darfur State - Nyala. Sudan.

Dear participant please tick on appropriate answer. In case of facing any difficulties to get full meaning or full insight of any statement please feel free to inquiry illustration direct and as soon as possible from researcher.

Note: The data needed to serves only the purpose of this study, personal information such as name and address are not required.

Section one

Specific for meat handlers at butcheries points.

General demographic information

Name of the market:

Big market ( ) El-Malaja market ( ) El-Shaabi market ( )

Mogafe El-geneina market ( ) El-Zariba market ( )

Age:

Less than 18 year ( ) 19-39 year ( )

40-59 year ( ) more than 60 year ( )

Education level:

Illiterate ( ) basic ( )

Secondary ( ) graduate ( )

Post graduate ( )

First pivot (axis): meat market hygiene conditions

No	Statements	Strongly agree	agree	undecided	Disagree	Strongly disagree
1	The place of butchery is close to public toilet					
2	The place of butchery is close to fruits and vegetable selling place					
3	The place of butchery is close to tobacco selling place					
4	The place of butchery is close to wastes gathering place					
5	Meat shop or butchery is not supplied with potable water source					
6	Meat shop or butchery is not connected to drainage system					
7	Meat is displaying on tables outside near to street					
8	Meat is displaying inside butchery open on the tables and hooks					

Second pivot (axis): meat handlers (butchers) hygiene practices.

No	Statements	Strongly agree	agree	undecided	Disagree	Strongly disagree
1	wash our hands before and after handling meat					
2	wash our hands after handling waste					
3	wash and sanitize our hands after using toilet					
4	wash our hands after smocking or chewing tobacco					
5	wash our hands after sneezing					
6	Wash our hands only if we want to eat					
7	wear gloves while we are working					
8	wear cap at all day time working					
9	Wear apron while working					
10	Wash apron after each day working					
11	We wear mask while working					
12	Do not clean the surface and walls of the butchery					
13	Surfaces and walls of butchery would be cleaned twice before and after finishing work					
14	Knives, surface of tables, hooks, and weighing machines we kept without cleaning unless they are not touch the soil					
15	We clean knives, surface of					

	tables, hooks and weighing machine by smearing with clothes					
16	We eat and drink inside the butchery					
17	The person who serve the customer is one that who catch money with bare hands					
18	Use stem of large tree as cutting surface and don not wash it					
19	Use stem of large tree and left it open at night after day work					
20	Use insecticides direct to meat surface to control or kill flies					
21	Butchers use public toilets in the market with their same clothes and shoes					
22	Rings and watches are not replaced while working					
23	In case of communicable disease such as diarrhea, flu, typhoid fever, and even open wounds a butcher may keep working if able to work					

Third pivot (axis): meat handler's hygiene attitudes

No	Statements	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
1	Meat is handled with bare hands					
2	Butcher can let consumer to be inside the butchery and can shake hands as greeting					
3	Safe meat handling in the butchery is the job responsibility of butchers					
4	Butcher can works without wearing apron					
5	Butcher replace ring or watch on the hands while working					
6	Washing hands before and after handling meat can reduce cross-contamination with hazards					
7	Keeping work place, equipment and surfaces clean is reduces the risk of safety hazards					
8	Cutting boards, hooks and knives should be clean before and reusing					
9	Using cap is important to prevent risk of contamination					
10	In case of hands' injuries or wounds handler stop working until healing					
11	Usually blow the air of our mouth to open plastic bags for packaging meat					
12	Smoking and chewing tobacco are common inside the butchery					
13	Butchers throw inedible parts of carcasses such as genital organs, abscesses and watery sacks direct to dogs and cats					

Fourth pivot (axis): The level of basic hygiene knowledge and awareness on good hygiene practices among the butchers.

No	Statement	Strongly agree	agree	Undecided	Disagree	Strongly disagree
1	Meat is a high-risk food and if not handled careful can cause dangerous diseases to consumer					
2	Food hygiene means prevent food from cross-contamination with germs					
3	HACCP is a preventive approach to attain meat safety					
4	Bare hands of butchers can be source of meat contamination and may cause Typhoid fever to consumers					
5	Regular washing of hands during meat handling and processing reduce risks of contamination					
6	Washing hands with warm water and phenol carbolic soap can reduce risks of meat contamination by germs					
7	Tall nail of fingers can contain germs that can contaminate meat and cause food poisoning or diarrhea					
8	Displaying meat openly at					

	room temperature is prone to contaminate with health risks factors					
9	Existence of dog, cat, or rats inside the butchery is danger for you and customer alike					
10	Flies, mouse and cockroaches are victors of foodborne disease					
11	Butcher suffering from cough, diarrhea and skin wounds can contaminate meat with pathogenic organism					
12	Knives, surface of table, hooks and axe can cause cross-contamination of meat with pathogenic					
13	Keeping animal by-products such as blood, pieces of bones, inedible tissues inside the butchery can expose to safety risks					
14	Spitting, sneezing and coughing inside the butchery can contaminate meat with pathogenic organisms					
15	Cleaning as you go is a key to meat safety					

Fifth pivot (axis): Deployment and communication of food safety regulations, laws, and hygiene procedures among meat handlers and butcheries.

No	Statement	Strongly agree	agree	Undecided	Disagree	Strongly disagree
1	Relevant authorities provide us training opportunities in food safety requirements aspects					
2	Relevant authorities inform us best hygiene practices and food safety regulations and related laws through meetings					
3	Relevant authorities provides us with manual, leaflets and instructions as knowledge materials containing hygienic operations and practices					
4	I have attended basic hygiene training course certification and certified					
5	I have attended advance hygiene training course and certified					
6	I have never been trained on good hygiene practices					
7	The official authorities					

	did not specify a specific description as pre-hygiene requirements for establishment of butcheries to us					
8	Obtaining license is always after work start at butchery					
9	There are no preconditions that identify an appropriate equipment and hygiene facilities that must be in place to obtain license					
10	Having a license is always associated with collection of government fees while visiting the relevant authorities					
11	Butchers can work without possessing health card					
12	Butchers may start work even at the first time without prior medical examination					
13	There is no requirement about periodic medical examination to butchers					
14	We often subjected to					

	penalties without informing us what was legal and what was illegal					
15	There is no coordination or meetings in regular base between relevant authorities and butchers					

Section two

Specific to relevant authorities (Veterinary Services and Public Health Providers).

General demographic information

Age:

Less than 18 year ( ) 19-39 year ( )

40-59 year ( ) More than 60 year ( )

Gender:

Male ( ) Female ( )

Education level:

Illiterate ( ) basic ( )

Secondary ( ) graduate ( )

Post graduate ( )

Occupation:

Public health professional ( ) veterinarian ( ) technician ( )

Public health observer ( ) public health observer assistance and employee ( )

Technologist ( ) worker ( ) other ( )

Sixth pivot (axis): potential challenges that can inhibit related governmental authorized bodies to introduce and enforcement of food safety management requirements and HACCP principles at meat market and butcheries point.

No	Statements	Strongly agree	Agree	undecided	Disagree	Strongly disagree
1	There is overlapping between relevant authorities in terms of responsibilities and roles regard to meat markets					
2	There is lack of coordination and collaboration between relevant authorities to deal with meat market hygiene conditions					
3	Public are not aware of food borne diseases and their consequences					
4	There is lack of training programs to personnel who work in meat markets as inspector or supervisor					
5	There is lack of financial resources that challenges governmental authorized bodies to play effective and efficient roles					
6	There is no well-equipped and competent laboratory specific for food safety					
7	There are abuse use of veterinary drugs and pesticides at farm level					
8	Unity food safety authorized body can be an option to address overlapping issue					

ANNEX 3

Checklist sheet for observational assessment.

Sudan University of Science & technology

College of Post Graduate Studies

Master of Total Quality Management and Business Excellence.

Assessment of Red Meat Market Hygiene Conditions based on the Food Safety Management System and HACCP approach Principles. South Darfur State, Nyala - Sudan.

Note: These data needed to serve the purpose of this study only, personal information such as name and address are not required.

Assessment of red meat markets' hygiene conditions			
	Yes	**No**	**any additional comments**
Location, boundaries, internal and external design and license of butchery or meat shop			
Does the location of the butchery is close to public toilet			
Does the location of butchery is close to fruits and vegetable selling place			
Does the location of butchery is close to tobacco selling shop			
Does the location of selling meat close to waste collection garbage			
Does the internal design of the butchery facilitate cleaning and sanitation			
Meat is displaying open on the tables at roadside			
Does the layout of the butchery facilitate cleaning and sanitation			
Does the butchery has valid license			
Hygiene facilities, cleaning equipment, sanitation and disinfectant agents			
Are there toilets and washbasins			

Are there hard and soft brushes			
Are there air pump and dust removable			
Does the butchery supplied with potable water source			
Does the butchery connected to drainage system			
Are there liquid or solid soap			
Are there sanitary and disinfectant agents			
Processing areas and equipments			
Is the tables and equipment are made of iron			
the surfaces of tables are rough and have cracks			
Are there peeling of paints of the meat contact surfaces and/or walls			
Do the cleaning status of table surfaces can assure meat safety			
Do the cleaning status of hooks, knives and axes are conform to good hygiene practices			
Do the status and cleanliness of cutting boards or woods assure meat safety			
Is there water boilers			
Meat storage and displaying			
Is there a refrigerator			
Is there reserve source of electricity			
Do they display meat on table and open to flies and winds			
Personal hygiene and meat handling hygiene practices			
Do the meat handlers have valid personal health card			
Do butchers wear ring or watch			
Do butchers work with bar hands			
Do butchers wear head caps			
Is butchers wear aprons			
Do butchers clothes are dirty			
Do butcher smoke while serving consumer			
Do butcher chewing tobacco while serving consumer			
Do butcher handle meat and catch money with bar hand at the same time			
Are there wounded or sick butcher and still			

keep working			
Do the butchers smear knives, table surfaces and weighing machine with piece of clothes			
Do butchers wash their hands regularly after serving the last customer			
Do the butcher work with the same clothes after being back from public toilets			
Do butchers eat inside the butchery			
Pest control			
Are there flies seen on the meat, surfaces, or even inside the butchery			
Is there any chemical agent or any tool to control flies			
Is there dog or cat inside or nearby the butchery			
Wastes control			
Is there waste containers			
Are there solid wastes container			
Is there liquid wastes container			
Do the waste containers kept open to pests			
Do the waste containers are kept nearby to meat displaying or processing area			
Is there bones, bloods, leather or parts of leather, hairs are abandon on the ground or at meat contact surfaces			
Are there any signs or written rules to deal with wastes			

Figure ( ): food safety checklist.

Source: Adopted with modifications to suit the context of the study topic from Eat-Safe-Brisbane.www.brisbane.qld.gov.au (2010).