

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

**Evaluation of Implementation of HACCP Principles in Slaughterhouses  
in the Gezira State, Sudan**

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**BSc. Veterinary Medicine, Assuit University Egypt (1985)**

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## **DEDICATION**

To the sole of my father, who encouraged me through my life.

To my mother, the most wonderful woman.

To my sisters and brothers.

To my daughters, sons and my husband.

## **ACKNOWLEDGMENT**

Ever ultimate Hamd to ALLA , gave me the power to complete this thesis.

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**ABSTRACT**

Food safety is one of challenges facing the national, regional and international scientists, to achieve food security. Food safety is ongoing process you need everyday proper perfection, observation, evaluation and monitoring. Hazard Analysis and Critical Control Points (HACCP) is the available solution nowadays for food safety. It was recommended by all international organizations concerned about food safety. The objectives of this study were: to evaluate implementation of HACCP principles in slaughterhouses in Gezira State using questionnaire. The methodology approaches the descriptive and analytical methods using questionnaire. Data were collected from workers in the slaughter houses. The results were presented in percentage form. The results showed that, 35% agreed that hazard analysis was applied, 42% agreed that the basic requirements were applied, 42% agreed that slaughterhouse construction was applied and 28% agreed that good meat handling was not applied. The study concluded that HACCP application in Gezira State slaughterhouses is very poor, as the average of agreement in the four sectors in the seven localities in Gezira state is not more than 36%. The study recommended that: HACCP awareness should be raised by all means and methods addressing all target sectors (political, executive, professional, technical, producers, skill labors, butchers, civil community organizations and the consumers).

عنوان الرسالة: تقويم تطبيق أساسيات الهسب في المسالخ في ولاية الجزيرة ,السودان

الطالبة: إحسان خالد محمود محمد

ماجستير العلوم في الصحة العامة و صحة البيئة

كلية العلوم الصحية و البيئية

#### ملخص الدراسة

سلامة الغذاء أحد التحديات التي تواجه العلماء محلياً و إقليمياً لتحقيق الأمن الغذائي. كما أن سلامة الغذاء عملية مستمرة تحتاج يومياً إلى متابعة و تمحيص و تقييم وتدقيق. و يعتبر نظام تحليل المخاطر و تحديد نقاط التحكم الحرجة من الحلول المتاحة لسلامة الغذاء، و قد أوصى به المنظمات الدولية التي



تهتم بسلامة الغذاء. الهدف من هذه الدراسة تقويم مدي تطبيق نظام الهسب في مسالخ اللحوم الحمراء في ولاية الجزيرة. منهجية البحث تعتمد علي دراسة وصفية و تحليلية وقد اتبعت نظام الاستبيان لجمع المعلومات ومن ثم تحليلها. و قد تم جمع الإحصاءات من العاملين بالمسالخ في المحليات السبعة بولاية الجزيرة. عند تحليل إجابات العاملين وجد أن 35% من العينة يتفقون أن نظام الهسب مطبق في المسالخ، 42% من العينة يتفقون أن أساسيات نظام الهسب مطبقة. و أن 42% من العينة يتفقون أن طريقة تصميم المباني متوافقة مع نظام الهسب كما أن 28% من العينة يتفقون أن طريقة استلام و ترحيل اللحوم مطابقة لنظام الهسب. خلصت الدراسة إلى أن تطبيق نظام الهسب في سلخانات ولاية الجزيرة ضعيف جداً، حيث بلغ متوسط الذين يوافقون على أن نظام الهسب مطبق في مسالخ الولاية 36%. أوصت الدراسة إلى ضرورة زيادة الوعي والجهود في كل المستويات بغية تهيئة الولاية لتطبيق نظام الهسب و نعني بذلك السياسيين و التنفيذيين و المهنيين و الفنيين و العمال المهرة و منظمات المجتمع و المستهلكين.

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### **ABBREVIATION**

STEC	Shiga toxin-producing E. Coli
VTEC	Verotoxinogenic E. Coli
HACCP	Hazard Analyses and Critical Control Points
FAO	Food and Agriculture Organization
WHO	World Health Organization
WTO	World Trade Organization
Codex Alimentarius	A subsidiary of the Food and Agriculture Organization (FAO) and the World Health Organization (WHO)
'SPS Agreement'	The Agreement on the Application of Sanitary and

	Phytosanitary Measures
TQM	Total quality management
NASA	National Aeronautics & Space Administration
FDA	United States Food and Drug Administration
ICMSF	International Commission on Microbiological Specifications for Foods
IAMFES	International Association of Milk, Food and Environmental Sanitarians
GMPs	Good manufacturing practices
GATT	General Agreement on Tariffs and Trade
TBT Agreement	Technical Barriers to Trade Agreement
CAC	Codex Alimentarius Commission 2001
LACF	low-acid canned food
FDA	U.S. Food and Drug Administration
CFR	Code of Federal Regulations
USDA	the U.S. Department of Agriculture
NRC	National Research Council
NACMCF	National Advisory Committee on Microbiological Criteria for Foods

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1: Introduction**

Global meat consumption has increased by nearly three-quarters since 1990, in line with global economic growth. Consumers in both developed and developing countries are requiring higher quality meat, a broader diversity of meat cuts, more ease in preparation and enhanced assurances of safety. However, escalating and pervasive outbreaks of animal diseases, for example bovine spongiform encephalopathy and avian influenza, are posing considerable challenges to livestock producers, industries and policymakers



around the globe. Producers are becoming increasingly aware of their responsibility for the safety of the foods they produce and are developing and implementing, mainly in developed countries, farm-level quality assurance systems based on hazard analysis critical control point (HACCP) principles. Gezira State rank third to Khartoum state in population and second in economic importance among Sudan states, it is inhabited by 3.8 millions, consuming around nine thousands tons of red meat annually, slaughtered under veterinary supervision in thirty six slaughterhouses distributed throughout the state covering the seven localities. Gezira State slaughterhouses and slabs provide the market with fresh beef and mutton five days a week.

## **1.2 Justification of the study**

Traditional visual inspection of carcasses by trained personnel is not an effective strategy for protecting consumers against meat-borne infections and physical and chemical hazards. A Hazard Analyses and Critical Control Points (HACCP)-based approach to production and processing is better suited for the manufacture of hazard-free meat. HACCP principles became law for all red meat slaughterhouses in the developed countries. An important change introduced by this new law was that all red meat slaughterhouses were obliged to operate according to HACCP principles.

Because of fast-growing demand, export markets can absorb high value-added products and bring high returns, and for many developing countries export market development is a key requirement for rural income generation and rural growth. The Agreement on the Application of Sanitary and Phytosanitary Measures (SPS) of the World Trade Organization (WTO) sets out a number of basic rules regarding trade measures meant to protect human,

animal or plant life or health, aimed at ensuring that such measures will not create unfair barriers to trade.

### **1.3 Objective of the study**

#### **1.3.1 General objective:**

To evaluate the implementation of HACCP principles in slaughterhouses in Gezira State.

#### **1.3.2: Specific objectives**

To:

- Revile the importance of HACCP implementation in slaughterhouses.
- Raise the awareness of food safety programs within Gezira State slaughterhouse personnel.
- Revile the coordination necessity between different levels and institutes for food safety.
- Insure the knowledge of workers in slaughter houses regarding HACCP principals.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

HACCP is widely recognized in the food industry as an effective approach. To establishing good productive sanitation and manufacturing practices that produce safe for food safety and its importance in international trade for food safety and its importance in international trade. (Pierson and Corlett, 1992). Gezira State rank third to Khartoum state in population and second in

economic importance among Sudan states, it is inhabited by 3.575 millions, (Sudan Population 2009), consuming around nine thousands tons of red meat annually (Planning and Statistic Department, Animal wealth General directorate ) , slaughtered under veterinary supervision in thirty six slaughterhouses distributed throughout the state covering the seven localities. Gezira State slaughterhouses and slabs provide the market with fresh beef and mutton five days a week.

Gezira state announced as disease free area, with modern abattoir for meat export, and this explore the important of the HACCP application as an influence factor in animal products export.

## **2.2 Importance of HACCP**

Several trends are bringing greater attention to food safety regulation in many countries. Science is identifying new food borne pathogens and understanding their potential for serious consequences. Demand for safer food is growing as consumers become more affluent, live longer, and better understand the links between diet and health. The proportion of food obtained from food services is increasing, even in middle income countries, and this reduces consumer control over food handling and preparation. International trade in food products is a larger source of supply in many countries as both technical and trade barriers to food trade are reduced, and this can introduce new sources of risk into the food supply. These trends converge to create both public and private demand for greater food safety. At the same time, governments everywhere are trying to make more efficient use of public resources.

Private markets often fail to provide for adequate food safety because the safety is not readily apparent to consumers and it is often very costly to test for the safety of product. Furthermore, producers or retailers may not be able

to ascertain or certify the safety of foods given the wide array of microbial agents and their potential for hazard. Without the ability to fully capture returns to costly control of product hazard, firms lack incentive to implement controls for food safety.

### **2.2.1 HACCP worldwide**

As a result, many governments are taking a new approach to ensuring the safety of the food supply: mandated use of the Hazard Analysis Critical Control Point (HACCP) system in food industries. Such a system focuses on verifiable control of the process. For example, the European Union Directive 93/43, effective in December 1995, requires food companies to implement HACCP (Grijspaardt-Vink, 1995). In the United States, HACCP was mandated through regulation for seafood in 1994, for meat and poultry in 1996, and proposed for fresh fruit juice in 1998, with regulations for other food industries expected in the future (Morris, 1997). Australia, New Zealand, and Canada also have mandatory or voluntary public programmes to encourage adoption of HACCP (Peters, 1997; Dean, 1990). As an outcome of its use in most developed countries, HACCP is increasingly practiced in less developed countries that export food products into industrialized markets (Merican, 1996). The growing use of HACCP as a sanitary standard in international trade led the Codex Alimentarius to adopt guidelines for HACCP in 1993, and to incorporate HACCP into food hygiene codes starting in 1995 (Whitehead and Orriss, 1995).

### **2.2.2 Controversial Surrounding HACCP**

Despite the widespread enthusiasm for HACCP among regulatory and international agencies, there are several controversies surrounding mandatory imposition of HACCP. First, there is disagreement regarding how effectively HACCP will control or eliminate some food safety hazards, and whether it

must be combined with specific product standards (Hathaway,1995). Second, there is controversy regarding whether it improves or reduces regulatory oversight (Smith-De Waal, 1996). Third, there is controversy regarding whether it allows firms to meet food safety objectives in the most efficient manner or whether it is overly prescriptive (Antle, 1998). Finally, there is disagreement regarding whether it can reasonably be used in place of sanitary performance standards in international trade (Hathaway and Cook, 1997).

### **2.2.3 HACCP and food born disease**

The appearance of diseases caused by food borne pathogens is increased due to industrialization and centralization of food production and supply, international trade, etc. (Tauxe, 1997). In developed countries the most common food borne pathogens are Salmonellae, *Staphylococcus aureus*, *Clostridium perfringens* and *Campylobacter* spp. (Altekruse et al., 1997). Foods implicated in outbreaks caused by these pathogens are mainly of animal origin, including meat, eggs, milk and their products Food borne illness is not at all new. In fact, gastrointestinal and food borne illnesses have a lengthy history. Citing of such illnesses can be found, for example, in the Bible, in early Greek and Roman writings, and in the codes of the Egyptians and Phoenicians (Doyle et al., 1997).

HACCP has become synonymous with food safety. It is a worldwide-recognized systematic and preventive approach that addresses biological, chemical and physical hazards through anticipation and prevention, rather than through end-product inspection and testing.

It is difficult to know the true number of food borne illness cases and resulting costs. First food borne illness is seriously underreported. Most

food borne illness goes undiagnosed and unreported because many individuals fail to visit a doctor when they fall ill, or doctors fail to issue specific diagnoses (Billy and Wachsmuth, 1997).

Healthy animals often have organisms that can cause food borne illness as a natural part of the flora of their gastrointestinal tracts. Contamination of foods can occur during processing and manufacturing because of equipment malfunctions or failure to clean or sanitize equipment properly, improper use of cleaning materials, and rodent or insect infestations (Ali AA 2007).

#### **2.2.4 HACCP and TQM**

The HACCP system for managing food safety concerns grew from two major developments. The first breakthrough was associated with W.E. Deming, whose theories of quality management are widely regarded as a major factor in turning around the quality of Japanese products in the 1950s. Dr Deming and others developed total quality management (TQM) systems which emphasized a total systems approach to manufacturing that could improve quality while lowering costs. Deming's Fourteen Points for Management:

- 1 Create constancy of purpose for improvement of product and services.
- 2 Adopt the new philosophy.
- 3 Cease dependence on mass inspection.
- 4 End the practice of awarding business on price tag alone.
- 5 Constantly and forever improve the systems of production and services.
- 6 Institute modern methods of training on the job.
- 7 Institute modern methods of supervision and leadership.
- 8 Drive out fear.
- 9 Break down barriers between departments.
- 10 Eliminate numerical goals for the work force.
- 11 Eliminate work standards and numerical quotas.

- 12 Remove barriers to pride of workmanship.
- 13 Institute a vigorous programme of education and training for everyone.
- 14 Create a structure in top management that will push every day on the above 13 points.

### **2.2.5 Development of HACCP concepts**

The second major breakthrough was the development of the HACCP concept itself. The HACCP concept was pioneered in the 1960s by the Pillsbury Company, the United States Army and the United States National Aeronautics and Space Administration (NASA) as a collaborative development for the production of safe foods for the United States space programme. NASA wanted a "zero defects" programme to guarantee the safety of the foods that astronauts would consume in space. Pillsbury therefore introduced and adopted HACCP as the system that could provide the greatest safety while reducing dependence on end-product inspection and testing. HACCP emphasized control of the process as far upstream in the processing system as possible by utilizing operator control and/or continuous monitoring techniques at critical control points. Pillsbury presented the HACCP concept publicly at a conference for food protection in 1971. The use of HACCP principles in the promulgation of regulations for low-acid canned food was completed in 1974 by the United States Food and Drug Administration (FDA). In the early 1980s, the HACCP approach was adopted by other major food companies.

The hazard analysis and critical control points (HACCP) food safety system was developed by the Pillsbury Company, the National Aeronautics and Space Administration, and the U.S. Army Natick Laboratories in the late 1960s to develop foods for the space program. Which first presented by

Pillsbury at the 1971 National Conference on Food Protection, the HACCP system initially consisted of procedures designed for three purposes:

- Identification and assessment of hazards associated with the growing, harvesting, processing-manufacturing, marketing, preparation, and use of a given raw material or food product;
- Determination of critical control points (CCPs) at which identified hazards could be controlled; and
- Establishment of procedures to monitor the CCPs.

These procedures were used, in part, by the low-acid canned food (LACF) industry in the development of good manufacturing practices to address *Clostridium botulinum* concerns in the early 1970s and, in 1973, by the U.S. Food and Drug Administration (FDA) to promulgate LACF regulations, which are contained in 21 Code of Federal Regulations (CFR) Part 113.

#### **2.2.6 HACCP and food safety**

HACCP has gained international status as the premier food safety system in the European Union, Canada, Australia, and New Zealand, as well as other countries, and it serves as the foundation of the World Health Organization's Codex Alimentarius Commission's General Principles of Food Hygiene.

In 1980, at the request of the FDA, the U.S. Department of Agriculture (USDA), the National Marine Fisheries Service, and the Natick Research and Development Center, the National Research Council (NRC) convened a panel of experts to formulate general principles for the application of microbiological criteria for foods. Based on the panel's review, the HACCP principles introduced at the 1971 National Conference on Food Protection were endorsed, along with the recommendation that the principles be made mandatory for all food processors.



The NRC also recommended formation of a commission on microbiological criteria for foods, which was subsequently established in 1988 as the National Advisory Committee on Microbiological Criteria for Foods (NACMCF), to advise food regulatory agencies about food safety. NACMCF drafted a guide containing HACCP principles and published papers in 1989, 1992, and 1997 that articulated and expanded the original HACCP principles. The principles, as defined in the NACMCF's Hazard Analysis and Critical Control Points Principles and Application Guidelines, published in 1997, are the benchmark for all food safety programs ( Robert , 2010)

The United States National Academy of Science recommended in 1985 that the HACCP approach be adopted in food processing establishments to ensure food safety. More recently, numerous groups, including for example the International Commission on Microbiological Specifications for Foods (ICMSF) and the International Association of Milk, Food and Environmental Sanitarians (IAMFES), have recommended the broad application of HACCP to food safety.

### **2.3- The Codex Alimentarius**

Recognizing the importance of HACCP to food control, the twentieth session of the Codex Alimentarius Commission, held in Geneva, Switzerland from 28 June to 7 July 1993, adopted Guidelines for the application of the Hazard Analysis Critical Control Point (HACCP) system (ALINORM 93/13A, Appendix II). The commission was also informed that the draft revised General Principles of Food Hygiene would incorporate the HACCP approach.

The revised Recommended International Code of Practice - General Principles of Food Hygiene [CAC/RCP 1-1969, Rev 3 (1997)] was adopted by the Codex Alimentarius Commission during its twenty-second session in

June 1997. The Hazard Analysis and Critical Control Point (HACCP) system and guidelines for its application is included as its Annex.

The Codex General Principles of Food Hygiene lay a firm foundation for ensuring food hygiene. They follow the food chain from primary production through to the consumer, highlighting the key hygiene controls at each stage and recommending an HACCP approach wherever possible to enhance food safety. These controls are internationally recognized as essential to ensuring the safety and suitability of food for human consumption and international trade.

#### **2.4 Advantages of HACCP**

The HACCP system, as it applies to food safety management, uses the approach of controlling critical points in food handling to prevent food safety problems. The system, which is science based and systematic, identifies specific hazards and measures for their control to ensure the safety of food. HACCP is based on prevention and reduces the reliance on end-product inspection and testing.

The HACCP system can be applied throughout the food chain from the primary producer to the consumer. Besides enhancing food safety, other benefits of applying HACCP include more effective use of resources, savings to the food industry and more timely response to food safety problems.

HACCP enhances the responsibility and degree of control at the level of the food industry. A properly implemented HACCP system leads to greater involvement of food handlers in understanding and ensuring food safety, thus providing them with renewed motivation in their work. Implementing HACCP does not mean undoing quality assurance procedures or good manufacturing practices already established by a company; it does, however,

require a revision of these procedures as part of the systematic approach and for their appropriate integration into the HACCP plan.

The application of the HACCP system can aid inspection by food control regulatory authorities and promote international trade by increasing buyers' confidence. Any HACCP system should be capable of accommodating change, such as advances in equipment design, changes in processing procedures or technological developments.

### **2.5 Application of HACCP**

While the application of HACCP to all segments and sectors of the food chain is possible, it is assumed that all sectors should be operating according to good manufacturing practices (GMPs) and the Codex General Principles of Food Hygiene. The ability of an industry segment or sector to support or implement the HACCP system depends on the degree of its adherence to these practices.

The successful application of HACCP requires the full commitment and involvement of management and the workforce. It requires a multidisciplinary approach which should include, as appropriate, expertise in agronomy, veterinary health, microbiology, public health, food technology, environmental health, chemistry, engineering, etc. according to the particular situation. The application of the HACCP system is compatible with the implementation of TQM systems such as the ISO 9000 series. However, HACCP is the system of choice in the management of food safety within such systems.

### **2.6- HACCP and Trade**

The Final Act of the Uruguay Round of multilateral trade negotiations, which began in Punta del Este, Uruguay in September 1986 and concluded in Marrakesh, Morocco in April 1994, established the World Trade

Organization (WTO) to succeed the General Agreement on Tariffs and Trade (GATT). The Uruguay Round negotiations were the first to deal with the liberalization of trade in agricultural products, an area excluded from previous rounds of negotiations.

Significant implications for the Codex Alimentarius Commission arise from the Final Act of the Uruguay Round: the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) and the Agreement on Technical Barriers to Trade (TBT Agreement).

The purpose of the SPS Agreement is to ensure that measures established by governments to protect human, animal and plant life and health, in the agricultural sector only, are consistent with obligations prohibiting arbitrary or unjustifiable discrimination on trade between countries where the same conditions prevail and are not disguised restrictions on international trade.

The SPS Agreement is particularly relevant to food safety, providing a framework for the formulation and harmonization of sanitary and phytosanitary measures. It requires that such measures be based on science and implemented in an equivalent and transparent manner. They cannot be used as an unjustifiable barrier to trade by discriminating among foreign sources of supply or providing an unfair advantage to domestic producers.

To facilitate safe food production for domestic and international markets, the SPS Agreement encourages governments to harmonize their national measures or base them on international standards, guidelines and recommendations developed by international standard-setting bodies.

The purpose of the TBT Agreement is to prevent the use of national or regional technical requirements, or standards in general, as unjustified technical barriers to trade. The agreement covers all types of standards including quality requirements for foods (except requirements related to

sanitary and phytosanitary measures), and it includes numerous measures designed to protect the consumer against deception and economic fraud.

The TBT Agreement also places emphasis on international standards. WTO members are obliged to use international standards or parts of them except where the international standard would be ineffective or inappropriate in the national situation.

Codex standards, guidelines and other recommendations have become the specifically identified baseline for safe food production and consumer protection under the SPS Agreement. In this environment, Codex standards, guidelines and other recommendations take on unprecedented importance with respect to consumer protection and international food trade. As a result, the work of the Codex Alimentarius Commission, including the Guidelines for the application of the Hazard Analysis Critical Control Point (HACCP) system, has become the reference for international food safety requirements. In this light it is imperative that the Codex guidelines for the application of the HACCP system be unequivocal in their guidance; otherwise conflicts on food safety grounds could arise.

The application of HACCP as a public policy requires definition of the role of government in the utilization of the HACCP process. Food-exporting countries may require additional resources to enhance their food industries to meet the requirements. Adequate steps should be taken to facilitate food trade, such as assessment of food safety, training of personnel, technology transfer and strengthening of the national food control system.

## **2.7- Training**

Food industries and food control regulatory agencies worldwide have shown interest in implementing the HACCP system. A common understanding about terminology and approaches for application will greatly enhance its

adoption and will lead to a harmonized approach to food safety among countries all over the world. Many countries have integrated or are in the process of integrating the HACCP system into their regulatory mechanisms. In many countries, application of the HACCP system to foods may become mandatory. As a result, there is a tremendous demand, particularly in developing countries, for training in the HACCP system and for the development and assembly of reference materials to support this training. It is in this context that FAO has prepared this training package on the Codex General Principles of Food Hygiene and the guidelines for the application of the HACCP system.

## **2.8- Objectives of the FAO Approach to HACCP**

The objectives of the FAO approach to HACCP include:

- Promotion of the implementation of the HACCP system based on the harmonized Codex General Principles of Food Hygiene and GMPs
- Development of a programme to train trainers who are in a position to train others who can apply the knowledge gained
- Identification and provision of appropriate reference and training materials on the application of HACCP to support the training
- Provision of training to individuals involved to varying degrees with the preparation, monitoring, administration and verification of HACCP plans
- Enhancement of the role of science and risk assessment in the development of HACCP systems
- Creation of a framework for determining the equivalence of food safety control programmes through a harmonized approach to the application of HACCP

## **2.9- Seven Principles of HACCP**

Principle 1:

Conduct a Hazard Analysis (evaluate the process). This involves creation of a "Process Flow Diagram" representing the various stages / steps of the process. The team must first identify all possible hazards and understand the measures / steps needed to control them.

Principle 2:

Determine the Critical Control Points (CCPs). The team must evaluate each potential area of risk to establish where the critical control points will exist.

Principle 3:

Establish Critical Limits. The team must determine measurements or values that indicate the operational limits for each critical limit. These values represent the difference between being in or out of control.

Principle 4:

Establish Monitoring Procedures for the measurement of the CCP. This describes the techniques and methods of measurement used to evaluate critical limits and will be well described in the documentation created for Principle 7 (creation of standard operating procedures).

Principle 5:

Establish Corrective Actions. This considering what may occur if the process does not meet critical control limits. How can errors be corrected (if possible)? What organizational procedures will be used to correct and document such procedures?

Principle 6:

Determine / Establish Verification Procedures. These are methods to check / verify whether the HACCP plan is functioning correctly.

Principle 7:

Create Documentation./ Standard Operating Procedures. This requires documented instructions (standard operating procedures) and accurate record keeping for all critical control points.

There are a number of ways of implementing these principles into a functional HACCP program. One implementation technique is described as the twelve steps shown in the following:

### **2.10 Logical sequence for the application of HACCP**

1. Assemble HACCP team
2. Describe product
3. Identify intended use
4. Construct flow diagram
5. On-site confirmation of flow diagram
6. List all potential hazards.
7. Conduct a hazard analysis
8. Consider control measures
9. Determine CCPs
10. Establish critical limits for each CCP
11. Establish a monitoring system for each CCP
12. Establish corrective actions
13. Establish verification procedures
14. Establish documentation and record keeping (Source: FAO and WHO, 2003, p. 42.).

### **2.11 Stages in Carrying out a HACCP Study**

Stage 1 : Define the Terms of Reference

Establishing the terms of reference allows for definition of the goals, range and targets of the HACCP program. The optimum system is typically simple,



effective and focused on food safety. HACCP terms of reference / definition activities can include a number of elements:

- What is the product or process to be controlled via the HACCP program?
- What is the nature of the potential hazard(s) - microbial?, chemical?, physical?
- Will the program only deal with food safety or will it also address product quality?

#### Stage 2 : Select the HACCP Team

The team should be relevant, knowledgeable and multidisciplinary. Using a blend of production and management personnel will ensure that "shop floor" ideas, issues and observations are developed into a functional HACCP program. Depending on the size of the organization it is wise to assemble a diverse range of talents. This could include:

- Team Leader: a good leader to verify the compliant documentation and procedure. Once the HACCP team is assembled the group begins to clearly define / identify the product(s) which will be involved.
- Microbiologist/ Scientist: with respect to food safety, the microbiologist will be essential in establishing critical control points and helping to identify areas of risk. Laboratory analysis will be required to establish conditions which control (or fail to control) potentially pathogenic organisms in the food production process, particularly if there is no established technical literature.
- Process Engineer - to determine mechanical / communicator who is well informed of HACCP principles and practices is the starting point for the HACCP process.
- Production personnel - well acquainted with the issues, needs and potential hazards.

- QA/QC personnel processing risks and means of controlling potential risks. The process engineer will be aware of functional limitations of specific process limitations and will be invaluable in creating the essential process flow chart.
- Small Businesses can benefit significantly from acquiring the assistance of local consultants or other experts with experience in the implementation of HACCP and other quality control programs. In the long run this can significantly focus team efforts.

### Stage 3 : Describe the Product

Description of the product is essential to fully understanding potential risks and control issues. Description of the product must be comprehensive and should include descriptions of:

- Identity - product name and raw materials.
- Factors impacting upon safety: microbial loading, water activity, pH, temperature of processing and / or storage, etc.
- Chemical composition.
- Physical structure.
- Processing.
- Required shelf life.
- Packaging and packaging materials.
- Storage and Handling .
- Distribution and environmental conditions.
- Intended consumer use.
- Labeling and instructions.

### Stage 4 : Identify Intended Use

Fully understanding the intended (consumer) usage of the product is a key requirement of the HACCP team. This is important since consumer handling

and usage may greatly influence both the quality and safety of the food product. Many food products are susceptible to microbial and/ or pathogenic contamination or may in fact carry pathogenic microorganisms as part of their indigenous microflora. How the product is to be used may directly impact on the identification of critical control points.

Furthermore, the target market may impact on the degree of food safety. Those with reduced immunological function, such as infants or seniors may be far more susceptible to pathogenic infection. Other issues may include sales of product to large institutions where longer handling and transportation of prepared foods may occur.

Stage 5 : Create a Flow Diagram

The flow diagram is intended to provide a clear, precise "snapshot" of all steps involved in the process. This must include initial handling and receipt of the raw materials, the flow, timing, temperature and all other conditions / steps involved in the process.

Areas of specific interest include the interaction between packaging and raw materials, environmental conditions at each stage of the process, as well as impact of cleaning and preventative maintenance cycles on the "flow" (CAC Codex Alimentarius Commission 2001).

Stage 6: Verify the Flow Diagram

Stage 7: Identify & Analyze Hazards & their Control Steps

Stage 8: Determine the CCPs

Stage 9: Establish Critical Limits

Stage 10: Establish Monitoring Procedures

Stage 11: Establish Corrective Actions

Stage 12: Verify the HACCP Study

Stage 13: Establish Documentation

## Stage 14: Review the HACCP Study

### **2.12 HACCP prerequisites**

The World Health Organization defines prerequisite program as “practices and conditions needed prior to and during the implementation of HACCP and which are essential for food safety”. Prerequisite programs provide a foundation for an effective HACCP system. They are often facility-wide programs rather than process or product specific. They reduce the likelihood of certain hazards.

Learn Prerequisite programs deal with the “good housekeeping” concerns of the establishment, whereas, HACCP manages specific process hazards. The plant must provide all documentation including the written program, records and results for all prerequisite programs which support their HACCP system. For example, an establishment may conclude that *E. coli* O157:H7 is a hazard not reasonably likely to occur in the establishment’s processing because the establishment has a prerequisite program with purchase specifications addressing *E. coli* O157:H7. The information regarding this prerequisite program is supporting documentation which must be maintained according to 417.5(a)(1). Without this documentation, FSIS would question the adequacy of the establishment’s HACCP system and Hazard Analysis. FSIS expects the supporting documentation concerning prerequisite programs to include the program’s procedures and operational controls in writing. In addition, FSIS expects the documentation to include records that document the program is effective and that *E. coli* O157:H7 is not reasonably likely to occur. Inspectors are required to review testing and prerequisite program records at least once per week according to Directive 5000.2. 2 Prerequisite Programs May prevent food safety concerning objectives: Define prerequisite program. Describe the relationship between prerequisite programs and the

HACCP System. Distinguish between a prerequisite program and a CCP. Evaluate if the prerequisite program is effective. Evaluate that the prerequisite program is being implemented appropriately. Identify when a failure to meet a prerequisite program is a noncompliance. Describe how often to review the records of a prerequisite program. 1 Prerequisite Programs Support the HACCP.

### **2.13 Types of hazards**

There are five major types of hazards which can put both your health and your safety at risk.

#### 2.13.1 chemical hazards

If you are working with cleaning products, bleaches, paints, and other chemical agents, you need to understand what a chemical hazard is as well as how to protect yourself. Chemical hazards include:

- Liquids such as cleansers, acids, and paints
- Vapours and fumes such as welding fumes
- Gases such as carbon mon-oxide
- Products that can catch fire or explode

#### 2.13.2 physical hazards

Physical hazards include:

- machinery
- electrical power
- noise
- power and hand tools
- working and walking surfaces
- trip and fall hazards
- ladders and scaffolds
- heat and cold

- noise
- ventilation

### 2.13.3 biological hazards

Why be careful around ticks, mouse droppings, bird poop and wild animals? Because you can get sick from working around certain animals, including people. Biological hazards include bacteria, viruses, insects, plants, birds, animals, and humans. The risks from skin irritation and allergies to infections. Dangers can come from:

- Unclean restrooms.
- Mold and fungus.
- Bacteria.
- Insect stings.
- Animal bites.
- Poorly stored medical waste.

Salmonellosis is the most common food-borne bacterial disease worldwide and the main source is *Salmonella*-infected food-producing animals; the herd prevalence varies from 0% to 90%, depending on animal species and region (sci. tech. Off. int. Epiz., 2006) .

The emergence of strains resistant to antimicrobials, often as a result of antimicrobial usage in animals, is a public health hazard of great concern. However, in a few countries the prevalence of *Salmonella* in foods of animal origin has been reduced to almost zero by the strict implementation of risk mitigation measures along the whole of the food production chain and several other countries are striving towards this goal.

*Escherichia coli* are one of the main inhabitants of the gastrointestinal tract of most mammalian species, including man (sci. tech. Off. int. Epiz., 2006). Shiga toxin-producing *E. coli* (STEC), also called verotoxinogenic *E. coli*

(VTEC), do not usually cause disease in animals, but may cause watery diarrhea, hemorrhagic colitis and/or hemolytic uraemic syndrome in humans (sci. tech. Off. int. Epiz., 2006). These zoonotic STEC include the O157:H7 strains and, more and more frequently, certain non-O157 strains. The importance of the latter is probably underestimated as they have been less well characterized and are more difficult to detect in samples than O157:H7. Cattle and other ruminants are the most important reservoir of the zoonotic STEC, which are transmitted to humans through the ingestion of foods or water contaminated with animal faeces, or through contact with infected animals or their environment.

In the past 25 years, *Listeria monocytogenes* has become increasingly important as a pathogen in food-borne infections (sci. tech. Off. int. Epiz., 2006). Because of its high fatality rate, listeriosis ranks among the most frequent causes of death due to food-borne illness. The ability to persist in food-processing environments and multiply under refrigeration temperatures makes *L. monocytogenes* a unique and significant threat to food safety and public health.

Understanding how these organisms are able to successfully adapt their cellular physiology to overcome the various forms of stress is an important step in order to develop better ways of controlling *L. monocytogenes* in food environments.

Campylobacteriosis is one of the most important bacterial food-borne illnesses in humans (sci. tech. Off. int. Epiz., 2006). One of the principal sources for Campylobacter infections in humans is the handling and consumption of poultry meat and control of this pathogen in meat-producing poultry would reduce the human burden of illness. Although risk factors for the infection of flocks have been identified, preventive measures in primary

production based on these risk factors have hitherto had limited and unpredictable effects.

Zoonotic parasites found in food animals include a wide variety of protozoa, nematodes, trematodes and cestodes. Many of these parasites are emerging or occurring globally due to increased movements of animals, food and people, and changes in farming practices (sci. tech. Off. int. Epiz., 2006). Data from WHO suggest that food-borne disease (together with water) is a significant contributor to mortality from diarrhoeal disease (2.1 million deaths in 2000). Each year, food borne disease causes an estimated 76 million illnesses, 325 000 hospitalizations and 5 000 deaths in the United States of America, and 2 366 000 cases, 21 138 hospitalizations and 718 deaths in England and Wales (Adak et al., 2005; Mead et al., 1999). Microbiological sampling and testing of carcasses was also introduced to verify that HACCP schemes were effectively monitoring plant processing . HACCP is a systematic, preventive approach that combines the principles of food microbiology and risk assessment. Codex Alimentarius, a subsidiary of the Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO), have adopted HACCP as the international standard. To achieve an acceptable level of food safety it is necessary for governments and industry to work collaboratively to provide quality assurance systems based on sound risk management principles throughout the food chain. Quality assurance systems on livestock farms should encompass food safety using good practices and HACCP principles. These systems should target areas such as biosecurity, disease monitoring, and reporting, safety of feeds, use of agricultural and veterinary chemicals, potential food-borne pathogens and traceability. Although in general terms the Agreement can be said to have triggered regulatory reform and prompted action to open markets, it has also raised



concerns that it unduly favours advanced countries, because they are in a much better position to gain market access than those countries which lack sufficient capacity to meet sanitary and other safety and quality requirements.

#### 2.13.4 job design

If your job is poorly designed, you can develop long term health problems. These problems can arise from simple things, like working for long periods in an awkward position or having to make the same motions over and over again. Problems can come from:

- Lighting.
- Chairs.
- Lifting.
- Repeated movements.
- Computer screens.

#### 2.13.5 stress

Stress can lead to long-term health problems. Headaches, anxiety, and impatience are early signs of stress. Workplace causes of stress include:

- Heavy workloads.
- Lack of control over the place of work.
- Shift work.
- Noise.
- Working by yourself.
- Fear of job loss.
- Conflict with the employer.

## **CHAPTER THREE**

### **MATERIAL AND METHOD**

#### **3.1 Introduction**

The study approach the Cross-sectional method to solve the study problems and answer the study questions. This study adopts a number of components

to evaluate the slaughterhouses workers knowledge attitude and practice regarding HACCP principals, namely:

- Sector one : Implementation of Hazard Analysis.
- Sector two: Basic Requirements needed for HACCP application.
- Sector Three: The eligibility of the slaughterhouse construction and equipments to apply HACCP system.
- Sector four: Handling of meat, offal's and residues from slaughterhouse to the consumer.

### **3.2 Study population**

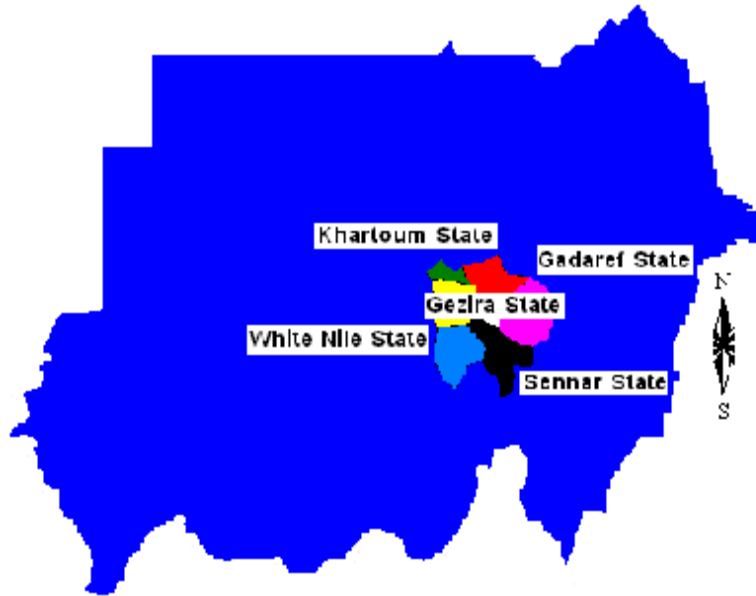
The study population includes: the slaughter houses workers in seven localities in Gezira State. Address target group of people that the study based on. Questionnaire address veterinarians, technicians, skill labors, health officers, and butchers deal with the meat in the slaughterhouse.

### **3.3 Study area**

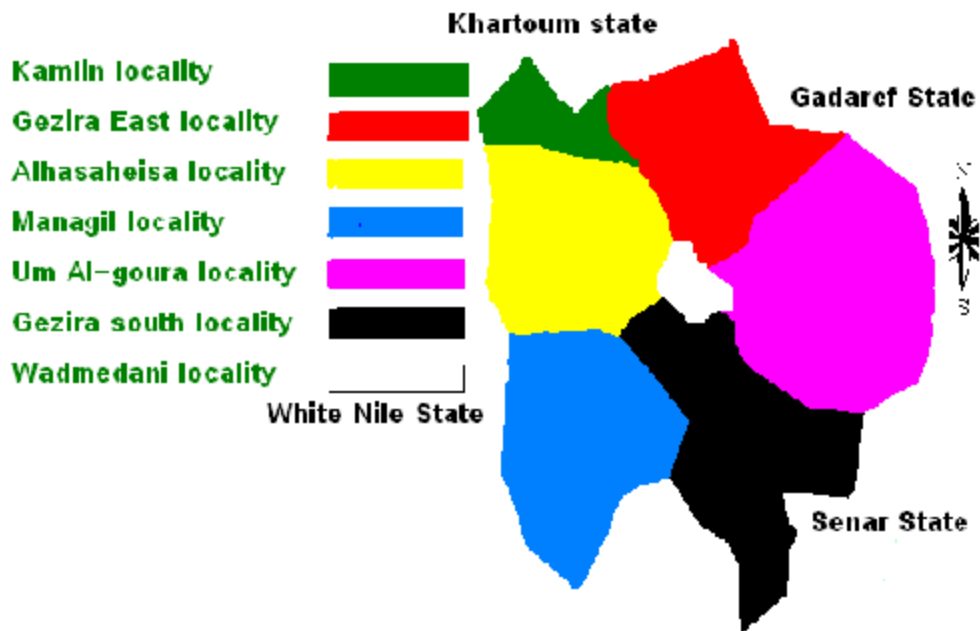
Gezira state is located at the middle of the Sudan ,south to Khartoum state, west to Gadarif state ,east to white Nile state and north to the Sennar state.

Gezira state embedded two main agricultural scheme in the Sudan, providing the animals with their by-products beside one millions pasture area at Butana range land.

### Sudan Map



### Gezira State Localities



### **3.4 Data collection**

The questionnaire was used as a tool of research. The questionnaire consist of 80 questions cover four sectors. Each sector consists of 20 questions. The questionnaire was designed with three options for answering, yes, no, and to some extend. The study covers the seven capitals of the seven Gezira state localities, and data was collected from the main slaughterhouse of the capital town.

The validity of the questionnaire was checked by educational and HACCP experts, who assessed and checked the questionnaire. The assessors suggested the use of Arabic translation of the questionnaire.

The reliability of the questionnaire was checked by application and reapplication method, as the questionnaire was applied on a pilot group of 15 workers.

### **3.5 Study Sample**

The sampling technique was done by using (57) workers in slaughterhouses in Gezira State. Area of the study is the Gezira state. Data was collected from the seven localities main slaughterhouses.

### **3.6 Data analysis**

The two questionnaires were administered and analyzed by the percentage weight equation. Any item has percentage weight more than 50% is considered as accepted and less than 50% is rejected. More than 75% is highly accepted and 50 to 75% is medium.

### **3.7 Data analysis techniques**

Data were analyzed using the computer statistical programme (SPSS version 10.0 1999). The collected data of the questionnaire (workers in slaughter houses) was analyzed according to the Percentage Weight of each question. The results cover the four sectors. Sector one : Implementation of Hazard

Analysis, sector two: Basic Requirements needed for HACCP application, sector Three: The eligibility of the slaughterhouse construction and equipments to apply HACCP system and sector four: Handling of meat, offal's and residues from slaughterhouse to the consumer.

## **CHAPTER FOUR**

### **RESULTS AND DISCUSSIONS**

#### **4.1 Implementation of Hazard Analysis**

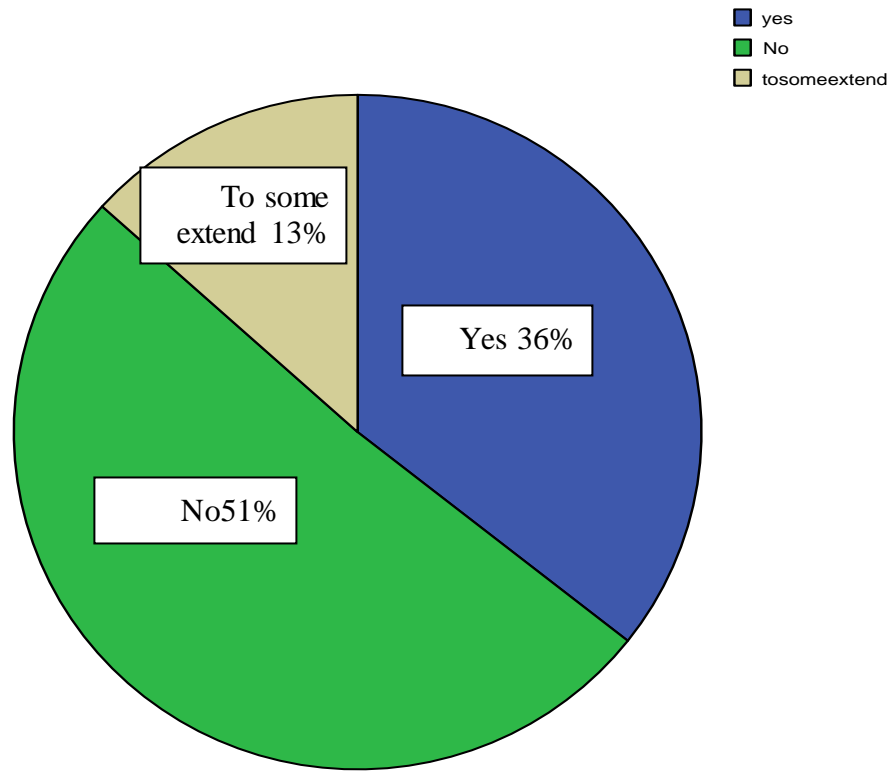
Sector one composed of 20 questions dealing with application of hazard analysis in the slaughterhouse, these questions concern about HACCP awareness among the workers , HACCP application, workers training, critical control points detect ability, and the biological ,chemical and natural risks control, also this sector inquire about the quality control certificate ,and the relationship between HACCP and quality control.

In this sector 36% agreed that, the hazard analysis awareness and implementation is low that means HACCP system is not well known by this group. Whereas, 51% agreed that HACCP analysis was not implemented in slaughter houses in Gezira state. Low awareness and poor HACCP implementation in the seven slaughterhouses of the seven localities capitals means that, all public and private institutes involved in HACCP implementation should exert more efforts in raising the awareness of HACCP among the slaughterhouse workers.

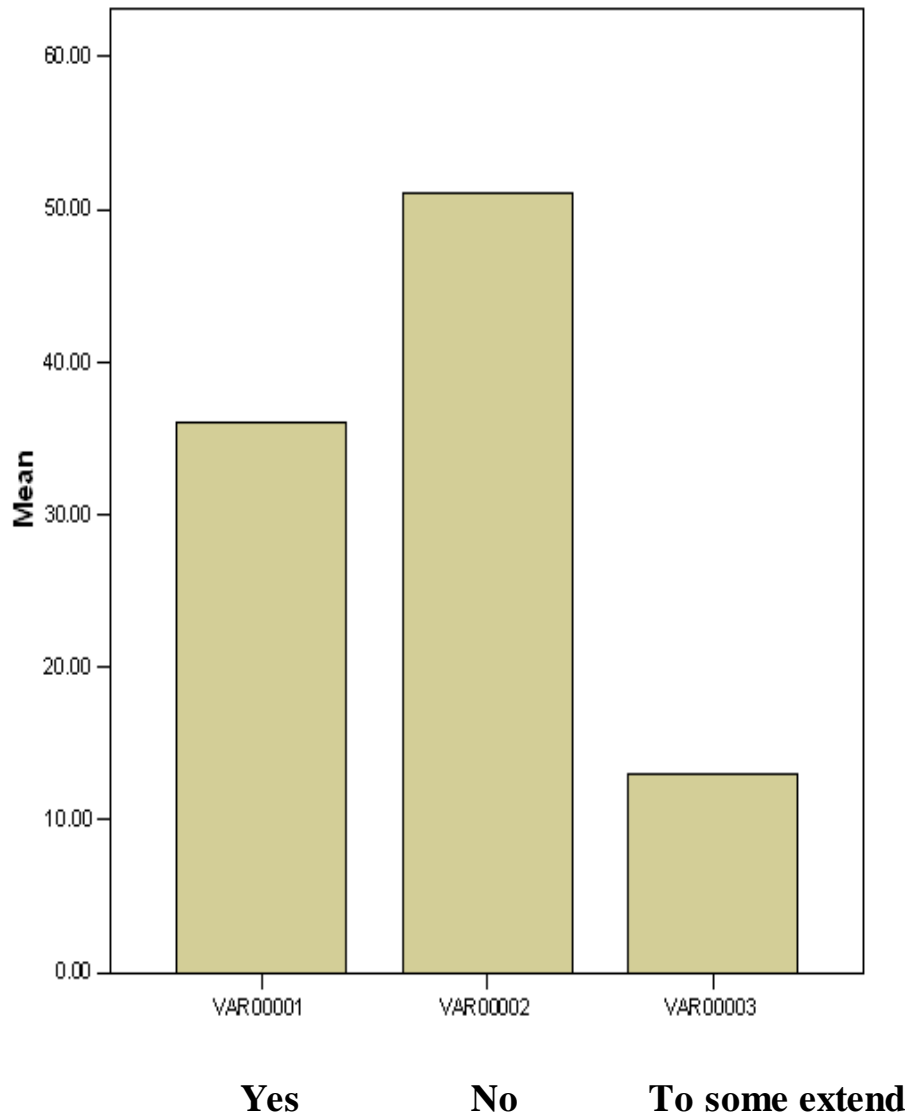
**Table 4.1 Implementation of Hazard Analysis**

No	Question	Yes	No	To some extend
<b>1</b>	Do you heard about HACCP system?	<b>29</b>	<b>27</b>	<b>1</b>
<b>2</b>	Is there any team working according to HACCP system?	<b>5</b>	<b>47</b>	<b>5</b>
<b>3</b>	Is this team trained on HACCP?	<b>6</b>	<b>49</b>	<b>2</b>
<b>4</b>	Of what HACCP teams constitute?	<b>7</b>	<b>46</b>	<b>4</b>
<b>5</b>	Is there any relation between HACCP and quality control?	<b>34</b>	<b>21</b>	<b>2</b>
<b>6</b>	Is there any quality control certificate for the slaughter house?	<b>10</b>	<b>43</b>	<b>4</b>
<b>7</b>	What quality control? Is it implemented in slaughter house?	<b>16</b>	<b>25</b>	<b>16</b>
<b>8</b>	Is there meat quality control certificate?	<b>21</b>	<b>31</b>	<b>5</b>
<b>9</b>	What work risk in slaughterhouse?	<b>41</b>	<b>4</b>	<b>12</b>
<b>10</b>	Do you know how many sections in the work risk?	<b>29</b>	<b>21</b>	<b>7</b>
<b>11</b>	Is there any procedure for expected work risk analysis?	<b>17</b>	<b>31</b>	<b>10</b>
<b>12</b>	Is there any means for detecting of critical control points?	<b>5</b>	<b>37</b>	<b>15</b>
<b>13</b>	Is there any critical limits confined to critical control points?	<b>16</b>	<b>32</b>	<b>9</b>
<b>14</b>	Is there any critical limits monitoring?	<b>11</b>	<b>38</b>	<b>8</b>
<b>15</b>	Is there any biological risk in the slaughterhouse?	<b>39</b>	<b>10</b>	<b>8</b>
<b>16</b>	Is there any means for biological risk control?	<b>17</b>	<b>30</b>	<b>10</b>
<b>17</b>	Is there any chemical risk in the slaughterhouse?	<b>27</b>	<b>25</b>	<b>5</b>
<b>18</b>	Is there any means for chemical risk control?	<b>12</b>	<b>36</b>	<b>9</b>
<b>19</b>	Is there any natural risk in the slaughterhouse?	<b>43</b>	<b>7</b>	<b>7</b>
<b>20</b>	Is there any means for natural risk control?	<b>22</b>	<b>22</b>	<b>13</b>
Average		36%	51%	13%





**Figure 4.1 Implementation of Hazard Analysis**



**Figure 4.2 Implementation of Hazard Analysis**

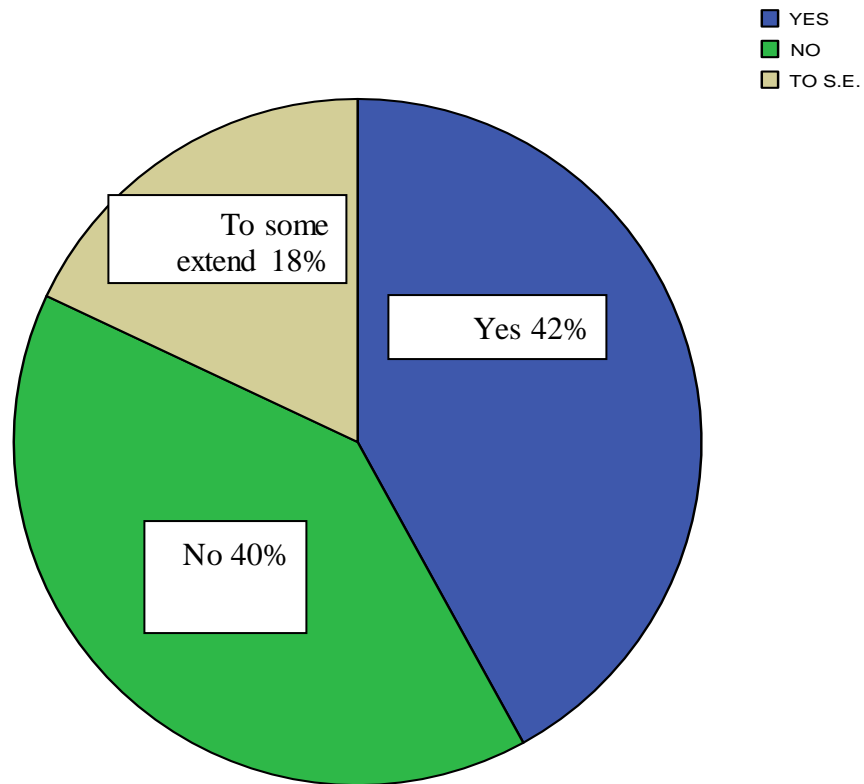
## **4.2 Basic Requirements needed for HACCP application**

Sector two composed of 20 questions dealing with the basic requirements needed for HACCP application, such as the workers education, workers personal hygiene, workers' boots and uniform, identity cards and its validity, health certificates and its validity, also this sector deal with the rejection and resumption of infected , wounded , or biologically contaminated workers.

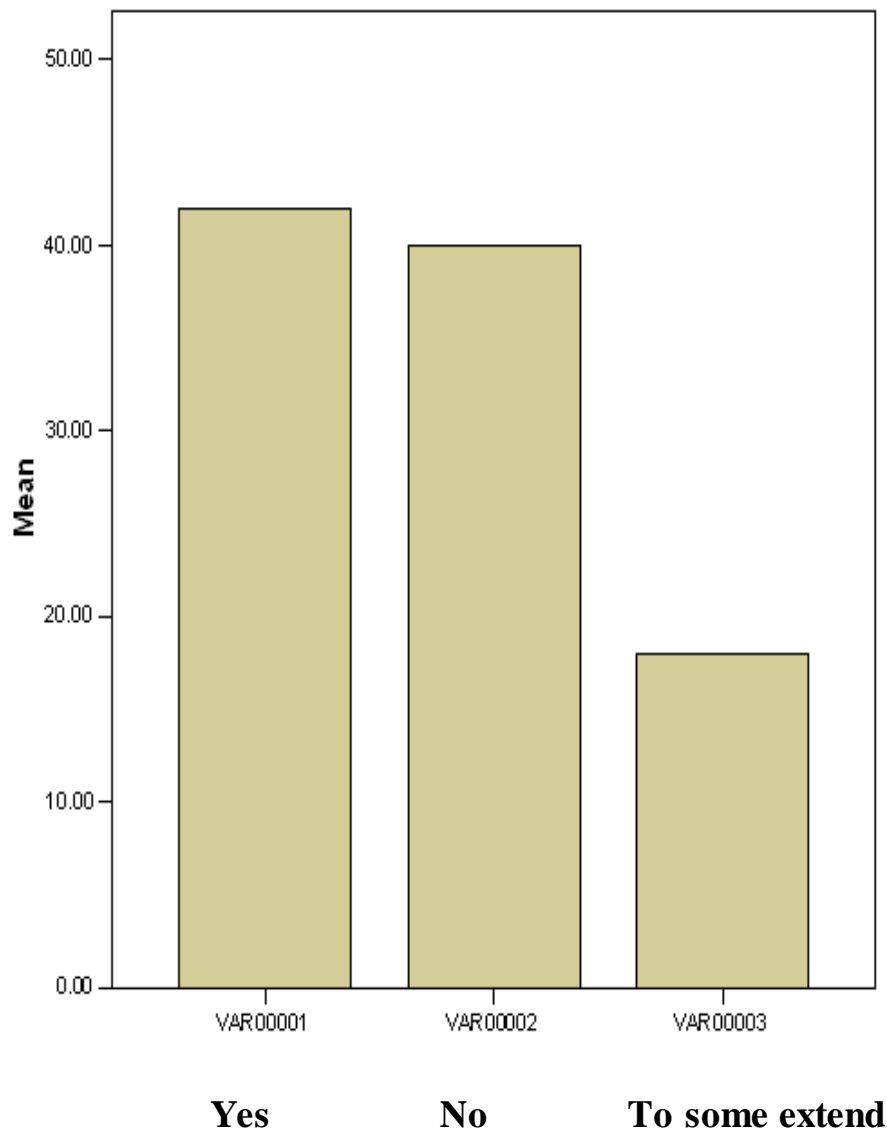
In this sector 42% of the workers agreed that , the basic requirements available according to their opinion, while 40% are not agreed. This result should tackled carefully due to non significance of the result (42% and 40%), but still authorities should exert more attention to the slaughterhouses basic requirements. Also the result should tackled carefully due to the low awareness of the workers about the HACCP according to the first sector results, hence a workers with low or nil HACCP knowledge cannot determine the basic requirements needed for HACCP implementation, and at the same time expert slaughterhouse workers know well about slaughterhouse basic requirements.

**Table 4.2 Basic Requirements needed for HACCP application**

No	Question	Yes	No	To some extend
21	Is there workers identity card for entry check?	17	36	4
22	Are workers identity cards valid?	16	36	5
23	Is the education level of workers suit their tasks?	25	23	9
24	Is the experience of workers suit their tasks?	31	17	9
25	Do state slaughterhouses workers trained in HACCP?	6	44	7
26	Do infected workers with infectious diseases or disease carrier workers rejected from work?	39	9	9
27	Do workers with wounds, ulcers, or any biological contamination, rejected from work?	39	14	4
28	Do workers being rejected for health reasons, should present health certificate to resume work?	28	19	10
29	Do workers have high level of personal hygiene?	27	19	11
30	Do workers wear the specified uniform?	25	23	9
31	Is the specified workers uniform clean?	23	18	16
32	Is there room for workers to change their clothes?	25	17	15
33	Do workers being available at work hall before wearing the uniform?	17	32	8
34	Do workers put off the work uniform before toilet usage?	16	33	8
35	Is workers wear the specified work boots at production hall	18	28	11
36	Is the specified work boots in good condition and clean without holes and cracks?	21	24	12
37	Do workers wash hands with tap-water and soap before work?	23	22	12
38	Do workers wash hands with tap-water and soap after toilet usage?	19	18	20
39	Do wounded workers treated before meat contaminated with blood?	38	8	11
40	Is smoking prohibited in the slaughterhouse production hall?	28	13	16
Average		42%	40%	18%



**Figure 4.3 Basic Requirements needed for HACCP application**



**Figure 4.4 Basic Requirements needed for HACCP application**

### **4.3 The eligibility of the slaughterhouse construction and equipments to apply Haccp system**

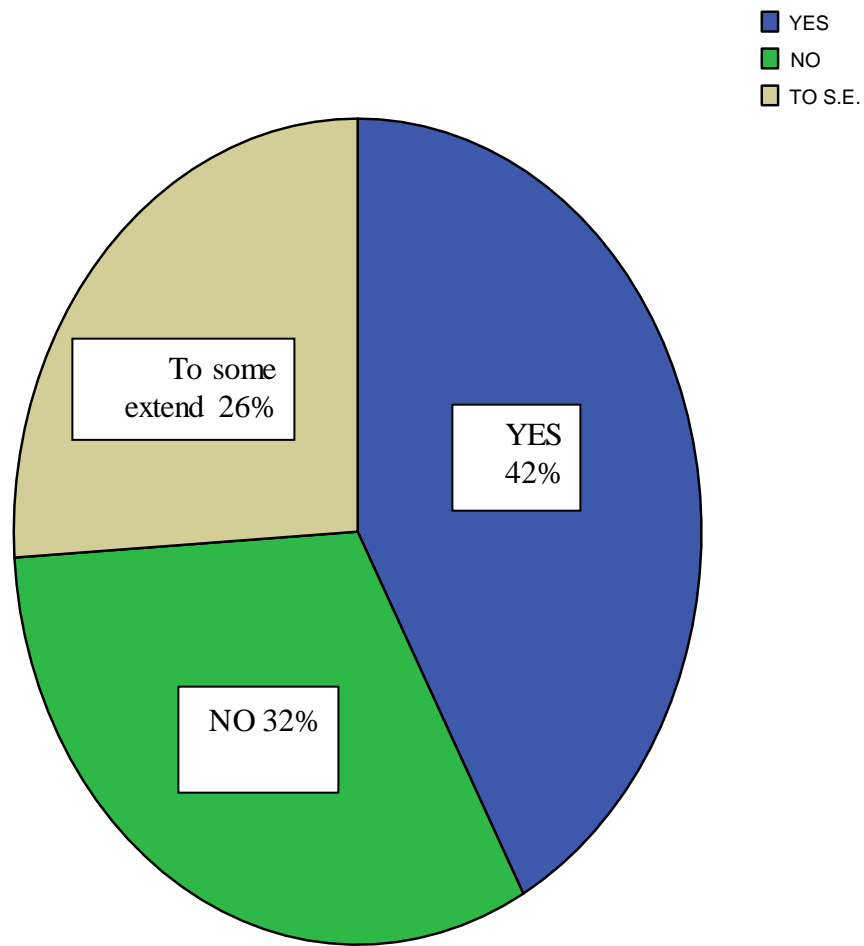
Sector three composed of 20 questions verifying about the eligibility of the slaughterhouse to apply HACCP system, verifying construction about the slaughterhouse in question is it according to the technical standers in floor decline , drainage system, manholes gravity decline and directions, concretes condition and slope, and meat transport containers, this sector also ask about the hygiene measurements been adopted in the slaughterhouse such as disinfection usage in carpets, floor and shoe entry basins.

In this sector 42% agreed that , the slaughterhouse construction is according to the standards, while 32 % disagreed ,while 26% agreed that it is to some extend. This data shows obviously that, the slaughterhouse construction is not properly to standard. It is important to develop laws and rules side by side to an effective executive, technical and professional system implementation.

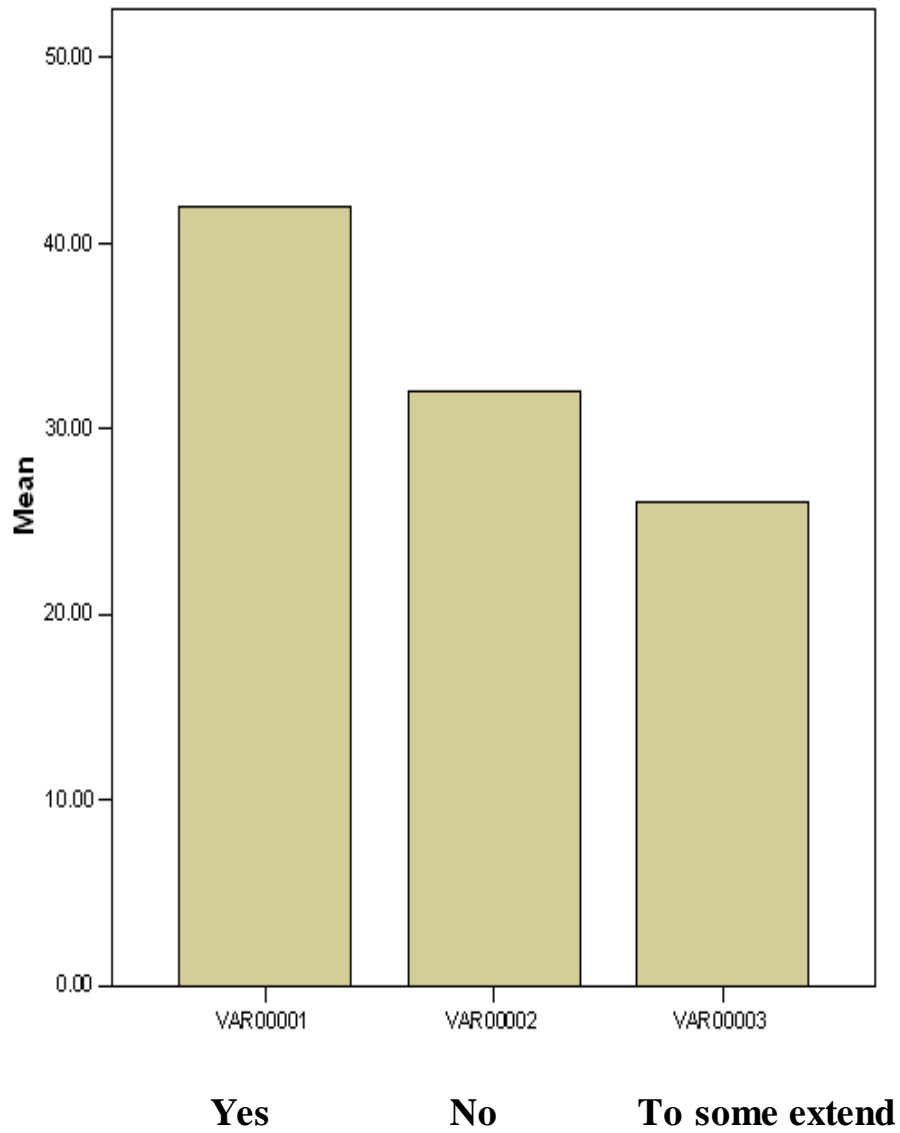
**Table 4.3 The eligibility of the slaughterhouse construction and equipments to apply HACCP system**

No	Question	Yes	No	To some extend
41	Is the slaughterhouse constructed according to the technical standards?	19	17	21
42	Is there by gravity drainage holes?	13	14	14
43	Is there disinfection basin for shoes?	30	41	13
44	Is there enough disinfected passed - on carpets that routinely cleaned?	6	38	13
45	Is there special container for meat transportation?	16	33	8
46	Is that special containers thoroughly cleaned?	13	31	13
47	Is the meat stored in good condition till distribution to butchers shops?	20	25	12
48	Are the corridors spacious enough without rubbish & storage materials?	23	15	19
49	Are the concretes in good conditions and well leveled?	20	18	19
50	Are the floor bricks neatly located together and within the walls without in – between cracks?	32	13	12
51	Are all floors decline go within the general drainage system directions?	38	6	13
52	Are all floors well leveled without water pools in low level areas?	29	10	18
53	Are all floors always kept dry?	30	11	16
54	Is floors cleaned with water boost?	30	15	12
55	Are the manholes routinely cleaned from the residues after cleaning?	30	14	13
56	Are the manholes without offensive odour?	17	26	14
57	Are all manholes mesh cleaned daily after working hours?	23	19	15
58	Is manholes mesh not sink with water?	22	8	17
59	Are the manholes meshes and the covers in good condition and well placed and located?	24	16	17
60	Are the labors having valid health certificate?	27	11	19
Average		42%	32%	26%





**Figure 4.5 The eligibility of the slaughterhouse construction and equipments to apply HACCP system**



**Figure 4.6 The eligibility of the slaughterhouse construction and equipments to apply HACCP system**

#### **4.4 Handling of meat, offal's and residues from slaughterhouse to the consumer**

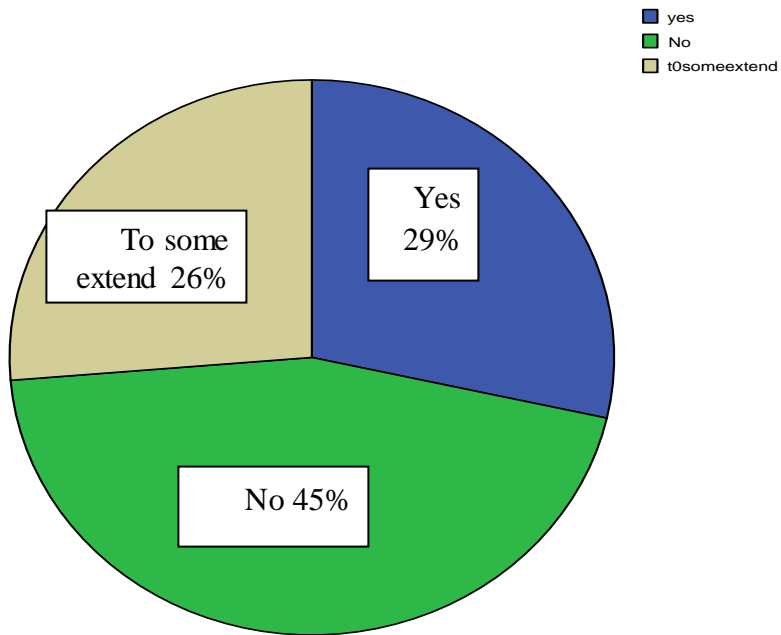
Sector four composed of 20 questions, deal with the meat, offal's and residues handlings from slaughterhouse to the consumer (handlings vehicles cleaning, plastic covers, cooling system and butcher shop). Also this sector deal with the disposal of the condemn meat, offal's content, claws, hoofs, hide, skin and (kwaria).

In this sector 29% agreed that , the meat and byproduct handling is according to the standards, while the majority 45% disagreed, while 26% agreed that, it is to some extend.

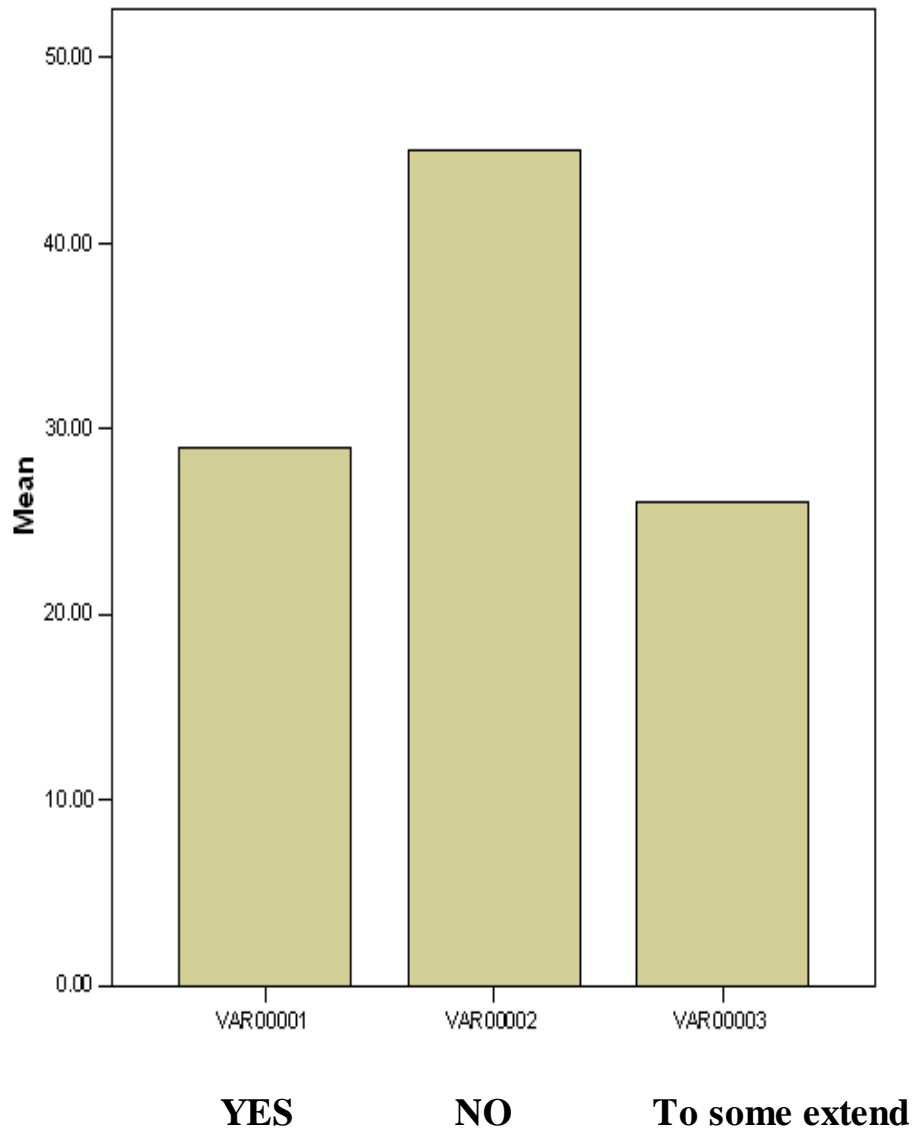
This data shows the need for more work in meat handlings, and this can be done by revising laws, rules and carry out all recommendation in this sector concerning the transport vehicle equipments, the covers, the cooling chain , labors health certificate, butcher shop hygiene.

**Table 4.4 Handling of meat, offal's and residues from slaughterhouse to the consumer**

No	Question	Yes	No	To some extend
61	Is the meat transport from slaughterhouse to markets good and perfect?	14	18	25
62	Is the meat transport vehicle well equipped and cool?	3	47	7
63	Is there meat plastic covers while transport?	15	33	9
64	Is the meat transport vehicle equipped with cooling system?	3	42	12
65	Is the meat transport vehicle regularly washed?	21	20	16
66	Is the transport vehicle is confined only for meat transport?	6	46	5
67	Are you satisfied with constructions & cleaning of the meat transport vehicle?	4	39	14
68	Is condiment meat disposed in right way?	24	12	21
69	Is the offal's content disposed in right way?	17	11	29
70	Is the claws, hoofs and fat disposed in right way?	16	12	29
71	Is the hide, skin and (kowaria) collected in right way?	25	12	20
72	Is the work equipments, instruments, and utensils are adequate?	8	29	20
73	Is the work equipments, instruments, and utensils washed before and after use?	26	10	21
74	Is the work equipments, instruments, and utensils steel less made & against rust?	29	12	16
75	Is there special labor for meat transport and delivery?	21	26	10
76	Are the labors wearing especial uniform?	12	36	9
77	Is the vehicle driver help in carrying and delivering meat?	23	25	9
78	Are butchers wearing especial uniform?	24	29	4
79	where and how the butcher store the meat delivered from the slaughterhouse?	12	38	7
80	Are the butcher shops regularly washed and cleaned?	22	18	17
Average		29%	45%	26%



**Figure 4.7 Handling of meat, offal's and residues from slaughterhouse to the consumer**



**Figure 4.8 Handling of meat, offal's and residues from slaughterhouse to the consumer**

## **CHAPTER FIVE**

### **Conclusion and Recommendations**

#### **5.1 Conclusion**

Food safety is one of challenges facing the national, regional and international scientists, to achieve food security. Food safety is ongoing process you need every day for proper perfection, observation, evaluation and monitoring. Hazard and Critical Control Points (HACCP) is the solution available nowadays for food safety that recommended by all international organizations concerned about food safety. The objectives of this study were: to evaluate implementation HACCP Principles in Gezira state using questioner. The methodology approaches the descriptive and analytical methods. Data were collected from workers in the slaughter houses. The result were presented in percentage form. The results showed that: 36% agreed that hazard analysis was applied, 42% agreed that the basic requirements were applied, 42% agreed that slaughterhouse construction was applied and 28% agreed that good meat handling was applied. The study concluded that HACCP application in Gezira state slaughter houses is very poor, as the average of agreement in the four sectors in the seven localities in Gezira state is not more than 36% .

#### **5.2 Recommendations**

##### **5.2.1 General recommendations**

- 1- Legislative review should be carried out to suit the requirements needs and recommendations of OIE, FAO, WHO & WTO, concerning HACCP implementation in Slaughterhouses.
- 2- HACCP awareness should be raised by all means and methods addressing all target sectors (political, executive, professional,

technical, producers, skill labors, butchers, civil community organizations and the consumers).

- 3- Different levels of HACCP Training Programs should be adopted and carried out addressing all workers levels in slaughterhouses and those deal with meat process throughout till consumers.

### **5.2.2 Specific recommendations**

- 1- Rules should be implemented in the slaughterhouse, for expected work risk analysis, detecting of critical control points, exploring limits confined to critical control points & detecting & monitoring the critical points limits.
- 2- Especial interest should be paid to the chemical, biological, and natural risks by raising the awareness, providing training programs and monitoring the implementation.
- 3- Rules of slaughterhouse basic requirements should be implemented.
- 4- Basic workers requirements (identity cards, especial full uniform, especial private workers room, health certificates, first aid ,personal hygiene, etc...) should be implemented, monitored and controlled.
- 5- Rules of slaughterhouse technical constructions should be implemented otherwise no license for work.
- 6- Biosafety measurements should be considered meanwhile construction of slaughterhouses (drainage system, concrete decline levels, manholes distributions and separate areas for blood, heads, skins, viscera, and the carcass).



- 7- Rules of slaughterhouse technical handling of meat and all other animal parts should be implemented; otherwise no license or sanctions will be carried out.
- 8- Rules of meat transport should be implemented (well equipped cool vehicle, meat handling with gloves, covered with plastic covers, handled by healthy personnel, etc...)
- 9- Rules of meat condemnation and disposal should cater for, bearing in mind sanitary, hygienic and biosafety measurements.
- 10- Butcher shops hygiene should be revised

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## **APPENDIXES**

## Appendix-A

### GLOSSARY OF TERMS

**Animal-by-product:** the entire bodies or parts of animals or products of animal origin not intended for human consumption.

**Audit:** A systematic and independent examination to determine whether activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

**Control:** (a) to manage the condition of an operation to maintain compliance with established criteria. (b) The state where correct procedures are being followed and criteria are being met.

**Control measure:** any action or activity that can be used to prevent, eliminate, or reduce hazard.

**Corrective action:** any action to be taken when the result of monitoring at the CCP indicate the loss of control.

**Critical control points:** A step at which control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to acceptable level.

**Critical limits:** a maximum and /or minimum value to which a biological, chemical, or physical parameter must be control at a CCP to prevent, eliminate, or reduce to an acceptable level the occurrence of a food safety hazard.

**HACCP:** A system which identifies, evaluates, and control hazards which are significant for food safety.

**HACCP Plan:** A document prepared in accordance with the principles of HACCP to insure control of hazards which are significant for food safety in the segment of the food chain under consideration .

**HACCP System:** The result of the implementation of the HACCP plan.

**HACCP Team:** the group of people in a slaughterhouse who are responsible for developing, implementing, and maintaining the HACCP system.

**Hazard:** A biological, chemical, or physical agent in, or condition of, food with the potential to cause an adverse health effect

**Hazard Analysis:** the process of collecting and evaluating information on hazards associated with the food under consideration to decide which are significant and must be addressed in the HACCP plan.

**Monitor:** The act of conducting a planned sequence of observations or measurements of control parameters to assess whether a CCP is under control.

**Pre-requisite program:** Procedures, including good manufacturing practices and good hygiene practices that address operational conditions providing the foundation for the HACCP system.

**Product recall:** the removal of unsafe food from the distribution chain extending to food sold to consumer and therefore involving communication with consumers.

**Product withdrawal:** the removal of unsafe food from the distribution chain not extending to food sold to consumer.

**Quality control:** A system by which desired standard of quality in a product or a process maintained.

**Risk assessment:** Is the identification and quantification of the risk resulting from the specific use or occurrence of a hazard taking into account the possible harmful effects on individual people or society from that hazard.

**Severity:** the seriousness of the effect(s) of a hazard.

**Specified risk material:** is the skull, brain, eyes, tonsils, and the vertebral column excluding the vertebrae of the tail, but including the dorsal root

ganglia and spinal cord of bovine animals aged over twelve months and the intestines from the duodenum to the rectum of bovine animals of all ages.

**Standard operating procedure(SOP):** this is detailed set of instructions, which describe how to carry out a repetitive task.

**Sanitation Standard operating procedure (SSOP):** this is a description of the methods applied to the slaughterhouse relating to hygiene and sanitation.

**Traceability :** The ability to follow a product batch forward through the slaughter process via distribution chain to the immediate customer and backwards to supplier of cattle ,services and packaging etc..

**Validation :** that element of verification focused on collecting and evaluating scientific and technical information to determine if the HACCP plan, when properly implemented, will effectively control the hazards .

**Verification :** The application of methods, procedures ,tests, and other evaluations, in addition to monitoring ,to determine compliance with the HACCP plan.

## Appendix-B

### Sector one : Implementation of Hazard Analysis

No	Question	Yes	No	To some extend
<b>1</b>	Do you heard about HACCP system?			
<b>2</b>	Is there any team working according to HACCP system?			
<b>3</b>	Is this team trained on HACCP?			
<b>4</b>	Of what HACCP teams constitute?			
<b>5</b>	Is there any relation between HACCP and quality control?			
<b>6</b>	Is there any quality control certificate for the slaughter house?			
<b>7</b>	What quality control? Is it implemented in slaughter house?			
<b>8</b>	Is there meat quality control certificate?			
<b>9</b>	What work risk in slaughterhouse?			
<b>10</b>	Do you know how many sections in the work risk?			
<b>11</b>	Is there any procedure for expected work risk analysis?			
<b>12</b>	Is there any means for detecting of critical control points?			
<b>13</b>	Is there any critical limits confined to critical control points?			
<b>14</b>	Is there any critical limits monitoring?			
<b>15</b>	Is there any biological risk in the slaughterhouse?			
<b>16</b>	Is there any means for biological risk control?			
<b>17</b>	Is there any chemical risk in the slaughterhouse?			
<b>18</b>	Is there any means for chemical risk control?			
<b>19</b>	Is there any natural risk in the slaughterhouse?			
<b>20</b>	Is there any means for natural risk control?			



### Appendix-C

#### Sector two: Basic Requirements needed for HACCP application

No	Question	Yes	No	To some extend
21	Is there workers identity card for entry check?			
22	Are workers identity cards valid?			
23	Is the education level of workers suit their tasks?			
24	Is the experience of workers suit their tasks?			
25	Do state slaughterhouses workers trained in HACCP?			
26	Do infected workers with infectious diseases or disease carrier workers rejected from work?			
27	Do workers with wounds, ulcers, or any biological contamination, rejected from work?			
28	Do workers being rejected for health reasons, should present health certificate to resume work?			
29	Do workers have high level of personal hygiene?			
30	Do workers wear the specified uniform?			
31	Is the specified workers uniform clean?			
32	Is there room for workers to change their clothes?			
33	Do workers being available at work hall before wearing the uniform?			
34	Do workers put off the work uniform before toilet usage?			
35	Is workers wear the specified work boots at production hall			
36	Is the specified work boots in good condition and clean without holes and cracks?			
37	Do workers wash hands with tap-water and soap before work?			
38	Do workers wash hands with tap-water and soap after toilet usage?			
39	Do wounded workers treated before meat contaminated with blood?			
40	Is smoking prohibited in the slaughterhouse production hall?			

### Appendix-D

Sector Three: The eligibility of the slaughterhouse construction and equipments to apply  
HACCP system

No	Question	Yes	No	To some extend
41	Is the slaughterhouse constructed according to the technical standards?			
42	Is there by gravity drainage holes?			
43	Is there disinfection basin for shoes?			
44	Is there enough disinfected passed - on carpets that routinely cleaned?			
45	Is there special container for meat transportation?			
46	Is that special containers thoroughly cleaned?			
47	Is the meat stored in good condition till distribution to butchers shops?			
48	Are the corridors spacious enough without rubbish & storage materials?			
49	Are the concretes in good conditions and well leveled?			
50	Are the floor bricks neatly located together and within the walls without in – between cracks?			
51	Are all floors decline go within the general drainage system directions?			
52	Are all floors well leveled without water pools in low level areas?			
53	Are all floors always kept dry?			
54	Is floors cleaned with water boost?			
55	Are the manholes routinely cleaned from the residues after cleaning?			
56	Are the manholes without offensive odour?			
57	Are all manholes mesh cleaned daily after working hours?			
58	Is manholes mesh not sink with water?			
59	Are the manholes meshes and the covers in good condition and well placed and located?			
60	Are the labors having valid health certificate?			

## Appendix-E

### Sector four: Handling of meat, offal's and residues from slaughterhouse to the consumer

No	Question	Yes	No	To some extend
61	Is the meat transport from slaughterhouse to markets good and perfect?			
62	Is the meat transport vehicle well equipped and cool?			
63	Is there meat plastic covers while transport?			
64	Is the meat transport vehicle equipped with cooling system?			
65	Is the meat transport vehicle regularly washed?			
66	Is the transport vehicle is confined only for meat transport?			
67	Are you satisfied with constructions & cleaning of the meat transport vehicle?			
68	Is condiment meat disposed in right way?			
69	Is the offal's content disposed in right way?			
70	Is the claws, hoofs and fat disposed in right way?			
71	Is the hide, skin and (kowaria) collected in right way?			
72	Is the work equipments, instruments, and utensils are adequate?			
73	Is the work equipments, instruments, and utensils washed before and after use?			
74	Is the work equipments, instruments, and utensils steel less made & against rust?			
75	Is there special labor for meat transport and delivery?			
76	Are the labors wearing especial uniform?			
77	Is the vehicle driver help in carrying and delivering meat?			
78	Are butchers wearing especial uniform?			
79	where and how the butcher store the meat delivered from the slaughterhouse?			
80	Are the butcher shops regularly washed and cleaned?			

## Appendix-F

### استبانة

عن معرفة و تطبيق الهسب في سلخانة ود مدني

المحور الأول: تحليل المخاطر

الرقم	البند	نعم	لا	لحد ما
1	هل سمعت بنظام الهسب ؟			
2	هل هنالك تيم عامل بنظام الهسب ؟			
3	هل التيم مدرب على نظام الهسب ؟			
4	مما يتكون تيم نظام الهسب ؟			
5	هل توجد علاقة بين الجودة ونظام الهسب ؟			
6	هل توجد شهادة جودة لدى المسلخ ؟			
7	ماهى الجودة فى نظرك هل هناك عمل بما فى المسلخ ؟			
8	هل هناك شهادة ضمان جودة للحوم ؟			
9	ماهى مخاطر العمل بالمسلخ ؟			
10	هل تعرف الى كم قسم تنقسم المخاطر ؟			
11	هل هنالك إجراءات تحليل للمخاطر المتوقعة أثناء عمل المسلخ؟			
12	هل هنالك وسائل لتحديد نقاط التحكم الحرجة؟			
13	هل هنالك حدود حرجة خاصة بنقاط التحكم الحرجة؟			
14	هل تتم مراقبة الحدود الحرجة الخاصة بنقاط التحكم الحرجة؟			
15	هل توجد المخاطر البيولوجية فى المسلخ؟			
16	هل هنالك وسائل للتحكم فى المخاطر البيولوجية؟			
17	هل توجد المخاطر الكيميائية فى المسلخ؟			
18	هل هنالك وسائل التحكم فى المخاطر الكيميائية؟			
19	هل توجد المخاطر الطبيعية فى المسلخ؟			
20	هل هنالك وسائل التحكم فى المخاطر الطبيعية؟			

المحور الثاني: برنامج المتطلبات الأساسية

الرقم	البند	نعم	لا	لحد ما
21	هل توجد بطاقات هوية لدخول المسلخ؟			
22	هل البطاقات سارية المفعول؟			
23	هل المستوى التعليمي يتناسب مع وظيفة العامل بالمسلخ؟			
24	سنوات الخبرة تتناسب مع وظيفة العامل بالمسلخ؟			
25	يتلقى العاملون دورات تدريبية علي نظام الحساب بالمسالخ بالولاية؟			
26	يتم إستبعاد أي شخص مصاب بمرض معدى أو أثناء حملة لميكروب مرض معدى؟			
27	يتم استبعاد أي شخص مصاب بجروح أو بثرات أو قروح معدية أو أي مصدر أخر غير عادي يمكن أن يكون مصدراً للتلوث الميكروبي؟			
28	يتم مطالبة العاملين العائدين للعمل بعد الانقطاع نتيجة للإصابة بمرض معدى بتقرير طبي يفيد شفائهم من المرض؟			
29	يتوافر لدى العاملين درجة مرتفعة من النظافة الشخصية لمنع تلوث اللحوم؟			
30	يلتزم كل العاملين بإرتداء الملابس الخاصة بالعمل؟			
31	تكون الملابس الخاصة بالعمل نظيفة؟			
32	يقوم العاملون بتغيير الملابس الخاصة بالمسلخ في الأماكن المخصصة لذلك و يتم الاحتفاظ بملابس العمل نظيفة بعيدا عن ملابس الخروج؟			
33	يتواجد العاملون في صالات الإنتاج بملابس الخروج؟			
34	يتم خلع ملابس العمل قبل الذهاب إلى دورة المياه؟			
35	يتم إرتداء الأحذية الخاصة بالمسلخ في صالات الإنتاج؟			
36	تكون الأحذية الخاصة بالمسلخ نظيفة وفي حالة جيدة وخالية من الثقوب أو الشقوق؟			
37	يتم عملية غسيل الأيدي بصورة جيدة باستخدام الماء الدافئ والصابون قبل العمل؟			
38	يتم عملية غسيل الأيدي بصورة جيدة باستخدام الماء الدافئ والصابون بعد استخدام دورة المياه؟			
39	في حالة تعرض أحد العاملين بالمسلخ إلي جرح هل يتم ربطه بضمادة حتى لا يلامس اللحوم؟			
40	يمنع التدخين في صالات المسلخ وذلك لتقليل خطر تلوث المنتج عن طريق انتشار البكتريا من الفم والأيدي؟			

المحور الثالث: المسلخ

الرقم	البند	نعم	لا	لحد ما
41	البناء المعماري داخل السلخانة مصمم حسب المواصفات القياسية؟			
42	هنالك فتحات للصرف مصممة بطريقة انسيابية؟			
43	توجد أحواض لتطهير الأحذية؟			
44	توجد دواسات كافية مشبعة بالمطهرات و تتم نظافتها بصورة دورية؟			
45	هنالك أوعية خاصة لنقل اللحوم؟			
46	هذه الأوعية يتم تنظيفها بصورة جيدة؟			
47	يتم تخزين اللحوم بطريقة جيدة لحين تسليمها للمحلات التجارية؟			
48	الممرات أتساع فسيح وخالية من التراكمات المواد المخزنة الأخرى؟			
49	لأرضيات الأسمنتية في حالة جيدة وخالية من المناطق غير المستوية؟			
50	يجب أن تكون بلاطات الأرضيات في حالة جيدة من حيث أماكن التصاق البلاطات ببعضها أو بالحوائط الجانبية؟			
51	جميع أسطح الأرضيات ذات ميل في اتجاه فتحات الصرف؟			
52	جميع أسطح الأرضيات خالية من المناطق المنخفضة حتى لا تصبغ برك لتجمع المياه؟			
53	يتم المحافظة على جميع أسطح الأرضيات في الحالة الجافة بصفة مستمرة؟			
54	يتم استخدام الخراطيم في رش أسطح الأرضيات بالقرب من اللحوم؟			
55	يتم تنظيف البالوعات حتى تكون خالية تماما من البقايا بعد تنظيفها؟			
56	البالوعات خالية من الروائح الكريهة؟			
57	يتم تصفية وتطهير كل مصافي البالوعات بصفة دورية في نهاية كل يوم عمل؟			
58	تكون مصافي البالوعات غير مغمورة بالماء وذلك لمنع انتشار الروائح؟			
59	توجد مصافي البالوعات وكذلك أغطيتها في أماكنها وأن تكون بحالة جيدة؟			
60	هل العمال يحملون شهادات صحية سارية؟			

المحور الرابع: التعامل مع اللحوم و المخلفات

الرقم	البند	نعم	لا	لحد ما
61	يتم نقل اللحوم من المسلخ لاماكن البيع على اكمل وجة؟			
62	هل عربات نقل اللحوم مجهزة ومبردة؟			
63	تستخدم أغطية بلاستيكية لغطاء اللحوم أثناءالنقل؟			
64	يتم تجهيز العربة لترحيل الحوم من ناحية التبريد؟			
65	يتم غسيل عربة نقل اللحوم بصورة منتظمة؟			
66	العربة مخصصة لترحيل اللحوم فقط؟			
67	هل أنت مقتنع بجودة و نظافة العربه لنقل اللحوم؟			
68	هل يتم التخلص من اللحوم المباداة بصورة صحيحة؟			
69	هل يتم التخلص من محتويات المعدة والأمعاء بصورة صحيحة؟			
70	هل يتم التخلص من بقايا الذبيحة (الشحوم والأظلاف) بصورة صحيحة؟			
71	هل يتم تجميع الجلود والكوارع بطريقة صحيحة؟			
72	هل أدوات العمل كافية؟			
73	هل يتم نظافة الأدوات قبل وبعد الاستخدام؟			
74	هل ادوات العمل متينة وغير قابلة للصدأ؟			
75	هل هنالك عامل لنقل وتسليم اللحوم؟			
76	هل العامل يرتدى زى كامل؟			
77	هل سائق العربة يساعد في عملية نقل تسليم اللحوم؟			
78	هل الجزار يرتدى زى؟			
79	اين تحفظ اللحوم بعد تسليمها مباشرة؟			
80	هل الجزارة تنظف بصورة منتظمة؟			

## **Appendix-G**

### **The assessors**

Dr. Afaf Mekki Ismail  
Director General Ministry of Agriculture, Animal wealth and Natural  
Resources  
Gezira State

Dr. Saif Aboud  
Director General animal wealth general directorate  
Ministry of Agriculture, Animal Wealth and Natural Resources  
Gezira State

Dr. Gaafar Ahmed Al-bashier  
Director of Animal Health Department  
Animal Wealth General Directorate  
Ministry of Agriculture, Animal Wealth and Natural Resources  
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Dr.Elfatih Hashash  
Former Director General Animal Wealth General Directorate  
Ministry of Agriculture, Animal Wealth and Natural Resources  
Gezira State