



بسم الله الرحمن الرحيم



Sudan University of Science and Technology

College of Graduate Studies

Deanship of Development & Quality

Title:

Evaluation of Hazard Analysis Critical Control Point (HACCP System) Implementation in Dry Packing Crops in Khartoum State - Sudan

تقييم تطبيق نظام تحليل المخاطر ونقاط التحكم الحرجة
(نظام الهاسب) في تعبئة المحاصيل الجافة في ولاية
الخرطوم - السودان

بحث تكميلي لنيل درجة الماجستير في إدارة الجودة الشاملة والامتياز

A Thesis Submitted In Partial Fulfillment for the Requirements of Master Degree
in Total Quality Management & Excellence

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March, 2017

الإستهلال

﴿ بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ ﴾

قال تعالى:

اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ ﴿١﴾ خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ ﴿٢﴾ اقْرَأْ وَرَبُّكَ
الْأَكْرَمُ ﴿٣﴾ الَّذِي عَلَّمَ بِالْقَلَمِ ﴿٤﴾ عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ ﴿٥﴾



صدق الله العظيم

سورة العلق: الآيات من 1 - 5

DeDication

*This simple effort dedicated to my parents,
My brothers and sisters, anything nice has come to
My life has been because of your example,*

Guidance and love

*A special Dedication to my Mother for all the sacrifices
that she made on my behalf*

All who taught me a letter

All my friends

I dedicate this work ...

ABD ELHMEED OMER ...

Acknowledgement

Thanks to Allah for health, assistance and patience that he has given me to complete this work.

I would like to express detest gratitude and thanks for My Supervisor:

PROF. MOHAMED ABDELSALAM ABDALLA

For his supervisor, proper guidance, kindness valuable and encouragement to carry out this work ...

I would like to express my detest thanks;

To the staff members of the department Food Science & Technology in University Of Khartoum,

MOROIJ COMMODITIES COMPANY LTD,

Dr. ABD ELMUTALAB ADAM

And all my colleagues for help me during the research ...

Finally, I would like to thank my family for their ongoing support, especially my Mother, for her unwavering love and encouragement with all my endeavors, without which this work would never have been possible.

مستخلص البحث

يعتبر نظام تحليل المخاطر ونقاط التحكم الحرجة (الهاسب) هو برنامج وقائي لسلامة الأغذية يهدف إلى ضمان حصول المستهلكين على إمدادات غذائية آمنة، وتهدف التدابير الوقائية المعتمدة لهذا المفهوم إلى تقليل الحاجة إلى إجراء الاختبارات الميكروبية، الفيزيائية والكيميائية بعد المعالجة ويمثل جزء رئيسي من نظام سلامة الأغذية، وهذا البحث يقوم بدراسة تقييم تطبيق تحليل المخاطر ونقاط التحكم الحرجة في شركات تعبئة البقوليات الجافة بولاية الخرطوم - السودان. أجريت هذه الدراسة على شركة قامت بتطبيق نظام تحليل المخاطر ونقاط التحكم الحرجة في الفترة من يناير 2016م حتى أكتوبر 2017م، في هذا البحث استخدمت المعايير الكمية لتحليل البيانات، وأيضاً أظهرت الدراسة تأثيرات إيجابية لنظام الهاسب وذلك بتقليل المخاطر الفيزيائية وبالتالي تقليل شكاوى العملاء وزيادة الثقة في منتجات الشركة. ولقد صممت خطط نظام تحليل المخاطر ونقاط التحكم الحرجة (الهاسب) مع إدراج ممارسات التصنيع الجيدة كدليل لوضع إجراءات التشغيل القياسية وتتبع خمسة مبادئ تمهيدية وسبعة مبادئ رئيسية، ويتم تقييم خطة تحليل المخاطر ونقطة التحكم الحرجة لتحديد ما إذا كان المنتج آمن وتم تصنيعه بشكل متسق، والتحقق الموضوعي من أن خطة الهاسب تنفذ على الوجه الصحيح، مع برامج العمليات التصنيعية الجيدة، النظافة الشخصية والبيئة الداخلية والخارجية والدعم المناسب من الإدارة العليا للحفاظ على تطبيق نظام تحليل المخاطر ونقاط التحكم الحرجة. وبالرجوع الي الشكاوى ومقارنتها قبل وبعد تطبيق نظام تحليل المخاطر ونقاط التحكم الحرجة (الهاسب) حيث تم أخذ تقارير الشكاوى قبل 6 أشهر في الفترة ما بين شهر يناير وحتى يونيو 2016 من قبل تطبيق نظام (الهاسب) وكانت 11 شكوى من المخاطر الفيزيائية من مجموع 17 شكوى. وبعد تطبيق نظام تحليل المخاطر ونقطة التحكم الحرجة في الفترة ما بين شهر يناير وحتى يونيو 2017، قدمت 7 شكوى منها 4 شكاوى فيزيائية. ونسبة لما ذكر أعلاه قد تم هذا البحث استناداً على المخاطر الفيزيائية في مصانع تعبئة المحاصيل البقولية الجافة (العدس).

ABSTRACT

Hazard Analysis Critical Control Point (HACCP) is a food safety prevention program designed to ensure that consumers have access to safe food supplies. The precautionary measures adopted for this concept aim to reduce need for post-processing microbial, physical and chemical testing , so it's a main part of ISO 22000 and this research to **Evaluate Of Hazard Analysis Critical Control Point (HACCP System) Implementation In Dry Packing Crops In Khartoum State - Sudan.** This study was conducted on a company that implemented HACCP system from January 2016 to October 2017, in this research quantitative criteria were used to analyze the data collected by the questionnaire 30 samples. HACCP plans was designed with the inclusion of good manufacturing practices as a guide to standard operating procedures five preliminary and seven principles. HACCP plan was evaluated to determine if product was safe and had been consistently manufactured, verified HACCP plan was implemented properly, with good manufacturing processes, personal hygiene, internal and external environment and appropriate support from top management to maintain HACCP implementation. Complaints were reviewed and compared before and after the implementation of the HACCP system. Complaints reports were taken six months ago (January - Jun 2016) before implemented HACCP system **11** complaints of physical hazards from a total of **17** complaints. After implementation of HACCP system (January - Jun 2017) **7** complaints were filed, which only **4** complaints physical hazard. As mentioned above, this research was based on physical hazards in plants of dry packing crops (Lentils).

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INTRODUCTION

Hazard Analysis Critical Control Point (HACCP) is a method or systematic and rational control of hazards to ensure the safety of a product. It is based on a simple principle: "Prevention is better than cure. HACCP is intimately linked to food safety. However, its application is not limited only to the agriculture food sector and is also used in other areas such as aerospace, chemical or nuclear industry. Only the nature of threats is changing from one sector to another, the principle remains the same. This document is a summary of HACCP in food products. HACCP includes steps designed to identify food safety risks, prevent food safety hazards before they occur, and address legal compliance. The most important aspect of HACCP is that it is a preventive system rather than an inspection system of controlling food safety hazards. Prevention of hazards cannot be accomplished by end product inspection. Controlling the production process with HACCP offers the best approach. The food safety program, HACCP, was first introduced as a joint venture between NASA and the Pillsbury Corporation in the early 1960s (Mayes. 2001).

It was initially created to eliminate the microbiological hazards from outer space but also increase the confidence that the space program could effectively maintain personnel safety. The primary basis for eliminating the microbiological hazards was to ensure that astronauts would be safe from sickness since they would be without medical care for several weeks (Etzkowitz. 2000).

HACCP has become accepted internationally as the best means of ensuring food safety. In 2004, the European Union (EU) adopted several new regulations on the hygiene of foods, including one (852/2004/EC) mandating that effective in 2006 all food business operators implement procedures based on the HACCP principles. Other government authorities across the globe, including Canada, Australia and Japan, have adopted or are adopting the HACCP-based food safety control system (Musaj *et al.* 2009).

The food borne diseases continue to be one of the biggest problems for public health throughout the world. Data of the Center for Control of Diseases in USA show that every year 76 million of people suffer food

borne infection, of whom 15% undergo hospitalization. Food borne disease can be classified either infectious or intoxications, also in Sudan diseases with food origin stated to become a serious problem, even though very often are unknown (Musaj *et al.* 2009).

Lentils are a pulse crop that has been used in agricultural production for a great deal of human history. There is evidence of human consumption of lentils dating back to roughly 10,000 years ago, and it has been indicated that they were among the first crops domesticated by humans. Lentils are known for their high nutrient content and health benefits in humans because they have the third highest protein content of any legume, at 30% of their calories. They are also a great source of carbohydrates and high in fiber. Furthermore, they are containing important minerals and vitamins such as iron and zinc. Lentils also include essential amino acids isoleucine and lysine, making them a cheap source of protein in developing countries (Callaway *et al.* 2004).

Research Importance

Importance of HACCP system (Taylor. 2001):

- A reduced public health risk.
- Cost-effective method of assuring food safety.
- Fewer customer complaints and recalls and overall quality improve.
- Facilitate recall of suspect product.

Research Objectives

- The apply HACCP in the food chain for consumption witch its implementation and scientific evidence to protect human health.
- To enhance food safety and implementation of HACCP for significant benefits.

CHAPTER ONE

LITERATURE REVIEW

1.1 Evolution of Quality

1.1.1 Quality Definition:

1. Fitness for uses (Juran. 2010) Fig 1.1.
2. The totality of features and characteristics that bear on the ability of a product or service to satisfy a given need (British Standard Institution; 1991).
3. The total composite product and service characteristics of marketing, engineering, manufacture, and maintenance through which the product and service will meet the expectations of the customer (Feigenbaum.1961).
4. Conformance to requirements (Crosby .1979).
5. Quality is a dynamic state associated with products, services, people, processes, and environments that meet or exceeds expectations and helps produce superior value (Goetsch, D. and Davis, S. 2010).

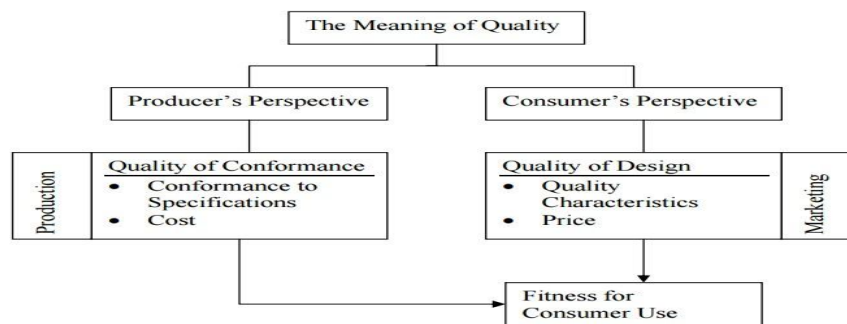


Fig 1.1 Meaning of Quality from the producer and consumer's perspective (Jervis *et al.*2002)

1.1.2 Evolution of Quality A four - level Model for

Morgan *et al.*(1990) outlined another four-level model of the evolution of quality management. In addition to the framework it proposes, clear definitions of quality terms are also provided (Fig 1.2).

1.1.2.1 Level 1 Inspection 1900. Measure the characteristics of a product and compare them with its specifications; the goal here is the fitness of standards. This is the passive "inspecting" attitude.

- 1.1.2.2 Level 2 Quality Control 1940.** Inspection performed by the workers themselves with a feedback loop to the production line; and avoid the "inspector" effect and allow some learning to take place.
- 1.1.2.3 Level 3 Quality Assurances 1960.** SET of (implemented) predefined and systematic activities necessary to give confidence in the process quality; one step further, Quality procedures are designed and planned as a whole to ensure that no bad products be delivered. Do not just rely on everybody's work and control. This introduces the notion of a coherent set of quality procedures/tests. The given confidence (in the definition of QA) is important both for the producer and for the customer.
- 1.1.2.4 Level 4 Total Quality Management 1980.** Management centered on quality and based on the participation of everybody which aims at the customer satisfaction and at the improvement of the company's personnel and society. The ultimate step, a quality assurance plan is operational but the management, the workers and the customers continuously interact to review / improve this plan (Shiba *et al.* 1993).



Fig 1.2: Evolution of Quality (Shiba *e tal.* 1993)

1.2 Total Quality Management (TQM)

Total: Make-up of the whole.

Quality: Degree of excellence a product or service provides

Management: Act, art or manner of handling, controlling, directing etc.

Total Quality Management (TQM) is an art of managing the whole to achieve excellence, TQM is also defined as both a philosophy and a set of

benchmarks that represent the foundation of a continuously improving organization. It is an application of quantitative methods and human resources to improve all the processes within an organization and exceed customer needs at present and in the future (Goetsch *et al.* 1995). TQM schemes address the approach that a manufacturing organization needs to take to ensure product quality. They aim to involve every member of the organization in the achievement of management objectives to produce safe, wholesome food, enhance customer satisfaction and confidence, and identify means of ongoing improvement. TQM is a comprehensive and structured approach to organizational management that seeks to improve quality products and services through ongoing refinements in response to continuous feedback. TQM schemes embracing HACCP and document control form an important framework within which quality requirements can be communicated effectively and in a way that can be demonstrated and audited. The overall approach is summarized in Fig 1.3 (Jervis *et al.* 2002).

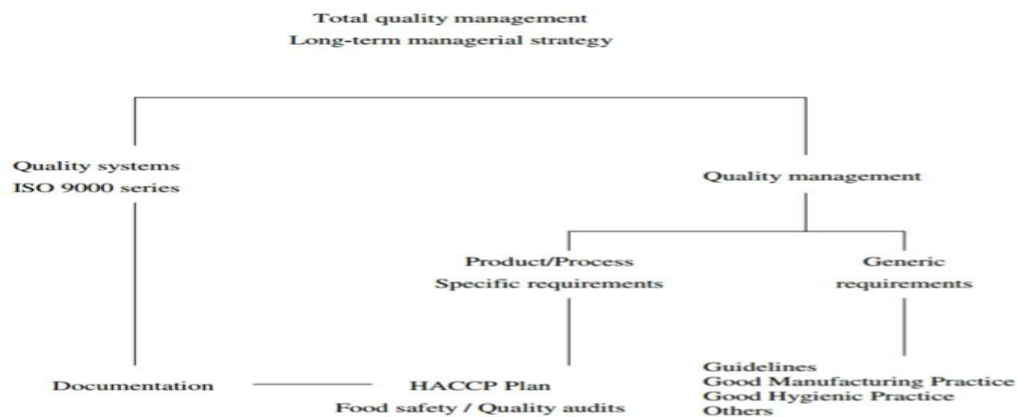


Fig 1.3: The elements of total quality management (Jervis *et al.* 2002)

1.3 International Organization of Standardization (ISO)

In 1946, representatives from 25 countries joined together to create a common and unified industrial standard; the organization created was the International Organization of Standardization (ISO). It has published more than 18,500 international standards in a 60-year time period beginning in 1947. These standards range from agriculture and Construction Standards, to mechanical engineering, to state-of-the-art information technology advances (Standardization. 2011). Until this time, ISO was primarily known for creating technical specifications for specific industries such

as clothing size and laser technology. The second major turning point for ISO was the development and implementation of the ISO 14000 Environmental Management Standard in 1993, this was a major step as it started to work with public policy and general public interest. The third major turning point for ISO was the development of standards that support sustainability (Morikawa *et al.* 2004). This standard was named ISO Horizon 2010: Standards for a Sustainable World. Six decades since its inception, ISO has grown into the world's largest standards development organization with well over 14,000 standards and 148 countries in the federation (Morikawa *et al.* 2004). In 2005, there was an international effort to attempt to standardize the food safety system worldwide. This effort resulted in ISO creating the ISO 22000 Food Safety Management System (FSMS) - requirements for any organization in the food chain.

1.4 Food Safety Management System ISO 22000

Food safety is linked with food-borne hazards present in food at the point of consumption. Since food safety hazards can occur at any stage in the food chain it is essential that adequate control measures be put in place to avoid or minimize food safety hazards (Popek, 2016). ISO 22000 is a standard developed by the International Organization for Standardization (ISO) as requirement for the food chain organization to enhance food safety. ISO 22000 international standard specifies the requirements for a food safety management system. It involves the elements of interactive communication, system management, pre-requisite programs and HACCP principles. According to ISO 22000 can be applied Fig 1.4 independently of other management system standards or integrated with existing management system requirements. This is accomplished by the flexibility of the design in the standard which enables an approach tailor-made for all segments of food safety in the food chain.



Fig.1.4: Concept of ISO 22000 (Popek, 2016)

1.5 Hazard Analysis Critical Control Points (HACCP)

1.5.1 Pre-requisite Programs

Pre-requisite programs are essential programs that are run on a facility wide basis, as opposed to concentrated on the food product and processing, which are essential for the safety of the food. The World Health Organization (WHO) describes pre-requisite programs as programs that are necessary before, during and after the implementation of a HACCP program. Federal agencies require that various programs that fall under pre-requisite programs are not only maintained by the food processing establishments, but that these programs are a source of data that requires inspection. The Food Safety Inspection Service (FSIS) directive 5000.2, and the Code of Federal Regulations, under Title 9 section 417.2 referring to the development and use of HACCP systems, requires that records relating to pre-requisite programs be maintained and reviewed (Corlett. 1998).

1.5.2 Good Manufacturing Practices (GMPs)

Good Manufacturing Practice is that part of Quality Assurance which ensures that products are consistently produced and controlled to the quality standards appropriate to their intended use and as required by the marketing authorization or product specification. All manufacturing processes are clearly defined, systematically reviewed in the light of experience and shown to be capable of consistently manufacturing products of the required quality and complying with their specifications and/or marketing authorization (Zschaler, R.1989).

1.5.3 HACCP is based on Preliminary and Seven Principles

Another critical element that must be emphasized at this point is management commitment. It is extremely important to have full commitment to the HACCP initiative from all levels of management at the establishment. Without this firm commitment, it may be difficult or impossible to implement the HACCP plan Fig 1.5. Commitment by top management to the HACCP system sends a strong message to all personnel that the food safety system is vitally important to the company.

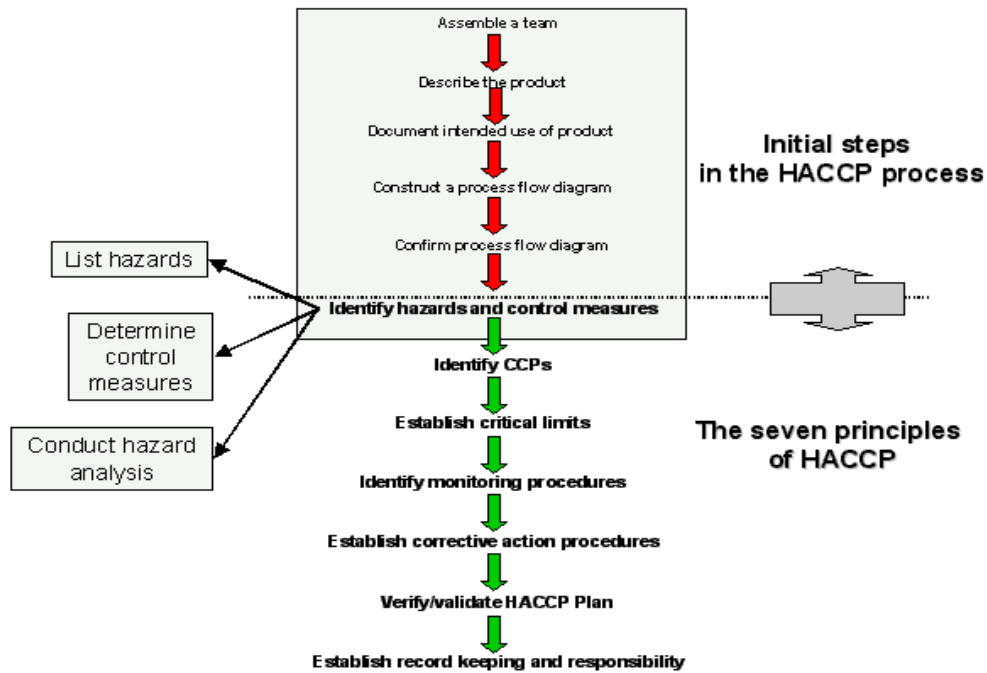


Fig 1.5: HACCP methodology (Tavolaro *et al.* 2012).

1.5.4 Benefits of HACCP system

- Increase customer and consumer confidence.
- Maintain or increase market access.
- Improve control of production process and quality.
- Reduce costs through reduction of product losses and rework
- Increase focus and ownership of food safety.
- Simplify inspections primarily because of the recordkeeping and documentation (ISO 22000), (Jervis *et al.* 2002).

1.6 Implementation of HACCP System

The CAC/RCP 1-1969 GENERAL PRINCIPLES OF FOOD HYGIENE was used as a basis which contains the requirements for a HACCP system for the development, implementation and effective management of a functional process hazard control program in the food and allied industries to enhance food safety Fig 1.6. The HACCP program was implemented within the framework of all the applicable laws, regulations and compulsory specifications Sudanese standards and metrology organization -SSMO, regulations relating to the application of the HACCP system (ISO 22000) and regulations governing general hygiene requirements for food (CAC/RCP1-1969).

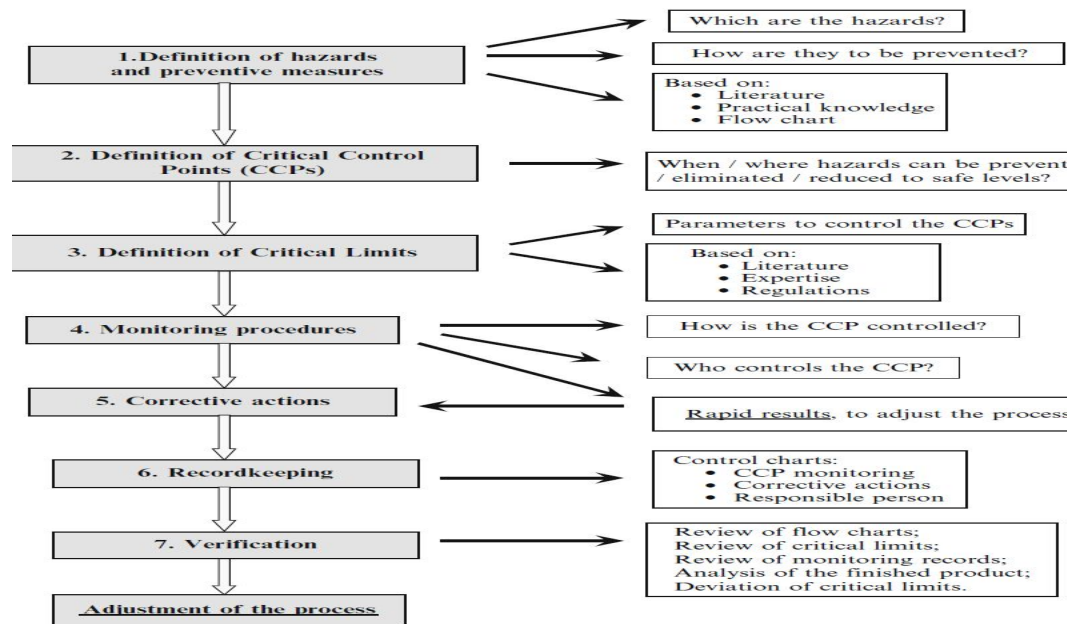


Fig. 1.6: HACCP principles and their application in the food industry (Jervis *et al.* 2002)

1.6.1 Packing lentils Process

The main processing steps involved added lentils to container and packing and storage. The most common risk is the presence of foreign objects (physical hazards). These physical hazards cause risks to the consumer as is known and also cause high productivity wastes. Therefore, the focus of these studies on the physical risks when implementation HACCP system (SSMO. 2015: 4897).

1.6.2 Gap Analysis

One of the first steps of (HACCP) implementation project in dry packing crops is to compare your current MS to the requirements of HACCP System. This is most commonly called a Gap Analysis. The most important tool for the Gap Analysis is the Audit Checklist. This is a list of the requirements in the code, written in question format. This list was used to compare current system with the requirements of HACCP System (ISO 22000:2005).

1.6.3 Preliminary Procedures

Management Commitment, Assembling the HACCP Team and Technical Training of the Personnel a basic requirement for the implementation of the HACCP system is related to the staff involved in the program, which should be aware of the characteristics of the system and of the necessary

commitment involved with it. The management of the company should be committed to the objectives of the plan and should be aware of the resources that have to be made available. The HACCP team, responsible for creating and implementing the plan, should be multidisciplinary and knowledgeable regarding production, engineering, health, microbiology, and quality assurance issues (Da Silva *et al.* 2017).

1.6.3.1 Assemble the HACCP Team

The team leader should have knowledge of the manufacturing process, leadership skills, and easy access to managers (Khandke. 1998 Tavolaro *et al.* 2012). The team should also include people involved in daily activities in the company, because they may contribute with information on particularities and limitations of the production process, and their presence may create a sense of commitment to the job Table 1.1. Employees should be previously trained in good manufacturing and handling practices, as well as in all aspects of HACCP. A continuing education program should be created to enable constant updating.

Table 1.1: HACCP Team

| No | Name | Title | Expertise | Location | Contact |
|----|------|-------------|-----------|----------|---------|
| 1 | | Team leader | | | |
| 2 | | Member | | | |

1.6.3.2 Description of the Food and its Distribution and Describe the Intended Use and Consumers of the Food

Description of the product creation and validation of the flowchart for the process Table 1.2. The HACCP team should know the food product in detail: microbiological and physical–chemical characteristics, ingredients and formula, packaging materials, specifications for storage and transportation, retail conditions, besides adequate handling procedures, shelf life and the type of consumer.

Table 1.2: Product description (Lintels)

| Product | Plant Name |
|---|---|
| Lintels | Dry Packing Crops |
| Formal product name | Lintels |
| Product description & food Safety Characteristic | Dry yellow or red seeds cropped from Lentils plants origin of <i>leguminous</i> family kind <i>Culinaris</i> complete seeds not germinate, smooth, and uniform size and color. Strictly free from added colors. |
| Packaging Used | Flex for protect the product and ready printed the code date is during the forming of the packages. |
| Ingredients | - |
| Product delivery method | <p>The product should transfer in covered trucks.</p> <ul style="list-style-type: none">▪ Cleaned, that would prevent and protect the seeds from losses, contamination, rodents, insect's infection, and climate changes condition.▪ Free from insecticides & pesticides traces, any pungent odor materials and toxic materials. |
| Storage and Distribution | Clean, dry, well vented, free from foreign smells, away from the chemicals, contaminates, and pesticides stores, at ambient Temperature for 24 months for plastic flex packed. |
| Intended Use | To be taken after Cooking for all ages. |
| Shelf life | 24 months from production date. |

1.6.3.3 Development of flow Diagram and Description of the Process and Verify

The flowchart Fig 1.7 described all the steps, identifying the equipment, and define working conditions. Flowcharts are the basis for the identification of hazards and preventive measures, and they should be periodically validated and adjusted, when necessary, to reflect the real processing conditions (Corlett *et al.* 1998).

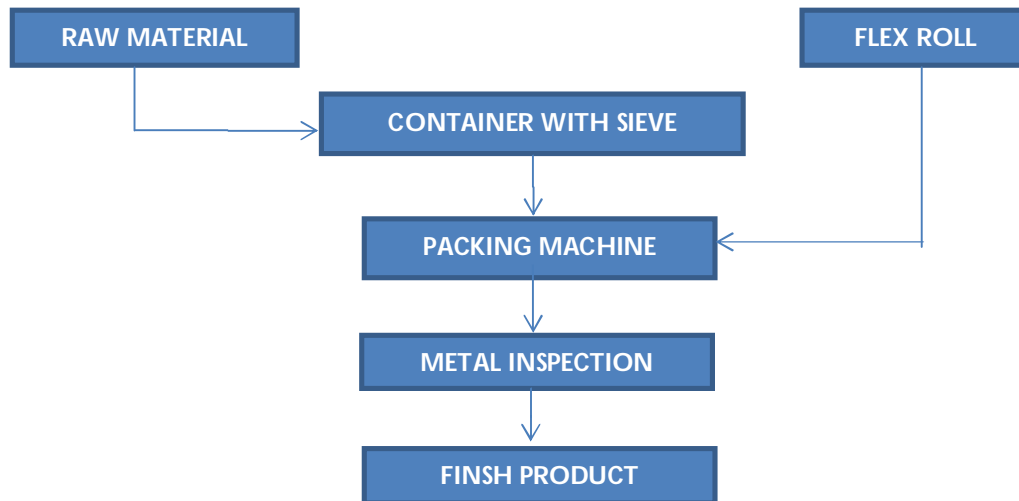


Fig 1.7: Macro flow diagram for lentils packing

1.6.4 Application of HACCP Principles

Principle 1 - Analysis of the Hazards and Definition of Preventive Measure

The possible physical, chemical, and microbiological contaminations (hazards) should be determined, as well as their respective preventive measures, based on specialized literature, on the knowledge of the raw material, and on the flowchart for the process. Although the HACCP system was originally developed to ensure food safety and protect the health of consumers, the definition of hazard is generally broader, considering not only factors that are harmless and of no consequence, but also those that cause “loss of quality and economic integrity of the product” and noncompliance Implementation of with standards defined by the manufacturer. This broader definition of “hazard,” however, may increase the complexity of HACCP, and create a greater number of critical control points (CCPs).

Principle 2 - Identification of the CCPs

Critical control points (CCPs) are the steps in the process where hazards may be eliminated, prevented, or reduced to acceptable levels are identified in the flowchart by using a decision tree, if necessary Fig 1.8.

Principle 3 - Definition of Critical Limits

CCP should have a critical limit defined in terms of time /temperature, pH, temperature, acidity, etc., in order to ensure the safety of the process. In some cases, safety limits should also be defined, in a way to prevent that critical limits are exceeded. Critical limits may be defined Fig 1.8 based on specialized literature, present regulations, or the practical expertise of the HACCP team (Tavolaro *et al.* 2012).

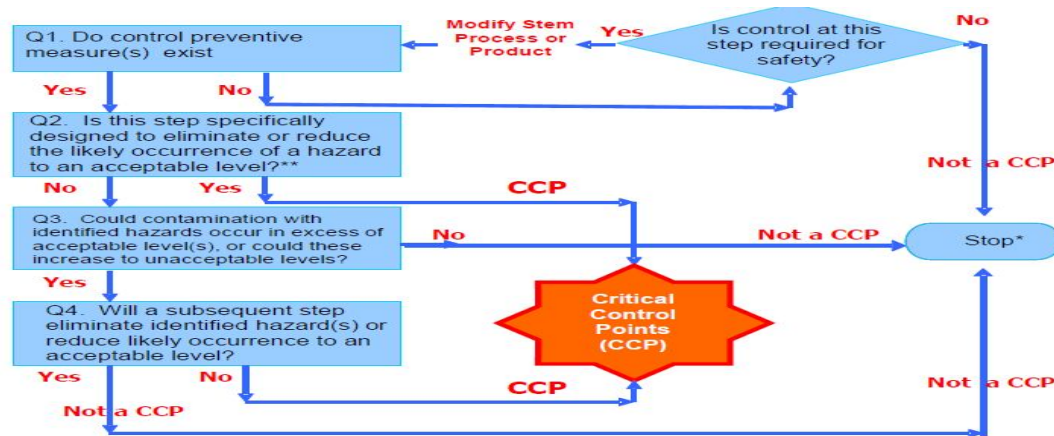


Fig 1.8: Decision Tree to Identify CCPs (CAC/RCP1-1969)

Principle 4- Definition of Monitoring Procedures

This step involves the definition of controls for each CCP, by means of visual observation, measurements, or laboratory analyses. The frequency, with which these controls should be conducted, as well as the person responsible for them, should also be defined. The choice of the monitoring procedure should take into account how easy and fast results are obtained to ensure that the process is adjusted without delay, and that the flow of the process is not affected. Inspection and calibration of the equipment used in CCP monitoring should receive special attention during this stage.

Principle 5- Definition of Corrective Actions

When monitoring shows that critical limits have been exceeded, previously determined corrective actions should be immediately put in place to control the CCP.

Principle 6 - Definition of Recordkeeping Procedures

All critical control point (CCP). Monitoring procedures should be recorded in control charts, which also have to show the necessary corrective actions. The recordkeeping system should, whenever possible, be integrated in the routine charts of the company to prevent the buildup of time-consuming forms to be completed. Only necessary changes should be made in the charts, such as fields for describing corrective actions and for the signature of the person responsible for the procedure (Mortimore, 2013).

Principle 7- Definition of Verification Procedures

Verification procedures should be performed periodically to assess whether the HACCP plan is working properly. The following methods of evaluation may be used: review of the flowchart for the process, review of the critical limits, review of CCP monitoring records, laboratory analyses of the finished product, and analysis of deviations in critical limits. Verification procedures enable adjustments in the HACCP plan, and may ensure the safety of the food.

1.6.5 Risk Assessment for Hazard Analysis

Even though it may be difficult to use a quantified matrix for biological or chemical hazards, it can be very useful for physical hazards. The severity and likelihood of physical hazards are easy to plot within a matrix and can be easily understood provided there is a solid definition for each rating given to the physical hazard in question.

1.6.5.1 Severity Rating Guidance

- **Minor:** Straw, vine, paper, cardboard, hair, congealed material (soft).
- **Medium:** Wood, soft plastic or rubber, insects, congealed material.
- **Major:** Metal, rock, glass, hard plastic, bones

1.6.5.3 Likelihood/Probability of Occurrence of Threat

- **Remote:** Chance of occurrence is less than once every 2 years
- **Possible:** Occurs at least once every year but less than once in 2 years
- **Potential:** Occurs at least once a month but less than 6 months
- **Likely:** Occurs at least twice a month or more often

1.6.5.4 Risk Level

Severity Rating × Likelihood/Probability

| | | | |
|--|------------------------|---|---|
| P R O B A B I L I T Y | 3 | 6 | 9 |
| | 2 | 4 | 6 |
| | 1 | 2 | 3 |
| | S E V E R I T Y | | |

Figure. 1.9: Risk Assessment

1.7 Evaluation of complaints between before and after implementation HACCP system:

Table 1.3: evaluation of complaints implementation between before and after HACCP system

| Months - 2016 | <u>Before</u> Implementation HACCP | | | Months - 2017 | <u>After</u> Implementation HACCP | | |
|---------------------|--|----|---|---------------------|---|---|---|
| | C | P | B | | C | P | B |
| Jan – 2016 | 0 | 2 | 3 | Jan – 2017 | 0 | 0 | 1 |
| Feb – 2016 | 0 | 3 | 0 | Feb – 2017 | 0 | 1 | 1 |
| Mar – 2016 | 0 | 3 | 1 | Mar - 2017 | 0 | 1 | 0 |
| Apr – 2016 | 0 | 1 | 1 | Apr - 2016 | 0 | 0 | 0 |
| May – 206 | 0 | 0 | 1 | May - 206 | 0 | 0 | 0 |
| Jun – 2016 | 0 | 2 | 0 | Jun - 2016 | 0 | 2 | 1 |
| Total Hazard | 0 | 11 | 6 | Total Hazard | 0 | 4 | 3 |

C = Chemical Hazard P = Physical Hazard B = Biological Hazard

- Before implementation HACCP system, the total number of complaints was 17, including eleventh complaints about physical hazard such as the

presence of stones, other impurities that come with lentils such as straw and the presence of metals resulting from the existence of parts of the packing machines or tools used by workers to open raw phones, etc. Within the final product. Sixth, other complaints were biological hazards, for example, the presence of pests within the final product.

- After implementation HACCP system, physical complaints decreased to only two where the following done:
 1. The sieves container has put into account the size of the aperture sieve to prevent the entry of stones or raw ossified or tools to open raw mobiles used by labors.
 2. The metal detectors, but not provided by the senior management, led to the existence of these complaints, representing one complaints of the four complaints.

CHAPTER TWO

MATERIALS & METHODS

2.1 Research Methodology

It involved such general activities as identifying problems, review of the literature, formulating hypotheses, procedure for testing hypotheses, measurement, and data collection analysis of data, interpreting results and drawing conclusions (Singh, 2006).

In this research descriptive method was used, using a questionnaire testing approach aim to examine impact of application ISO 22000:2005 on a food organization, this chapter illustrate the method of data collection, questionnaire and data analysis.

2.2 Research design

Research design is a choice of an investigator about the components of his project and development of certain components of the design. The selection of research components is done keeping in view of the objectives of the research. Research hypotheses also provide the basis for designing a research work (Singh, 2006).

2.3 Study area

This study conducted in Khartoum –Sudan in a company that has HACCP implementation.

Company area: Khartoum

Industry: Dry Packing Crops

Main products: Lentils

2.4 Study population

The study targets only the departments of marketing, production, quality control, supply chain and maintenance.

2.5 Sampling

The sample was selected by using random sampling technique to select 30 samples.

2.6 Data collection

The rating scale involved qualitative description of a limited number of aspects of a thing or traits of a person. When using rating scales (or categorical scales), and judged an object in absolute terms against some specified criteria (kothari, 2004).

The questionnaire was used 5 point of likert scale (strongly disagree, disagree, neutral, agree, and strongly agree).

Scaling described the procedures of assigning numbers to various degrees of opinions, attitude and other concepts (Kothari, 2004).

2.7 Data analysis

Inferential analysis was concerned with the various tests of significance for testing hypotheses in order to determine with what validity data can be said to indicate some conclusion or conclusions. It was concerned with the estimation of population values. It was mainly on the basis of inferential analysis that the task of interpretation is performed (Kothari, 2004).

SPSS software was used to analyze data.

CHAPTER THREE

RESULTS

3.1 Descriptive of the Variables Study

3.1.1 General information:

In table, 3:1 most of the individuals study was males 23/76.7% while the number of females was few 7/23.3%. Qualification of most individuals study were DP 6/20%, BSc 20/66.7% and HS 4/13.3%. Years of experience were 5 years and less 12/40%, 6-10 years 16/53.3% and 11 years and above 2/6.7%. About the individuals 13/43.3% were knowledge HACCP [Table 3.1].

Table 3:1 Demographic characteristics of the individuals of the study, n=30

| Characteristics | Frequency | Percentage |
|----------------------------|-----------|------------|
| Gander | | |
| Male | 23 | 76.7% |
| Female | 7 | 23.3% |
| Total | 30 | 100% |
| Qualification | | |
| DP | 6 | 20% |
| BSc | 20 | 66.7% |
| HS | 4 | 13.3% |
| Total | 30 | 100% |
| Years of experience | | |
| 5 years and less | 12 | 40% |
| 6 – 10 years | 16 | 53.3% |

| | | |
|-----------------------------------|----|-------|
| 11 years and above | 2 | 6.7% |
| Total | 30 | 100% |
| How well do you know HACCP | | |
| Very awareness | 6 | 20% |
| Awareness | 11 | 36.7% |
| To some extent | 13 | 43.3% |
| Total | 30 | 100% |

3.2 Test questionnaire: The questionnaire came out with:

3.2.1 Role of HACCP System on the management system

The value of chi-square in first axis 79.0%, with (P-value =0.000 < 0.05), this indicated that there was significant differences at the level 5% between answers of study individuals and in favor of agree. Has been achieved and in favor of agree.

Table 3.2: Frequency distribution of the first axis phrases Answers, n=30:

| No. | Phrases | Frequency and percentages% | | | | |
|-----|---|----------------------------|-------------|-------------|-----------|-------------------|
| | | Strongly agree | Agree | Some what | Dis agree | Strongly disagree |
| 1 | Top management supports the implementation of HACCP. | 8 26.7% | 12 40% | 9 30% | 1 3.3% | 0 0.0% |
| 2 | Application of global systems such as HACCP supports enterprise management and works on continuous improvement. | 12 40% | 6 20% | 10 33.3% | 2 6.7% | 0 0.0% |
| 3 | Top management encourages opinions, suggestions and ideas. | 5 16.7% | 13 43.3% | 12 40% | 0 0.0% | 0 0.0% |
| 4 | Management regularly reviews the HACCP. | 1 3.3% | 11 36.7% | 17 56.7% | 1 3.3% | 0 0.0% |

| | | | | | | |
|----|---|-------------|-------------|-------------|-------------|-----------|
| 5 | The concept of HACCP is published within the organization. | 7 23.3% | 5 16.7% | 18 60% | 0 0.0% | 0 0.0% |
| 6 | Management is working to improve the HACCP system through internal and external audits. | 3 10% | 6 20% | 16 53.3% | 5 16.7% | 0 0.0% |
| 7 | Management reviews clients' opinions. | 4 13.3% | 6 20% | 19 63.3% | 1 3.3% | 0 0.0% |
| 8 | Meeting the requirements of HACCP means increasing costs to the institution. | 6 20% | 5 16.7% | 9 30% | 10 33.3% | 0 0.0% |
| 9 | The application of HACCP to profit is the result of the organization | 9 30% | 11 36.7% | 8 26.7% | 2 6.7% | 0 0.0% |
| 10 | Management adopts the concept of continuous improvement. | 7 23.3% | 10 33.3% | 13 43.3% | 0 0.0% | 0 0.0% |
| 11 | The implementation of HACCP leads to the consolidation of the relationship with suppliers and stakeholders. | 10 33.3% | 9 30% | 7 23.3% | 4 13.3% | 0 0.0% |

3.2.2 Role of HACCP System on employee – Training

The value of chi-square in second axis 101.5%, with (P-value =0.001 < 0.05, this indicated that there was significant differences at the level 5% between answers of study individuals and in favor of somewhat. Has been achieved and in favor of somewhat.

Table3.3: Frequency distribution of the second axis phrases Answers, n=30:

| No. | Phrases | Frequency and percentages% | | | | |
|-----|--|----------------------------|------------|------------|-------------|-------------------|
| | | Strongly agree | Agree | Some what | Dis agree | Strongly disagree |
| 12 | Top management conducts awareness sessions on the importance of applying HACCP to all employees. | 5 16.7% | 4 13.3% | 18 60% | 2 6.7% | 1 3.3% |
| 13 | The application of HACCP means increased working pressure. | 5 16.7% | 4 13.3% | 8 26.7% | 11 36.7% | 2 6.7% |

| | | | | | | |
|----|---|------------|-------------|-------------|------------|-----------|
| 14 | New employees and individuals are trained. | 7 23.3% | 7 23.3% | 15 50% | 1 3.3% | 0 0.0% |
| 15 | There is a clear and written job description for all employees. | 5 16.7% | 11 36.7% | 10 33.3% | 4 13.3% | 0 0.0% |
| 16 | All employees participate in the improvement and development of the system. | 5 16.7% | 6 20% | 16 53.3% | 2 6.7% | 1 3.3% |
| 17 | Direct communication between managers and staff is easy. | 3 10% | 8 26.7% | 13 43.3% | 4 13.3% | 2 6.7% |
| 18 | All employees follow the food safety policy to keep the product safe. | 9 30% | 7 23.3% | 9 30% | 4 13.3% | 1 3.3% |
| 19 | All workers in the production areas maintain safety equipment's. | 5 16.7% | 7 23.3% | 13 43.3% | 5 16.7% | 0 0.0% |

3.2.3 Role of HACCP System on production process

The value of chi-square in third axis 82.9%, with (P-value =0.000 < 0.05), this indicated that there was significant differences at the level 5% between answers of study individuals and in favor of agree. Has been achieved and in favor of agree.

Table 3.4: Frequency distribution of the third axis phrases Answers, n=30:

| No. | Phrases | Frequency and percentages% | | | | |
|-----|--|----------------------------|-------------|-------------|-----------|-------------------|
| | | Strongly agree | Agree | Some what | Dis agree | Strongly disagree |
| 20 | HACCP system provides the enterprise with the overall framework of the manufacturing process. | 0 0.0% | 14 46.7% | 14 46.7% | 2 6.7% | 0 0.0% |
| 21 | Production processes are accurately described at all stages. | 5 16.7% | 12 40% | 11 36.7% | 2 6.7% | 0 0.0% |
| 22 | Implementing HACCP system reduces pollution of the product during manufacturing and thus leads to a safe | 13 43.3% | 11 36.7% | 5 16.7% | 1 3.3% | 0 0.0% |

| | | | | | | |
|----|--|------------|-------------|-------------|------------|-----------|
| | product. | | | | | |
| 23 | The implementation of HACCP improves the process of manufacturing and monitoring methods | 7 23.3% | 11 36.7% | 9 30% | 3 10% | 0 0.0% |
| 24 | HACCP and HACCP reduce waste. | 5 16.7% | 5 16.7% | 11 36.7% | 7 23.3% | 2 6.7% |
| 25 | Suppliers are selected and evaluated on specific basis by an organization. | 5 16.7% | 8 26.7% | 15 50% | 2 6.7% | 0 0.0% |

3.2.4 Role of HACCP system on product quality

The value of chi-square in fourth axis 37.5% 3.5, with (P-value =0.000 < 0.05), this indicates that there was significant differences at the level 5% between answers of study individuals and in favor of agree. Has been achieved and in favor of agree.

Table 3.5: Frequency distribution of the fourth axis phrases Answers n=30:

| No. | Phrases | Frequency and percentages% | | | | |
|-----|--|----------------------------|-------------|-------------|------------|-------------------|
| | | Strongly agree | Agree | Some what | Dis agree | Strongly disagree |
| 26 | Product quality is developed periodically according to the needs of customers. | 5 16.7% | 13 43.3% | 11 36.7% | 1 3.3% | 0 0.0% |
| 27 | Product quality specifications are clearly defined. | 8 26.7% | 8 26.7% | 12 40% | 2 6.7% | 0 0.0% |
| 28 | HACCP system helps in product quality. | 13 43.3% | 5 16.7% | 8 26.7% | 4 13.3% | 0 0.0% |
| 29 | There are labs for analysis required. | 16 53.3% | 11 36.7% | 2 6.7% | 1 3.3% | 0 0.0% |
| 30 | All measuring instruments are calibrated periodically. | 10 33.3% | 11 36.7% | 8 26.7% | 1 3.3% | 0 0.0% |

| | | | | | | |
|----|--|----------|-------------|-------------|-----------|-----------|
| 31 | Raw materials that affect product quality are examined and analyzed. | 9 30% | 10 33.3% | 10 33.3% | 1 3.3% | 0 0.0% |
|----|--|----------|-------------|-------------|-----------|-----------|

3.2.5 Internal and external environment

The value of chi-square in fifth axis 30.7% and this concentrated in the manufacturing environment [Table 3.6], (P-value =0.000 < 0.05), this indicates that there is significant differences at the level 5% between answers of study individuals and in favor of agree. Has been achieved and in favor of agree.

Table 3.6: Frequency distribution of the fifth axis phrases Answers [n=30]:

| No. | Phrases | Frequency and percentages% | | | | |
|-----|--|----------------------------|-------------|-------------|-----------|-------------------|
| | | Strongly agree | Agree | Some what | Dis agree | Strongly disagree |
| 32 | The manufacturing environment meets the HACCP requirements. | 4 13.3% | 14 46.7% | 10 33.3% | 2 6.7% | 0 0.0% |
| 33 | Environment is maintained clean and sterile. | 3 10% | 10 33.3% | 14 46.7% | 3 10% | 0 0.0% |
| 34 | Location is convenient. | 8 26.7% | 11 36.7% | 10 33.3% | 1 3.3% | 0 0.0% |
| 35 | Is disposed waste by scientific methods | 6 20% | 11 36.7% | 10 33.3% | 3 10% | 0 0.0% |
| 36 | Existence of a specialized an organization to pest controls. | 10 33.3% | 12 40% | 8 26.7% | 0 0.0% | 0 0.0% |

CHAPTER FOUR

DISCUSSION

From the questionnaire analysis the results based on the values of Chi-square study with role of HACCP system on the management system to standards mentioned by Gerundino (2014) in Juhayna food industry that implementing this system increase annual revenue and continuous improvement.

Individuals of this study agreed that Role of HACCP System on employee – Training have positive impact of personnel in HACCP principles and applications is essential. Employees must understand what HACCP is, learn the skills necessary to make it function properly, and must be given the materials and equipment necessary to control the CCPs agreed with (Dahiya *et al*, 2009).

Individuals of this study agreed that Roll of HACCP System on production process have positive impact and this agreed with Gerundino (2014) enhance performance and reduce cost of rework also agreed with Deming (2000) approach improve quality to increase productivity.

In our study there was positive Impact in product quality and this results in agreement with Nyakiokibe and Wanjaw (2014) mentioned that safety is one of the product quality aspects and also this finding similar to finding of Jaiswal (2009) ISO 22000 help organization to provide consistently safe end product.

The same positive impact was seen in this study agreed that Internal and external environment (Clute. M. 2008).

HACCP system it is an important standard for any organizations work in food production to assure that they produced safe food.

In Sudan there are many organizations implement food safety management system (included HACCP system) that's indicated the awareness of organizations and customers to the significant of food safety and it is impact on both business growth and customer health.

Conclusion and Recommendation

Conclusion

This study concluded that implementation of HACCP system have positive impact on the management system, increase annual revenue and continuous improvement. Positive impact on employee –training learn the skills necessary to make it function properly and must be given the materials and equipment necessary to control the CCPs. Also positive impact on production process where management based on the optimum distribution of resource, positive impact on customer satisfaction and retention by increasing customer confidence and reduce compliance, positive impact on internal process by reducing waste and enhance performance and positive impact on product quality by improving safety and the end product quality.

Recommendation

- The full commitment from organization is required to ensure the effectiveness and efficiently of the implementation HACCP system.
- Provide training on a continuous and sufficient basis. Therefore, top management must be committed to applying the HACCP system and work to raise awareness.
- Increase the awareness on food safety and make it a culture and life style in Sudan.
- Government regulations must be strict in food safety to push organizations to adopt ISO 22000:2005 as general and HACCP system certainly to ensure food safety.
- Commitment and direct involvement from top management is crucial to ensure the success of HACCP system based approach requires the synergistic interaction between all.

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APPENDIXES I

1- Figure (1): Gender

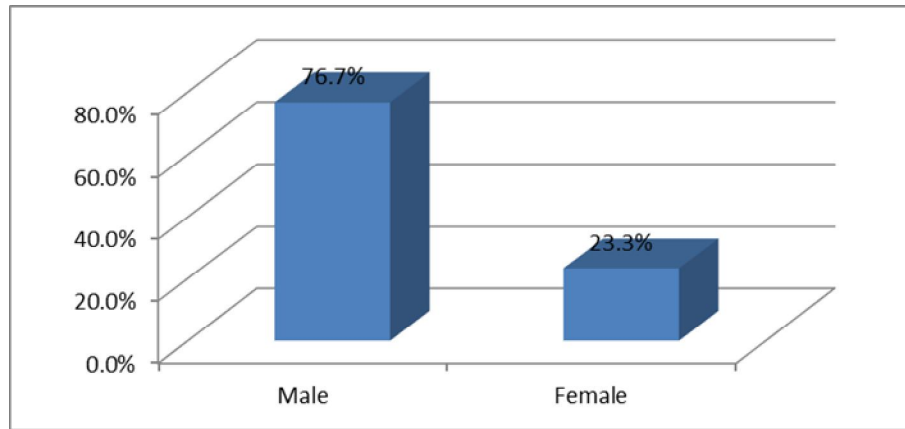


Figure (2): Age

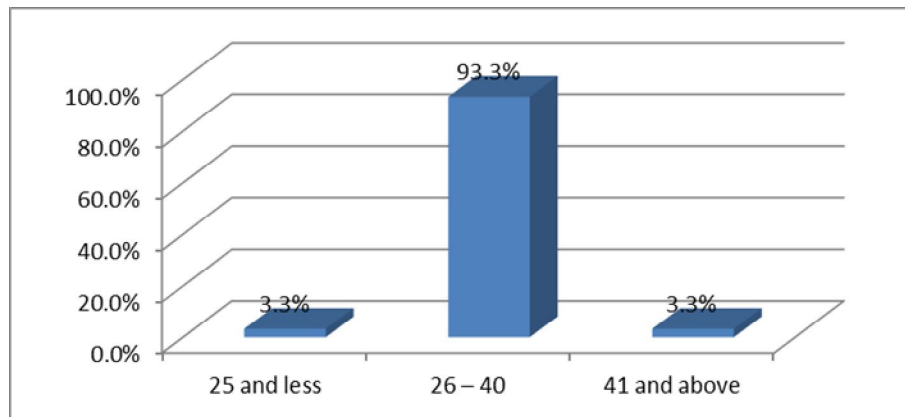


Figure (3): Qualification

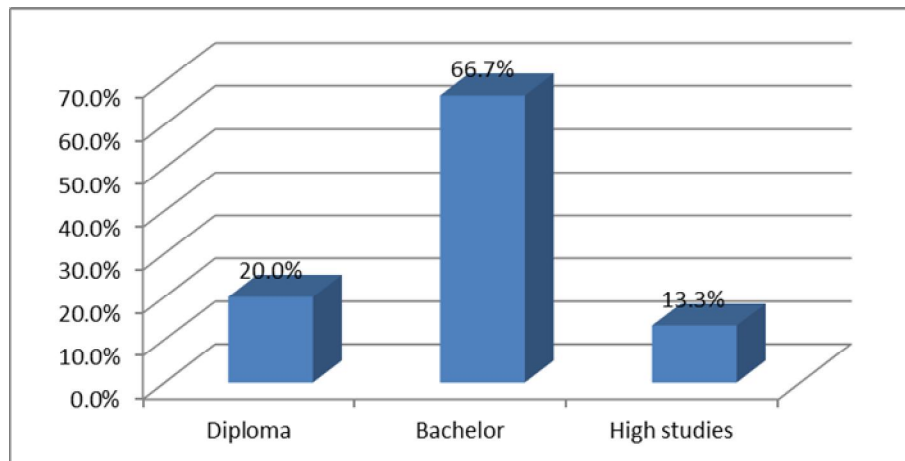


Figure (4): Position

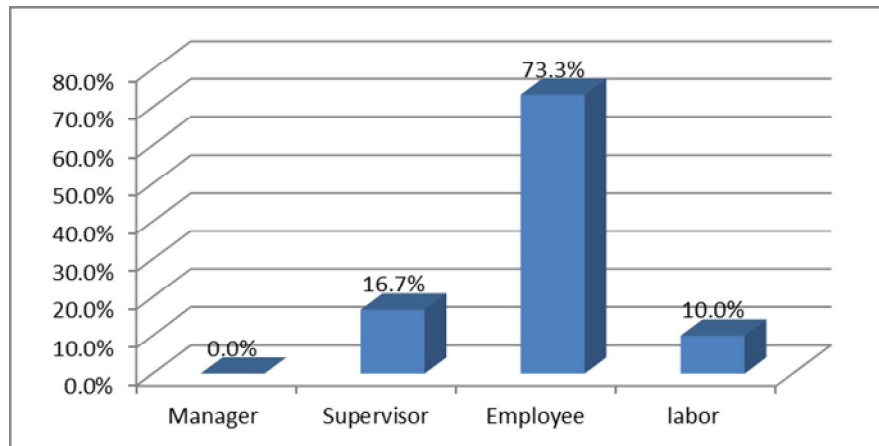


Figure (5): Years of experience

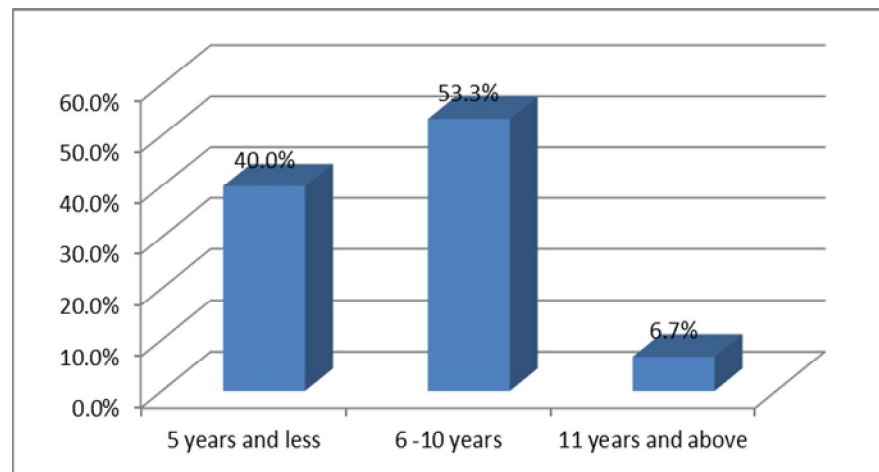
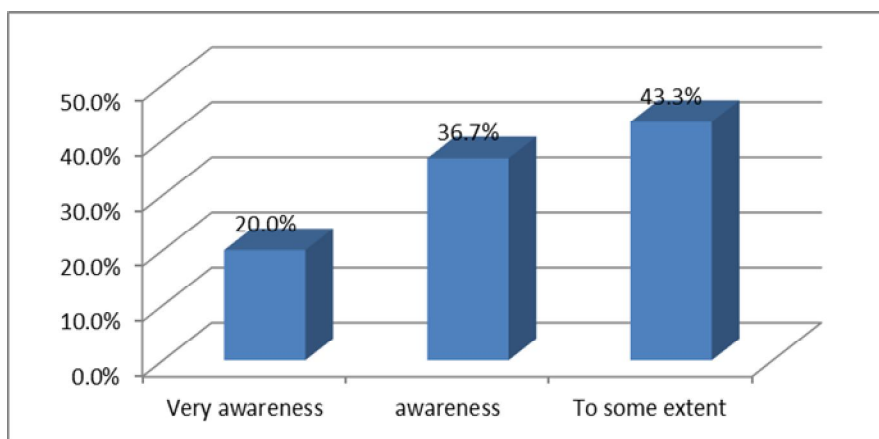


Figure (6): How well do you know HACCP



Reliability and Validity:

Stability means that measure give the same results if used more than once under similar conditions.

Reliability is defined as the extent to which a questionnaire, test, observation or any measurement procedure produces the same results on repeated trials.

Validity is defined as the extent to which the instrument measures what it purports to measure. And calculate in many ways represents the easiest being the square root of the reliability coefficient

$$\text{Validity} = \sqrt{\text{Reliability}}$$

Researcher calculates the reliability coefficient of the scale used in the questionnaire by alpha equation and the results as follows:

Table (7): Reliability and Validity:

| Reliability coefficient | Validity coefficient |
|--------------------------------|-----------------------------|
| 0.87 | 0.93 |

Source: prepared by researcher, using SPSS, 2017

Notes from the results table (7) that all reliability and validity coefficients for questionnaire is greater than (50%) and close to the one, This indicates that the questionnaire is characterized by high reliability and validity, and makes statistical analysis acceptable.

Role of HACCP System on the management system

Chi-square test results:

| No | Phrases | Chi-square value | P-value | Median | Trend |
|------|---|------------------|---------|--------|-----------|
| 1 | Top management supports the implementation of HACCP. | 8.7 | 0.034 | 4 | Agree |
| 2 | Application of global systems such as HACCP supports enterprise management and works on continuous improvement. | 7.9 | 0.049 | 4 | Agree |
| 3 | Top management encourages opinions, suggestions and ideas. | 3.8 | 0.150 | - | - |
| 4 | Management regularly reviews the HACCP. | 24.9 | 0.000 | 3 | Some what |
| 5 | The concept of HACCP is published within the organization. | 9.8 | 0.007 | 3 | Some what |
| 6 | Management is working to improve the HACCP system through internal and external audits. | 13.5 | 0.004 | 3 | Some what |
| 7 | Management reviews clients' opinions. | 25.2 | 0.000 | 3 | Some what |
| 8 | Meeting the requirements of HACCP means increasing costs to the institution. | 2.3 | 0.519 | - | - |
| 9 | The application of HACCP to profit is the result of the organization | 6.0 | 0.112 | - | - |
| 10 | Management adopts the concept of continuous improvement. | 1.8 | 0.407 | - | - |
| 11 | The implementation of HACCP leads to the consolidation of the relationship with suppliers and stakeholders. | 2.8 | 0.423 | - | - |
| Axis | | 79.0 | 0.000 | 4 | Agree |

Role of HACCP System on employee – Training

Chi-square test results:

| No | Phrases | Chi-square value | P-value | Median | Trend |
|------|--|------------------|---------|--------|-----------|
| 12 | Top management conducts awareness sessions on the importance of applying HACCP to all employees. | 31.7 | 0.000 | 3 | Some what |
| 13 | The application of HACCP means increased working pressure. | 8.3 | 0.080 | - | - |
| 14 | New employees and individuals are trained. | 13.2 | 0.004 | 3 | Some what |
| 15 | There is a clear and written job description for all employees. | 4.9 | 0.177 | - | - |
| 16 | All employees participate in the improvement and development of the system. | 23.7 | 0.000 | 3 | Some what |
| 17 | Direct communication between managers and staff is easy. | 13.7 | 0.008 | 3 | Some what |
| 18 | All employees follow the food safety policy to keep the product safe. | 8.0 | 0.092 | - | - |
| 19 | All workers in the production areas maintain safety equipment's. | 5.7 | 0.125 | - | - |
| Axis | | 101.5 | 0.001 | 3 | Some what |

Roll of HACCP System on production process

Chi-square test results:

| No | Phrases | Chi-square value | P-value | Median | Trend |
|----|---|------------------|---------|--------|-----------|
| 20 | HACCP system provides the enterprise with the overall framework of the manufacturing process. | 9.6 | 0.008 | 3 | Some what |

| | | | | | |
|------|---|------|-------|---|-----------|
| 21 | Production processes are accurately described at all stages. | 9.2 | 0.027 | 4 | Agree |
| 22 | Implementing HACCP system reduces pollution of the product during manufacturing and thus leads to a safe product. | 12.1 | 0.007 | 4 | agree |
| 23 | The implementation of HACCP improves the process of manufacturing and monitoring methods | 4.7 | 0.198 | - | - |
| 24 | HACCP and HACCP reduce waste. | 7.3 | 0.119 | - | - |
| 25 | Suppliers are selected and evaluated on specific basis by an organization. | 12.4 | 0.006 | 3 | Some what |
| Axis | | 82.9 | 0.000 | 4 | agree |

Roll of HACCP system on product quality

Chi-square test results:

| No | Phrases | Chi-square value | P-value | Median | Trend |
|------|--|------------------|---------|--------|----------------|
| 26 | Product quality is developed periodically according to the needs of customers. | 12.1 | 0.007 | 4 | Agree |
| 27 | Product quality specifications are clearly defined. | 6.8 | 0.079 | - | - |
| 28 | HACCP system helps in product quality. | 6.5 | 0.088 | - | - |
| 29 | There are labs for analysis required. | 20.9 | 0.000 | 5 | Strongly agree |
| 30 | All measuring instruments are calibrated periodically. | 8.1 | 0.043 | 4 | Agree |
| 31 | Raw materials that affect product quality are examined and analyzed. | 7.6 | 0.055 | - | - |
| Axis | | 37.5 | 0.000 | 4 | Agree |

Internal and external environment

Chi-square test results:

| No | Phrases | Chi-square value | P-value | Median | Trend |
|------|--|------------------|---------|--------|-----------|
| 32 | The manufacturing environment meets the HACCP requirements. | 12.1 | 0.007 | 4 | agree |
| 33 | Environment is maintained clean and sterile. | 11.9 | 0.008 | 3 | Some what |
| 34 | Location is convenient. | 8.1 | 0.043 | 4 | agree |
| 35 | Is disposed waste by scientific methods | 5.5 | 0.141 | - | - |
| 36 | Existence of a specialized an organization to pest controls. | 0.80 | 0.670 | - | - |
| Axis | | 30.7 | 0.000 | 4 | Agree |

HACCP PLAN

| CCP# | Process Step | Hazard Type | Critical Limits | | Monitoring | | | | | Corrective Action | | Verifier | Record |
|--|--------------------------|--|---------------------------------------|----|-----------------------------|--------------------------|--------------------------------|--|---|---|---|---------------|--------------------------------------|
| | | | OL | CL | What | Where | How | When | Who | How | Responsibility | | |
| PL.PK CCP 02 | Pluses Container Sieving | Physical Hazard Presence of Foreign Matters | Free from Presence of Foreign Matters | | Presence of Foreign Matters | Pluses Container Sieving | Visual Check As Production SOP | During Bags Preparation For Adding & During Adding | Pluses Adding labor Machine Operator QC Technician Production Supervisors QC Chemists | Review the visual inspection Procedure Steal less Sieves Checking & Cleaning | QC Manager Production Supervisor Production Manager | QA Department | Production and Quality Daily Records |
| OL = Operation Limits / CL = Critical Limits | | | | | | | | | | | | | |

| CCP# | Process Step | Hazard Type | Critical Limits | | Monitoring | | | | | Corrective Action | | Verifier | Record |
|--|----------------|---|------------------------|----|--------------------------|-----------------------|----------------|----------------|--|-----------------------------|---|---------------|--------------------------------------|
| | | | OL | CL | What | Where | How | When | Who | How | Responsibility | | |
| PL.PK CCP 03 | Metal Detector | Physical Hazard Presence of metal pieces | Free from metal pieces | | Presence of metal pieces | Pluses Metal Detector | Metal Detector | During Packing | Machine Operator QC Technician Production Supervisors QC Chemists | Maintain the metal detector | Production Manager Maintenance Manager | QA Department | Production and Quality Daily Records |
| OL = Operation Limits / CL = Critical Limits | | | | | | | | | | | | | |

APPENDIXES II

Questionnaire

Sudan University of Science and Technology
College of Graduate Studies
Deanship of Development and Quality
Master of Total Quality Management and Excellence
A questionnaire for scientific research

Dear Sir / Madam

After Greetings

I put in your hands a questionnaire for the purposes of scientific research on the topic "**Evaluate of Hazard Analysis Critical Control Point (HACCP System) Implementation in Packing Dry Crops**".

I would appreciate your cooperation and cooperation in answering all the statements in the questionnaire. I confirm that the information collected through your answers will be kept confidential and used for scientific research. I hope your cooperation and answer these questions objectively.

Personal data:

- **Gender:** Male Female

- **Age:** 25 and less 25-40 41 and above

- **Qualification:** Diploma Bachelor Higher Studies

- **Position:** Manager Supervisor Employee Labor

- **Years of experience:**

5years and less 5-10 years 11 years and above

- **How well do you know HACCP:**

Very awareness Awareness To some extent

| NO | Statement | S. Agree | Agree | Some what | Dis Agree | S. Disagree |
|---|---|-------------|-------|--------------|--------------|----------------|
| ▪ Role of HACCP System on the management system: | | | | | | |
| 1 | Top management supports the implementation of HACCP. | | | | | |
| 2 | Application of global systems such as HACCP supports enterprise management and works on continuous improvement. | | | | | |
| 3 | Top management encourages opinions, suggestions and ideas. | | | | | |
| 4 | Management regularly reviews the HACCP. | | | | | |
| 5 | The concept of HACCP is published within the organization. | | | | | |
| 6 | Management is working to improve the HACCP system through internal and external audits. | | | | | |
| 7 | Management reviews clients' opinions. | | | | | |
| 8 | Meeting the requirements of HACCP means increasing costs to the institution. | | | | | |
| 9 | The application of HACCP to profit is the result of the organization | | | | | |
| 10 | Management adopts the concept of continuous improvement. | | | | | |
| 11 | The implementation of HACCP leads to the consolidation of the relationship with suppliers and stakeholders. | | | | | |

| No | Statement | S. Agree | Agree | Some what | Dis Agree | S. Disagree |
|---|---|----------|-------|-----------|-----------|-------------|
| ▪ Role of HACCP System on employee – Training: | | | | | | |
| 1 | Top management conducts awareness sessions on the importance of applying HACCP to all employees. | | | | | |
| 2 | The application of HACCP means increased working pressure. | | | | | |
| 3 | New employees and individuals are trained. | | | | | |
| 4 | There is a clear and written job description for all employees. | | | | | |
| 5 | All employees participate in the improvement and development of the system. | | | | | |
| 6 | Direct communication between managers and staff is easy. | | | | | |
| 7 | All employees follow the food safety policy to keep the product safe. | | | | | |
| 8 | All workers in the production areas maintain safety equipment's. | | | | | |
| ▪ Roll of HACCP System on production process: | | | | | | |
| 1 | HACCP system provides the enterprise with the overall framework of the manufacturing process. | | | | | |
| 2 | Production processes are accurately described at all stages. | | | | | |
| 3 | Implementing HACCP system reduces pollution of the product during manufacturing and thus leads to a safe product. | | | | | |
| 4 | The implementation of HACCP improves process of manufacturing, monitoring methods and reduce waste. | | | | | |
| 6 | Suppliers are selected and evaluated on specific basis by an organization. | | | | | |

| ▪ Roll of HACCP system on product quality: | | | | | | |
|---|--|--|--|--|--|--|
| 1 | Product quality is developed periodically according to the needs of customers. | | | | | |
| 2 | Product quality specifications are clearly defined. | | | | | |
| 3 | HACCP system helps in product quality. | | | | | |
| 4 | There are labs for analysis required. | | | | | |
| 5 | All measuring instruments are calibrated periodically. | | | | | |
| 6 | Raw materials that affect product quality are examined and analyzed. | | | | | |
| ▪ Internal and external environment: | | | | | | |
| 1 | The manufacturing environment meets the HACCP requirements. | | | | | |
| 2 | Environment is maintained clean and sterile. | | | | | |
| 3 | Location is convenient. | | | | | |
| 4 | Is disposed waste by scientific methods. | | | | | |
| 5 | Existence of a specialized an organization to pest controls. | | | | | |

- S. Agree = strongly agree
- Somewhat = Somewhat agree
- S. Disagree = strongly disagree