



Sudan University for Science and Technology

*College of Graduate Studies*

*Total Quality & Excellence Center*

# **The role of implementation food safety Management system on dairy products**

Thesis submitted in partial fulfillment of the  
Requirements for the MSc. in Total Quality  
Management & Excellence

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February 2019

# Dedication

This simple effort dedicated to my  
parents with all my love.

# ACKNOWLEDGMENT

- All thanks to Allah for giving me health and power to reach this point and complete this research and for all his other grants.
- Thanks for those who helped, supported and encouraged me in preparing this thesis.
- I would like to thank everyone added knowledge to the quality field all over the world 'thank you'

## **Abstract**

The objective of this research is to evaluate the role of implementing food safety management systems (FSMS) on the quality of dairy products, this study consists of two parts; part one questionnaire was built to show the impact of implementing FSMS on customer satisfaction, internal processes and marketing. In part two 10 yoghurt samples from two dairy companies were taken for analysis to study the effect of FSMS on the physicochemical and microbiological quality of yoghurt. Descriptive and SPSS statistical software were used for analysis of data. The results showed that the Food safety management system application increases customer satisfaction and improves the internal processes and marketing also the FSMS application had a great effect on the quality of yoghurt the company practicing the FSMS the quality of its yoghurt positively improved while the one that did not apply the FSMS the quality of its yoghurt is of lower quality.

## مستخلص الدراسة

الغرض من هذه الدراسة هو تقييم تطبيق نظام ادارة سلامة الاغذية علي جودة منتجات الالبان, قياس تأثير تطبيق نظام ادارة سلامة الاغذية علي رضا العملاء و علي العمليات الداخلية و علي التسويق.

تشمل هذه الدراسة جزئين: الجزء الاول فيه تم تصميم استبيان لمعرفة دور تطبيق نظام ادارة سلامة الاغذية علي منتجات الالبان وفي الجزء الثاني تم أخذ عينات زبادة من شركتي البان أ و ب للتحليل لمعرفة أثر تطبيق نظام ادارة سلامة الاغذية علي الخواص الفيزيوكيميائية والميكروبيولوجية لعينات الزبادة في شركتي الالبان تم استخدام التحليل الوصفي وكذلك استخدام برنامج SPSS في تحليل البيانات. أوضحت نتائج الدراسة ان تطبيق نظام إدارة سلامة الاغذية زاد من رضا المستهلكين وحسن العمليات الداخلية والتسويق بينما تطبيقه ايضا عمل علي تحسين صفات الجودة للزبادة وكانت جودة الزبادة في الشركة التي لم تطبقه اقل.

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# CHAPTER ONE

## **Introduction**

Dairy products are considered to be amongst the most nutritionally complete foods they are major components of the human diet, providing about 30% of dietary proteins and lipids and about 80% of dietary calcium.

Unfortunately, this characteristic also makes them highly susceptible to bacterial contamination that can lead to outbreaks of food borne disease. Since modern dairy plants are capable of processing large volumes of products, outbreaks can potentially affect large sectors of the population.

Milk quality is all about prevention on each step of production. Quality control systems aimed the prevention of defects, rather than their detection. Quality control occurs at every step in the production, as a raw material on farm condition. Consumers, processors and regulatory agencies are increasingly interested in the safety and wholesomeness of milk resulting in increased emphasis on the farm management to insure the production of milk quality (Noordhuizen and Metz 2005).

The consumer demands safe and wholesome dairy products that can be purchased without any doubt. For raw milk the term quality is extremely comprehensive. There is a quality pyramid based for dairy products based on these kinds of perimeters. In summary, firstly the basic foundation of this pyramid is about the safety of these products, the second is the nutritional value and thirdly there must be the service to satisfy consumers for the long term. Some of the most important quality aspects are quality of content and



physical-chemical condition, hygiene quality (bacteriological and cytological traits, absence of pathogens and other contaminants), sensorial quality, nutritional quality and technological quality (processing ability) (Karakok 2007).

Food producers are responsible for the safety of the products, and to guarantee food safety of dairy products, the dairy industry has implemented hazard analysis of critical control points (HACCP) systems. This enables quality assurance of final products via a chain management approach (European Commission, 2004).

For the dairy plant manager, the HACCP program simplifies dairy product safety by identifying the critical operations and providing effective and efficient methods for monitoring and controlling them. The final outcome is the highest assurance of food safety.

### **Research problem**

Implementing food safety management system has so many benefits on companies and customers, so the problem of this research is measuring the role of implementation food safety management on dairy industry.

### **Importance of the study**

The importance of this study is that it measuring the impact of implementation food safety management system on dairy industry and the customer of these products

## **Research objectives**

The main objectives of this study are:

1. To evaluate the role of implementing FSMS on dairy product.
2. To measure the impact of implementing FSMS on customer satisfaction.
3. To show the effect of implementation FSMS on the quality of the product.
4. To study the implementation of FSMS on the improvement of the internal processes.

## **Research hypotheses**

There is no impact of implementation food safety management system on the quality of dairy products

There is no impact of implementation food safety management system on internal processes

There is no impact of implementation food safety management system on the customer satisfaction

There is no impact of implementation food safety management on marking

## **The research dimensions**

Two companies in Khartoum Sudan company (A) which apply food safety management system, company (B) which don't apply food safety management system.

# CHAPTER TWO

## Literature Review

### 2.1 Milk Processing:

There are many reasons to process milk into dairy products:

1. Many dairy products can be kept longer than fresh milk
2. The demand for fresh milk may be limited, and there may be more interest in dairy products
3. If the daily amount of fresh milk for sale is limited, it may be more economical to process the milk into less perishable products, store them, and sell them later in greater quantities.
4. There may be no market for fresh milk close by, and only preserved products can be sold at markets at a greater distance.
5. Greater financial gain may be obtained
6. Many people cannot or can hardly consume milk because of so-called lactose intolerance (Ebing and Rutgers, 2006 ).

### 2.2 Quality Definition:

The term quality can be defined by many researchers as follows;

Conformance to requirements (Crosby,1979)..Fitness for uses (Juran, 2010).Quality is a dynamic state associated with products, services, people, processes, and environments that meet or exceeds expectations and helps produce superior value (Goetsch, and Davis, 2010).

## **2.3 International Organization for Standardization:-**

**ISO** creates documents that provide requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose ([www.iso.org](http://www.iso.org)).

### **2.3.2 The story behind ISO: -**

The ISO story began in 1946 when delegates from 25 countries met at the Institute of Civil Engineers in London and decided to create a new international organization 'to facilitate the international coordination and unification of industrial standards'. On 23 February 1947 the new organization, ISO, officially began operations.

Since then, we have published over 22263 International Standards covering almost all aspects of technology and manufacturing.

Today we have members from 161 countries and 782 technical committees and subcommittees to take care of standards development. More than 135 people work full time for ISO's Central Secretariat in Geneva, Switzerland ([www.iso.org](http://www.iso.org)).

### **2.3.3 Benefits of ISO International Standards**

1. ISO International Standards ensure that products and services are safe.
2. Reliable and of good quality.
3. They are strategic tools that reduce costs by minimizing waste and errors and increasing productivity.
4. They help companies to access new markets.

5. Level the playing field for developing countries and facilitate free and fair global trade ([www.iso.org](http://www.iso.org)).

### **2.3.4 International standards: -**

International Standards make things work. They give excellent specifications for products, services and systems, to ensure quality, safety and efficiency. They are instrumental in facilitating international trade.

ISO has published more than 21000 International Standards covering almost every industry, from technology, to food safety, to agriculture and healthcare ([www.iso.org](http://www.iso.org)).

## **2.4 The Food Safety Management System (FSMS): -**

### **2.4.1 The Food Safety Management System definition**

A Practical Guide for the Food Industry is a unique book and a reference for the future (**Rao 2014**)

### **2.4.2 Reasons to Pursue a Food Safety Management System**

Designing and implementing a compliant food safety management system (FSMS) can help organizations improve in many areas beyond the system's defined tasks. It is critical for management to align the food safety objectives with the business needs for a successful and meaningful program implementation. Here are some of the top reasons why companies that work in the food industry may want to pursue developing and implementing an FSMS

1. Identify and categorize the organization's food safety risks.
2. Develop work instructions and/or procedures to guide employees' actions and to ensure that each food safety task is completed in a disciplined manner and approved by management.
3. Assure management that they, in fact, know and understand the regulatory food safety requirements that must be met daily.
4. Develop meaningful goals and objectives that drive food safety performance improvements and possibly reduce additional costs.
5. Create a strong training and educational program that stems from well-written procedures and work instructions and the clearly defines the company's requirements.
6. Develop appropriate monitoring and measurement practices.
7. Verify that the FSMS is functioning as designed and implemented.
8. Monitor and trend issues of concern and/or non-conformance and the actions used to rectify each identified situation through a fully functioning corrective/preventive action program.
9. Evaluate the business model and the FSMS in a holistic fashion.

The last and most important benefit for an organization that goes through the process of designing and implementing a compliant FSMS knows that the organization has done everything possible to maintain its business in a manner that meets all food safety laws, regulations and statutes every day the doors are open for business. To a business owner, that knowledge is priceless. This is how brands are built and how they maintain the promise of food safety to consumers (**Roberto Bellavia** )

The emerging need for higher food safety has led to stricter specifications and requirements regarding food safety and the management of food safety

hazards. These specifications and requirements are set either by customers or legislation or the food company itself. Thus, in order that a food company is able to conform to food safety specifications and requirements, food safety systems (FSS) have been created and launched worldwide (Botonaki *et al.*, 2006).

Arvanitoyannis and Mavropoulos(2000) pointed out that the implementation of systems aiming to ensure safety (e.g. HACCP) in the food industry and, in particular, in dairy companies has resulted in a remarkable improvement in terms of dairy product safety and quality.

## **2.5 The Hazard analysis and critical control points: -**

### **2.5.1 The Hazard analysis and critical control point's definition:**

The Hazard analysis and critical control points (HACCP) is a preventive system which seeks to ensure food safety and security.

It allows product protection and correction of errors, improves the costs derived from quality defects and reduces the final over control HACCP principles can be applied throughout the food chain from the primary producer to the final consumer (**Manning *et al.*, 2006**).

### **2.5.2 HACCP history**

Arvanitoyiannis *et al.* (2009) described the development of HACCP as the first food safety management system in the food industry. It was initiated in the 1960's by the need to produce the first astronaut safe meals for the Mercury, Gemini and Apollo space NASA flight programs. The project was successfully completed by the Pillsbury Company (in collaboration with NASA). In 1971, during the National Conference on Food Protection the concepts for reexamining Critical Control Points (CCP's) and Good Manufacturing Practices in producing safe foods were introduced. Pillsbury Co. in 1972 organised the first training program to the US Food and Drugs Administration (FDA) entitled 'Food Safety through the Hazard Analysis and Critical Control Point System', while in 1973 FDA included HACCP in the regulations applied for low-acid canned foods (Arvanitoyannis and Kassaveti 2009). In 1987 The National Advisory Committee on



Microbiological Criteria for Foods (NACMCF) was established and was initially responsible for defining HACCP's systems and guidelines for its application. During the next decade HACCP principles became widely accepted by food manufacturers and relevant authorities hence the HACCP principles become part of National Legislations in many Western European countries. Moreover, in 1997 the Codex Alimentarius Commission revised and adopted the seven HACCP principles. In the meantime, several food safety standards based on HACCP principles were introduced by the food market e.g. British Retail Consortium (BRC, 2005), International Food Standard (IFS). Wright and Teplitski (2009) argued that the acceptance of HACCP was due, partly, to the fact that its main principle made intuitive sense: kill pathogens at the crucial step in the production cycle and then maintain food processing under conditions that prevent recontamination. HACCP was a much-needed solution for an industry that was meeting the needs of an increasingly suburban population that no longer produced its own food. The development and acceptance of HACCP coincided with a number of changes in the industry including an increased concentration of agricultural production and globalization of food markets.

### **2.5.3 HASSP AND ISO**

The HACCP approach is the basic element of the ISO 22000 standard (ISO 22000, 2005). Aruoma (2006) also states that HACCP requirements are an intrinsic part of ISO 22000. It is worth noting that a food company can either simply implement the principles of HACCP, without holding any certification, or implement HACCP and simultaneously be ISO 22000 certified. Eves and Dervisi (2005) stated that HACCP per se does not make safe food, but its correct and effective application can make the difference.

However, in practice, the effectiveness of the HACCP FSS is often unsatisfactory due to unexpected outcomes in the food production conditions and the behaviour of the people that implement it (van der Spiegel *et al.*, 2004; Azanza and Zamora-Luna, 2005).

The HACCP procedure is generally targeted at food safety management (pathogenic microorganisms and their toxins), but, as an approach in the context of broader quality management, it can be effectively applied to microbiological spoilage, foreign-body contaminations or pesticide contamination. It is preferable to conduct a HACCP program with a narrow scope (a single pathogen or possibly pathogens) rather than attempt to cover an extended list of hazard areas when documentation will become complex. However, an experienced team might choose to cover the whole spectrum of hazard areas, depending on (a) the resources available to produce and maintain a composite HACCP plan and (b) the way in which it is to be incorporated into the local quality plan and quality system (Jervis, 2002).

#### **2.5.4 The benefits of HACCP program**

1. Reduced public health risk
2. Lower labor costs
3. Effective and efficient use of resources
4. Fewer customer complaints as overall quality improves.

#### **2.5.5 Prerequisite Programs: -**

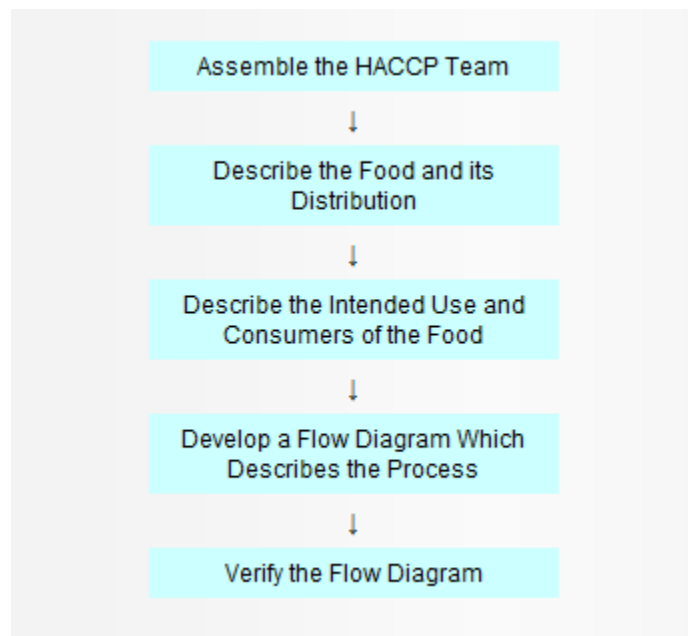
##### **2.5.5.1 Prerequisite Programs definition:**

The production of safe food products requires that the HACCP system be built upon a solid foundation of prerequisite programs.

### 2.5.5.2 HACCP Prerequisite program steps:

1. Step 1: Assemble a HACCP Team.
2. Step 2: Describe the food and its distribution.
3. Step 3: Identify the intended use and consumers of the food.
4. Step 4: Develop a flow diagram that describes the process.

Step 5: Verify the accuracy of the flow diagram. (Karl and Angus 2000)



**Figure 2.1.** Preliminary Tasks in the Development of the HACCP Plan

### 2.5.6 HACCP analysis principle: -

In theory, the only way of ensuring that every package of yoghurt from a given production line is safe, from a chemical or microbiological standpoint, is to test every package. Clearly, such a suggestion is totally impractical, so that instead, a representative group of packages is withdrawn against a sampling plan appropriate for the product and the history of the plant.

However, whilst this approach is essential to confirm that preset standards of hygiene are being met and that potential contaminants are at a low level or absent, the procedure can never prevent some spoiled packages from reaching the consumer. Consequently, the emphasis within quality assurance has turned to the avoidance of problems, a concept that forms the basis of HACCP. In particular, the system identifies seven aspects of production that merit constant attention and these aspects are enshrined in seven principles (Tamime and Robinson, 1999).

**The main principles of HACCP:**

1. Assess the hazards in a dairy plant.
2. Determine critical control points (CCPs).
3. Establish critical limits for each CCP.
4. Implement procedures to monitor CCPs and record data.
5. Institute corrective action.
6. Establish record keeping systems to document the HACCP plan.
7. Verify that the HACCP program is working (dairy processing plants-  
bc center for disease control).

Hoolasi (2005) reported that there is certainly a link between implementing a formalized system such as HACCP, and the outcomes of both in-process testing and analysis, and final testing and analysis, which significantly impact on reducing the number of customer complaints and, more importantly, the risk to the customer that could be posed by the product. This decrease in the risk to the customer was also contributed to minimizing the liability of the company in terms of legal, social, financial, image and other factors that contribute to the success of any company.

### **2.5.7 Good Manufacturing Practices (GMP):-**

GMP representing a combination of technical, instructions and quality insurance procedures it can prevent contamination; periodic cleaning of spaces and the equipment; fight against the devastating and the vermin (Heggum, 2001).

## **2.8 Process Control:**

Process control can be defined as the management of all elements of a process that control the legality, safety, contractual, and commercial requirements of the product. The scope is, therefore, from farm to consumer and embraces raw materials, formulation, bacteriocidal or bacteriostatic treatments, plant and equipment hygiene, personnel practices and hygiene, packaging, distribution conditions, and consumer use (Jervis, 2002)

# **CHAPTER THREE**

## **Materials and methods**

### **3.1 Experimental Design:**

This study was conducted during September to November 2018. The research consists of two parts; part one in which the descriptive method was used, using a questionnaire testing approach aim to examine the role of application food safety management system on the dairy industry and part two in which yoghurt samples were collected from two dairy companies for physiochemical and microbiological analysis to ensure the effect of application food safety management system (FSMS) on the quality of the product.

### **3.2 Method of data collection**

#### **3.2.1 Questionnaire**

For identifying the impact of implementing Food Safety Management System on dairy product, 25 questionnaires about the application of FSMS were distributed among the employees of the company.

#### **3.2.2 Chemical and microbiological tests**

For studying the impact of implementation Food Safety Management System on dairy product, 10samples of yoghurt from each of the two companies were collected randomly from the market and tested by the following tools and techniques.

For UHT milk analysis Foss milco scan ft1 was used

For determination of pH Jenway 315 PH meter was used

For determination of moisture Kern electronic moisture meter was used

### **3.3 Type of media**

For the purpose of studying coli forms in yoghurt VRBA (violet red bile agar) was used for coli forms detection.

For the purpose of studying yeast and mold in yoghurt the researcher used Yeast extract dextrose chloramphenicol.

For the purpose of culturing UHT milk the researcher used Plate count agar.

### **3.4 Culturing method**

#### **3.4.2 Pour plates method**

For the purpose of culturing UHT milk the Pour plates method was used. In a Pour plate, a small amount of inoculum from a broth culture is added by pipette to the center of a Petri dish. Cooled, but still molten, agar medium in a test tube or bottle is then poured into the Petri dish. The dish is then rotated gently, or moved back and forth (first N-S, then NW-SE, then NE-SW), to ensure that the culture and medium are thoroughly mixed and the medium covers the plate evenly ([www.nuffieldfoundation.org](http://www.nuffieldfoundation.org))

Pour plates allow micro-organisms to grow both on the surface and within the medium. Most of the colonies grow within the medium and are small in size and may be confluent. The few colonies that grow on the surface are of the same size and appearance as those on a streak plate ([www.nuffieldfoundation.org/](http://www.nuffieldfoundation.org/))

### 3.5 Research dimension

The dimension of this research was two companies in Khartoum (Sudan) ; Company (A) which applying food safety management system and company (B) which don't applying food safety management system. The study is aim to determine the extent of the Impact of implementing Food Safety Management System on dairy products by comparing these companies.

### 3.6 Data Measurement

In order to be able to select the appropriate method of analysis, the level of measurement must be understood. For each type of measurement, there are an appropriate method that can be applied and not others. For the purpose of the study, ordinal scales were used. Ordinal scale is a ranking or a rating data that normally uses integers in ascending or descending order. The numbers assigned to the important (0, 1, 2) do not indicate that the interval between scales are equal, nor do they indicate absolute quantities. They are merely numerical labels. Based on Likert scale we have the following:

Table (3.1):Likert scale

Item	Neutral	Agree	Disagree
Scale	0	1	2

### 3.7 Statistical Analysis:

To get results as accurate as possible, SPSS statistical soft ware has been used.



# CHAPTER FOUR

## Result

### 4.1 Survey on impact of safety management systems:

Data in table 4.1 showed the demographic characteristics of the survey respondents.

**Table (4.1) Demographic characteristics of the individuals of the study, n=25**

Characteristics	Frequency	Percentage
<b>Gender</b>		
Male	15	60%
Female	10	40%
<b>Age</b>		
25 and less	5	20%
25- 40	19	76%
41 and above	1	4%
<b>Qualification</b>		
Diploma	0	0%
Bachelor	11	44%
Higher Studies	14	56%
<b>Position</b>		
Manager	2	8%
Supervisor	8	32%
Employee	15	60%
<b>Years of experience</b>		
Less than 5 years	12	48%
5 – 10 years	7	28%
11 years and above	6	24%
<b>How well do you know HACCP</b>		
Very aware	8	32%
Ware	9	36%
To some extent	8	32%

### **4.1.1 Quality of the product:**

Table (4.2) shows that 96% of the employees agree that food safety management system has helped to improve the products produced by the company, and 4% are neutral. Table (4.3) shows that 80% of the employees agree that the company issue a tracking system allowing easy monitoring of raw materials coming from the suppliers and the products, for the purpose of the process of withdrawing from the market when a problem occurs to the product, and 20% are neutral.

Table (4.4) revealed that 80% of the employees agree that the production line stops when a fault occurs, such as the critical limits exceeded at any critical control point, and 20% are neutral. Table (4.5) demonstrated that 84% of the employees agree with that the results from the preparatory programs for operation and critical control points evaluated by someone with sufficient knowledge to assess the monitoring data, and 16% are neutral. Table (4.6) explained that 84% of the employees agree with that if evaluation process proven that the product cannot be launch to the market because of deep damage or critical point executed and waste disposal, 12% are neutral and 4% are disagree.

**Table (4.2) Improvement of the product by FSMS**

	Frequency	%
Valid Agree	24	96.0
Natural	1	4.0
Total	25	100.0

**Table (4.3) Tracking system of the product**

	Frequency	Percent
Valid Agree	20	80.0
Natural	5	20.0
Total	25	100.0

**Table (4.4) production line stops when a fault occurs**

	Frequency	%
Valid Agree	20	80.0
Natural	5	20.0
Total	25	100.0

**Table (4.5) Assessment of the monitoring data**

		Frequency	Percent
Valid	Agree	21	84.0
	Natural	4	16.0
	Total	25	100.0

**Table (4.6) Evaluation process of the product**

		Frequency	Percent
Valid	Agree	21	84.0
	Natural	3	12.0
	Disagree	1	4.0
	Total	25	100.0

### **4.1.2 Internal process**

Table (4.7) shows that 92% of the employees agree that the company has a deep understanding of the food safety management system, and 8% are neutral.

Results in table (4.8) demonstrated that 68% of the employees agree with that they are familiar with all the terms of the food safety management system, 20% are neutral, and 12% are disagree.

Table (4.9) shows that 88% of the employees agreed that the application of food safety management system had an impact on transfer the level of the internal operations to the best, and 12% are neutral.

Table (4.10) found that 76% of the employees accepted that the company's management provides computerized information network for storing information relating to the management of all the processes in the organization, and 24% are neutral.

Table (4.11) demonstrated that 92% of the employees confirmed that the company provides management capabilities necessary to manage the business that lead to the quality of its services, and 8% are neutral.

**Table(4.7) understanding of the food safety management system**

		Frequency	Percent
Valid	Agree	23	92.0
	Natural	2	8.0
	Total	25	100.0

**Table(4.8) Knowledge of the SFMS**

		Frequency	Percent
Valid	Agree	17	68.0
	Natural	5	20.0
	Disagree	3	12.0
	Total	25	100.0

**Table (4.9) Impact of application SFMS**

		Frequency	Percent
Valid	Agree	22	88.0
	Natural	3	12.0
	Total	25	100.0

**Table(4.10) Computerized information network for storing information**

		Frequenc y	Percent
Valid	Agree	19	76.0
	Natural	6	24.0
	Total	25	100.0

**Table(4.11)management capabilities of the company**

		Frequency	Percent
Valid	Agree	23	92.0
	Natural	2	8.0
	Total	25	100.0

### **4.1.3 Customer satisfaction: -**

Table (4.12) revealed that 84% of the employees said that customer satisfaction is a fundamental value of the company and all employees, and 16% are neutral.

Table (4.13) indicated that 68% of the employees confirmed that the company's management is keen to provide good services to internal clients (employees), and 32% are neutral.

Table (4.14) stated that 80% of the employees agreed that company's management is working to conduct surveys to identify the needs of customers, and 20% are neutral.

Table (4.15) revealed that 56% of the employees said that customers' complaints decreased after the application of food safety management system, 40% are neutral, and 4% are disagree.

Table (4.16) shows that 8% of the employees agree with that The Company's management keen to listen to the problems of customers and working to solve them, 16% are neutral and 4% are disagree.



**Table (4.12) customer satisfaction is a fundamental value**

		Frequency	Percent
Valid	Agree	21	84.0
	Natural	4	16.0
	Total	25	100.0

**Table(4.13) provide good services to internal clients**

		Frequency	Percent
Valid	Agree	17	68.0
	Natural	8	32.0
	Total	25	100.0

**Table (4.14) conduct surveys to identify the needs of customers**

		Frequency	Percent
Valid	Agree	20	80.0
	Natural	5	20.0
	Total	25	100.0

**Table (4.15) customers' complaints decreased**

		Frequency	Percent
Valid	Agree	14	56.0
	Natural	10	40.0
	Disagree	1	4.0
	Total	25	100.0

**Table (16) listen to the problems of customers**

		Frequency	Percent
Valid	Agree	20	80.0
	Natural	4	16.0
	Disagree	1	4.0
	Total	25	100.0

#### **4.1.4 Marketing**

Table (4.17) showed that 64% of the employees confirmed that the reason that more customers' turnout to company's products is the application of food safety management system, and 36% are neutral.

Table (4.18) shows that 72% of the employees agree with that customer's turnout to company's products increased after the application of food safety management system, and 28% are neutral.

Table (4.19) shows that 68% of the employees agree with that after the application of food safety management system, the proportion of sales of the company's products has increased, and 32% are neutral.

Table (4.20) shows that 72% of the employees agree with that there are certain areas where the demand has increased which shows the awareness of customers there, and 28% are neutral.

**Table (4.17) turnout to company's products**

		Frequency	Percent
Valid	Agree	16	64.0
	Disagree	9	36.0
	Total	25	100.0

**Table (1.18) customer's turnout to company's products increased**

		Frequency	Percent
Valid	Agree	18	72.0
	Natural	7	28.0
	Total	25	100.0

**Table(4.19) proportion of sales**

		Frequency	Percent
Valid	Agree	17	68.0
	Natural	8	32.0
	Total	25	100.0

**Table (4.20) certain areas where the demand has increased**

		Frequency	Percent
Valid	Agree	17	68.0
	Natural	8	32.0
	Total	25	100.0

## **4.2 Impact of Safety Management System on quality of dairy products:**

### **4.2.1. Physicochemical and Microbiological of UHT milk:**

Results in table (4.20) show that there was high level of significant difference in the fat, protein, SNF, and density of the UHT milk samples between the two companies.

Data in table (4.24) showed no detection of coliforms and yeast and moulds in the UHT milk samples collected from company (A) and (B) which indicated complete sterilization of these samples.

### **4.2.2. Physicochemical and Microbiological of yoghurt:**

Results in table (4.22 and table 4.23) revealed that there was high level of significant difference in the pH and Total solids contents of the yoghurt samples, between the two companies, the lower pH and the higher total solids were for the Samples in company A.

Data in table (4.24) indicated that there was no microbiological growth in yoghurt samples A while in samples of company B coliforms and yeast and moulds were detected. The high count of coliforms bacteria ranged between 0 – 125 cfu/ml. The results also showed that 40% of the yoghurt samples in company B contaminated with yeast and moulds and the count ranged between 0 – 200 cfu/ml.

**Table (4.20) physicochemical characteristics of UHT milk in two companies**

	<b>Chemical composition</b>									
	Fat		Protein		SNF		Ts		Density	
	Com A	Com B	Com A	Com B	Com A	Com B	Com A	Com B	Com A	Com B
1	3.58	2.48	3.06	2.28	12.71	13.46	16.29	15.94	043.84	048.78
2	3.59	2.49	3.04	2.29	12.61	12.88	16.20	15.37	044.44	048.66
3	3.59	2.49	3.05	2.31	12.57	13.36	16.16	15.85	044.28	048.37
4	3.59	2.49	3.07	2.30	12.51	13.40	16.10	15.89	044.03	048.53
5	3.59	2.48	3.06	2.28	12.51	13.40	16.10	15.88	044.01	048.54
6	3.59	2.48	3.07	2.29	12.50	13.47	16.09	15.95	044.00	048.82
7	3.60	2.49	3.07	2.29	12.48	13.41	16.08	15.90	043.90	048.60
8	3.60	2.44	3.07	2.29	12.43	13.50	16.03	15.94	043.67	048.98
9	3.60	2.44	3.07	2.29	12.20	13.36	16.20	15.80	043.67	048.92
10	3.59	2.47	3.07	2.30	12.43	13.43	16.02	15.90	043.71	048.67
Means	3.59	2.69	3.06	2.29	12.49	13.37	16.13	15.84	043.95	048.69
Sig level	**		**		**		**		**	

**Table (4.21) microbiological contents for UHT milk**

Sample NO	Company(A)	Company(B)
1	ND	ND
2		
3		
4		
5		
6		
7		
8		
9		
10		

ND means Not detected.



**Table (4.22) pH of yoghurt for the two companies**

Sample NO	Company (A)	Company(B)
1	4.33	4.34
2	4.29	4.42
3	4.31	4.50
4	4.32	4.31
5	4.32	4.44
6	4.33	4.30
7	4.34	4.31
8	4.33	4.30
9	4.28	4.32
10	4.31	4.34
Means	4.31	4.35
Sig level	**	

**Table (4.23) Total solids contents of yoghurt for company (A)and (B)**

Sample NO	Company (A)	Company(B)
1	13.95	13.56
2	13.96	13.91
3	13.99	13.03
4	13.90	13.21
5	13.94	13.01
6	13.94	13.89
7	13.99	13.41
8	13.93	13.14
9	14.01	13.10
10	14.10	13.22
Means	13.97	13.34
Sig level	**	

**Table (4.24) Microbiological contents of yoghurt for company (A) and (B)**

Sample NO	Company(A)		Company(B) cfu/ml	
	Coliforms	Yeast & Moulds	Coliforms	Yeast & Moulds
1	ND	ND	5	ND
2			125	200
3			15	ND
4			68	200
5			28	1
6			1	ND
7			ND	ND
8			8	ND
9			ND	ND
10			54	5

ND means not detected

# CHAPTER FIVE

## DISCUSSION

The application of food safety management system definitely improved the quality of the product the reason which necessitates the application of these systems.

From the questionnaire results the production line of the dairy plant could be stop since a problem occurred and the product was not allowed to pass through the process if a deep damage occurred or critical point is exceeded that might lead to a better quality of the product this result was confirmed by Keskin and Gulsunoglu (2012) who reported that the study designed an HACCP plan model, food safety management systems and the applicability of this systems for raw milk, pasteurized milk, UHT milk, yoghurt, cheese, butter and ice-cream to improve the safety and quality of products. This study proves that with only some adaptations and modifications, the HACCP systems can be developed and carried out in an individual way in dairy industry to get high quality products, this refers to the company's responsibility toward its product, customers and society.

From the questionnaire results food safety management facilitate to track the product from farm to fork. From the questionnaire results food safety management system was well spread throughout the company which lead to transfer of the internal processes to the next level and this has its impact on internal customer loyalty.

Providing a good service for internal and external customers this probably lead to reduce customer complaints these results were in accordance with those of Hoolasi (2005) who reported that there is certainly link between implementing a formalized system such as HACCP, and the outcomes of both in-process testing and analysis, and final testing and analysis, which significantly had impact on reducing the number of customer complaints and, more importantly, the risk to the customer that could be posed by the product. This decrease in the risk to the customer was also contributed to minimize the liability of the company in terms of legal, social, financial, image and other factors that contributed to the success of any company.

Food safety management systems have a role in decrease customer complain. Customer turnout to company products after application of FSMS which lead to increase of the proportion of sales this is commercial benefit for the company, there are certain areas where the demand has increased which shows the awareness of customers.

The results of the physicochemical properties (table 4.20) of the UHT milk samples from the two companies showed significant variations the high chemical percent of the chemical components of the UHT milk samples in company A possibly due to the application of the FSMS in that company which resulted in better quality products.

The results of the chemical analysis of the yoghurt samples in the two companies showed significant difference (Table 4.22) the high total solids contents of yoghurt in company A was higher than that in company B might

be due to the Good manufacturing practices and application of the FSMS in company A .

The microbiological results also showed that the yoghurt samples in company B contaminated with coliforms and yeast and moulds and the count ranged between 0 – 200 cfu/ml. These results were in accordance with those of Musaj *et al.* (2012) who stated that the microbiological results before the implementation of HACCP throughout periods of analyses conducted resulted beyond the limits of the national standard. Results after the implementation of HACCP are favorable and within the limits of the national standard.

Form the microbiological result all UHT samples collected from the two companies no detection were recorded this might be due to the high sterilization temperature applied to these samples. However, yoghurt samples showed that there were no coliforms; Yeast and moulds growth in these samples collected from company (A),while company (B) showed different numbers of coliforms; yeast and moulds colonies in eight samples and two of these samples were not detected.

# CONCLUSION and RECOMNDATIONS

## Conclusion: -

In this study the following conclusions were drown:

- Implementation of FSMS had positive impact on marketing, where the market share of the company has increased and the demand of the products increased.
- Implementation of FSMS had positive effect on customer satisfaction, and an evidence for that is the decrease of customer's complaints, also company's management keening to solve the existing ones.
- Implementation of FSMS had positive impact on the quality of products and the situation of the company in comparison with other dairy companies it better of them, and their market share explained that.
- Implementation of FSMS had positive effect on internal processes, from the first step of handling the raw materials and through all steps of production until preparing the final product, FSMS had helped in these processes improvement.

## **Recommendations: -**

- All the employees must know much better about FSMS and all its principles for better work environment and better products.
- Annual training should be established, so that everyone inside the company will be know the latest updates in the FSMS and gain more knowledge necessary to improve the work.
- More focus on customer's complaints helps improving products
- Implementation of FSMS in the other dairy companies probably improve the quality of their products



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# Appendices

## APPENDIX I

### 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

After Greetings I put in your hands a questionnaire for the purposes of scientific research on the topic "the role of implementation food safety management system on dairy product".

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

##### **Years of experience**

<5years                      5-10 years                  11 years and above

##### **How well do you know HACCP**

Very aware                      Aware                      To some extent

	Agree	Neutral	Disagree
<b>Impact of implementation food safety management system on quality of the product</b>			
Food safety management system has helped to improve the products produced by the company.			
The Company issues a tracking system allowing easy monitoring of raw materials coming from the suppliers and the products, for the purpose of the process of withdrawing from the market when a problem occurs to the product.			
The production line stops when a fault occurs, such as the critical limits exceeded at any critical control point.			
The results from the preparatory programs for operation and critical control points evaluated by someone with sufficient knowledge to assess the monitoring data.			
If evaluation process proven that the product cannot be launch to the market because of deep damage will be executed and waste disposal.			
<b>Impact of implementation food safety management system on internal processes</b>			
The Company has a deep understanding of the food safety management system.			
I am familiar with all the terms of the food safety management system.			
The application of food safety management system had an impact on transfer the level of the internal operations of the best.			
The Company's management provides computerized information network for storing information relating to the management of all the processes in the organization.			
The Company provides management capabilities necessary to manage the business that lead to the quality of its services.			
<b>Impact of implementation food safety management system on customer satisfaction</b>			
Customer satisfaction is a fundamental value of the company and all employees.			
The Company's management is keen to provide good services to internal clients (employees).			
Company's management is working to conduct surveys to identify the needs of customers.			
Customers' complaints decreased after the application of food safety management system.			
<b>Impact of implementation food safety management system on marketing</b>			
The reason that more customers' turnout to company's products is the application of food safety management system ISO 22000.			
Customer's turnout to company's products increased after the application of food safety management system.			
After the application of food safety management system, the proportion of sales of the company's products has increased.			
There are certain areas where the demand has increased which shows the awareness of customers there			

## Appendix II

### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
fat	Equal variances assumed	.	.	6687749908043195 .000	18	.000	1.10000	.00000	1.10000	1.10000
	Equal variances not assumed			6687749908043195 .000	9.000	.000	1.10000	.00000	1.10000	1.10000
Protein	Equal variances assumed	.	.	1020910294408981 0.000	18	.000	.78000	.00000	.78000	.78000
	Equal variances not assumed			1020910294408981 0.000	9.000	.000	.78000	.00000	.78000	.78000
Snf	Equal variances assumed	.	.	- 1101589104077581 .000	18	.000	-.75000	.00000	-.75000	-.75000
	Equal variances not assumed			- 1101589104077581 .000	10.269	.000	-.75000	.00000	-.75000	-.75000
Ts	Equal variances assumed	.	.	469992264258672. 560	18	.000	.35000	.00000	.35000	.35000
	Equal variances not assumed			469992264258672. 560	11.182	.000	.35000	.00000	.35000	.35000
Density	Equal variances assumed	.	.	- 4985847324548871 .000	18	.000	-4.94000	.00000	-4.94000	-4.94000
	Equal variances not assumed			- 4985847324548871 .000	18.000	.000	-4.94000	.00000	-4.94000	-4.94000

Table(1) show that p-value is less than 0.05 so there is no significant difference between fat protein contents and density in the samples collected from the two companies .

**Independent Samples Test**

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
ph Equal variances assumed	12.953	.002	-1.830	18	.084	-.04200	.02295	-.09021	.00621
Equal variances not assumed			-1.830	10.314	.096	-.04200	.02295	-.09292	.00892



Table(2) show that p-value is less than 0.05 so there is no significant difference between pH in the samples collected from the two companies .

**Independent Samples Test**

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
ts Equal variances assumed	18.623	.000	5.790	18	.000	.62300	.10760	.39694	.84906
ts Equal variances not assumed			5.790	9.498	.000	.62300	.10760	.38152	.86448

Table (4.27)

Table (3) show that p-value is less than 0.05 so there is no significant difference between the samples collected from the two companies.