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Extent of Implementing the Hazard Analysis Critical Control Point (HACCP) system in Sudanese Beef Industry.

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Abstract

An attempt was made to assess extent of implementing the hazard analysis and critical point (HACCP) system in the Sudanese beef processing factories. Six meat pants scattered in Khartoum State were surveyed for data in HACCP requirements using the recommend HACP checklist. Outside the scope of the HACCP, all these meat plants adopt company policy on product safety with documentation of quality and safety management, address product hygiene and acceptance of raw materials, and also adopt knowledge and understanding of policy at all levels of the organization. Looking into the specific requirements of the HACCP elements, almost none of these plant have documentation of risks to which the product is exposed from the raw materials until distribution, on flow diagram describing the production process, no validation of process engineering sheets, never conducted any assessment for potential risks in all production steps, and none of these plants actually address any aspects of the production process. More critical is that all of the six meat plants investigated, seemed not to be concerned about corrective or preventive measures adopted to eliminate or reduce risks to an acceptable level.

Key words: Beef, plant, HACCP, system, critical, hazard.

Introduction

Hazard Analysis Critical Control Point (HACCP) is a preventive system of food control which aims at food safety assurance. The HACCP is a documented and verifiable approach to the identification of hazards, preventive measures and critical control points (CCPs) and the implementation of a monitoring system (Hechelmann, 1993). The HACCP has become an internationally recognized tool for managing the safety aspects of the production, processing, preparation and distribution, of food. HACCP in relation to microbiological food

safety and born pathogens, the concept is recommended as the best insurance policy against undesirable microorganisms (Ababouch, 2002). The traditional approach to food safety assurance is based on applying codes of Good Hygiene Practice (GHP) and Good Manufacturing Practice (GMP) in food processing where confirmation of safety and identification of potential problems are obtained by end – product testing and the check for compliance with the codes by sampling the foods for laboratory analysis (Troller, 2003). In Sudan, the meat industry is one of the food processing sectors that are inthe process of implementing certain hygienic measures to assure safety requirements, the objective of this study:

1- To evaluate and assess the good manufacturing practices (GMP) in Khartoum state beef industries with the aim of future implementation of HACCP system.

2.1 Materials and tools used Documents containing HACCP checklists were adopted as an instrument for assessment of implementing HACCP plan system (Appendix No.1) in six meat factories in Khartoum province.

2.2Methods 2.2.1Survey Six factories for processing of meat scattered in Khartoum state, weresurveyed for data on HACCP requirements using HACCP checklist. Uponarrival at each plant, there was a meeting with representatives from qualitycontrol and plant management. The latter provided information anddiscussed what type of food safety system they follow .This provided ageneral idea on how the employees follow sanitation guidelines and theyfamiliarize the reviewer with the processing operations to facilitate a moreeffective HACCP plan assessment.

2.2.1.1 HACCP checklist A checklist of HACCP (Appendix No.1), recommended by SGS (1997) was used to investigate the following HACCP features

2.2.1.1.1Company information

2.2.1.1.1.1Process control

Six factories were investigated concerning availability of process control, documentation system covering safety assurance and product quality and coverage of process control flow charts for all aspects relevant, yet pertinent to the applicable legislation.

3.2.1.1.1.2 Responsibilities for the product safety The same companies were surveyed regarding company policy on product safety, documentation of management for the quality /safety policy , address of policy and its related objectives for hygiene and acceptance of raw materials and/or food production, documentation of HACCP system and knowledge and understanding of policy at (all) levels of the organization.

2.2.1.1.1.3 HACCP team The surveyed companies were investigated concerning identification and operation of HACCP team for maintaining the HACCP process control system, presentation of sufficient expertise in the various fields of HACCP system, establishment of criteria for membership of HACCP teams and nomination of a coordinator with responsibility for establishing HACCP process control system involving process and maintenance.

2.2.1.1.2 Product information 2.2.1.1.2.1 Product description The six companies were surveyed regarding availability of the product description, documentation of the risks to which the product is exposed from the raw materials until distribution, and availability of the end product documentation.

2.2.1.1.2.2 Identification of intended use The survey included statement and documentation of the target consumers for the product destination, reference to the international legislation, and definitions of other properties concerning consumption such as specific regulations.

2.2.1.1.3Processinformation 2.2.1.1.3.1Flowdiagram These factories were investigated on issues concerning description of production process and engineering flow set by the company, validation

2.2.1.1.3.2 On site verification of the flow diagram process engineering sheets by HACCP team, and product safety in process/ engineering flow sheets. The same companies were surveyed concerning updating the systematic process flow / engineering diagram which represents all the production units this should take place at least on a yearly basis so as to allow evaluation product safety risk and quality assurance aspects. **2.2.1.1.3.3 Facility lay-out** All of the companies were investigated on issues concerning seeing the locker rooms and personnel facilities are shown applicable, the regulatory requirements concerning facilities designs are being met and possibilities of cross contamination between raw materials and processing aids, intermediate products, end products and personnel waste.

2.2.1.1.4 Dangers, risk and preventive measures

2.2.1.1.4.1 Assessment These companies were investigated on assessment of all potential risks in all production steps which are made by HACCP team and addressing all aspects of the production processes which can negatively influence the product safety.

2.2.1.1.4.2 Preventive measures The six factories were investigated also on identification and implementation of preventive measures which address assessment of risks, elimination or reduction of the risks to an acceptable level by preventive measures, and the question of

expression of preventive measures in specifications (raw materials, processing aids, process tolerance), instructions, procedures, purchasing plants, hygiene plants, maintenance and cleaning plan.

RESULTS AND DISSCUSSION

3.1.1 Company Information of processed beef plants Table 1 shows company information of beef processing plants in Khartoum state The products processed by these plants included sausage, Burger, meat balls, martidella, ground beef, frankfurter, basturma

3.1.1.1 Process control Table 2 shows results concerning the process control of processed beef plants investigated. The results revealed that about 50% of these factories do have documented process control system describing how the company assures safety and quality of product, and possess process control flow charts which cover aspects relevant to international standards .The remaining factories lack such control facilities which are expected to lead to a negative impact on the product safety. Process control facilities are the tool and key for the enhancement of food safety (Bernard *et al.*, 1994). It is clear that almost one out of two beef processing plants lack tools for enhanced product safety.

3.1.1.2 Responsibilities for product safety Table 3 shows results of responsibilities for the product safety. Almost all these food plants adopted company policy system which includes the product safety, documentation of management for the quality/safety policy, addressing product hygiene and acceptance of raw materials or food production, knowledge and understanding of policy at all levels of the organization. These results are similar with the results reported by Wilkinson And Wheelock (2004) of a study conducted in Northern Ireland and the Republic of Ireland plants, who found that 95% of those companies have a formally documented food safety policy. The same situation was also reported by Anderson and Dormedy (1999) who reported a 94% adoption in American plants

Table 1. Company information of processed beef plant

Name of plants	Location of the factories	The products
Factory (A)	Khartoum	Sausage, burger, meat balls, Martidella, groundbeef, frankfurter, bosturma.

Factory (B)	Khartoum	Sausage, burger, meat balls, Martidella, groundbeef, frankfurter, basturma.
Factory (C)	Khartoum north	sausage, burger ,meat balls, Martidella, groundbeef, frankfurter, basturma.
Factory (D)	Khartoum north	Sausage, burger, meat balls, martidella, groundbeef, frankfurter, basturma.
Factory (E)	Omdurman	Sausage, burger, meat balls, martidella, groundbeef, frankfurter, basturma.
Factory (F)	Omdurman	Sausage, burger, meat balls, martidella, groundbeef, frankfurter.

Table 2. Process control feature in meat factories

Process control	Number of factories	OK		N.ok	
		No.	%	No.	%
Availability of process control documentation system (covering safety assurance and product quality).	6	3	50	3	50
Coverage of process control flow charts for all aspects relevant, yet pertinent tothe applicable legislation.	6	3	50	3	50

*Nok: Not Ok.

Table 3. Responsibilities for product safety feature in meat factories

Responsibilities for product safety.	nberof factories	OK		N.ok	
		No.	%	N0.	%
Company policy on product safety.	6	6	100	0	0
Documentation of management for the quality/safety policy.	6	6	100	0	0
Address of policy and its related objectives forhygiene and acceptance of raw materials and/or food production.	6	6	100	0	0
Documentation of HACCP system.	6	6	100	0	0
Knowledge and understanding of policy at (all) levels of the organization.	6	6	100	0	0

*Nok: Not Ok.

4.1.1.3 HACCP Team Table 4 shows results concerning HACCP team in the surveyed factories. The results indicated that all the plants have no HACCP element It I clear that the absence of the HACCP features would suggest absence of the whole HACCP concept unlike the reported 93% in Irish plants (Wilkinson and Wheelock, 2004), and 95% in Canadian ones (Hathaway,1993). It is also obvious that emerging food safety concepts such as HACCP are of no interest or access to this important and sensitive sector of food industry.

Table 4: HACCP team

HACCP team	mberof factories	OK		N.ok	
		No.	%	N0.	%
Identification and operation of HACCP team for maintaining the HACCP process control system.	6	0	0	6	100
Presentation of sufficient expertise in the various fields of HACCP system.	6	0	0	6	100
Establishment of criteria for membership ofHACCP teams.	6	0	0	6	100
Nomination of a coordinator with responsibility for establishing HACCP processcontrol system	6	0	0	6	100
Involving progress and maintenance.	6	0	0	6	100

*Nok: Not Ok.

4.1.2 Product information features in beef processing factories 4.1.2.1 Information on beef products Table 5 shows product information features in beef processing factories. The results indicated that half of these plants have end product description available and possess end product documentation. Anderson and Dormedy (1999) found that most of the American beef plants which practiced product description and end product documentation were available at a lower level. For the documentation of risks to which the product is exposed to from the raw material until distribution, all plants have no document of the risks. This situation has a significant effect on the product quality. Hathaway (1993) found that more of the Canadian processing beef plants documented raw materials risks. These variations

between Sudanese beef plants and Canadian beef plants could be attributed to the lack in quality concepts awareness

Table 5: Product information

Product information	Number of factories	OK		Not OK	
		No.	%	N0.	%
Availability of the product description.	6	3	50	3	50
Documentation of the risks to which the product is exposed from the raw materials until distribution.	6	0	0	6	100
Availability of the end product documentation.	6	3	50	3	50

*Nok: Not Ok.

4.1.2.2 Identification of intended use of beef products Table 6 shows identification of intended use of products in beef processing factories. Regarding statement and documentation of the target consumers for the product destination, all these plants did not adopt this parameter. Ababouch (2002) reported that the intended use of beef products should be based on expected use by the consumer. Also, Fries (1993) mentioned that the intended consumers may be the general public or a particular sector of the population e.g. infants and elderly. For the second feature in Table 6, none of the factories has applied this specification. Anderson and Dormedy (1999) found that most all the American beef plants which practiced identification of intended use of products referring to the relevant legislation. This trend in the Sudanese beef plants could be due to some carelessness or most likely unawareness of such quality concepts. It is clear from Table 6, that all the beef processing factories have practiced the definition of other properties concerning consumption, such as various information and instructions for use on the labels. A similar behavior was reported by Mulder (1996) for European beef plants.

Table 7: Identification of intended use of products

Identification of intended useof products	Number of factories	OK		N.ok	
		No.	%	N0.	%
Statement and documentation of the target consumers for the product destination.	6	0	0	6	100
Referring to the relevantlegislation.	6	0	0	6	100
Definitions of other properties concerning consumption such as various information and instructions for use on the labels	6	6	100	0	100

*Nok: Not Ok.

4.1.3 Process information features in beef processing factories 4.1.3.1 Flow diagram in beef processing factories

Flow diagrams feature	Number of factories	OK		N.ok	
		No.	%	No.	%
Description of production process and engineering flow sheets by the company.	6	0	0	6	100
Validation process engineering sheets by HACCP team.	6	0	0	6	100
Product safety in process/engineering flow sheets.	6	0	0	6	100

Table 7 presents the flow diagram features of beef processing factories. The results indicated that these plants have no flow diagram which is used to describe the production process. Hartig (1994) mentioned that the construction of a flow diagram chart is very useful in order to describe the products and locate the identification of the hazard at appropriate points on the chart. Also, Hathaway (1993) found that most of the Canadian beef beef plants possess a flow diagram. For the second feature which is pointed out in Table 7, all the plants under investigation lack the validation of process engineering sheets. This might be attributed to the absence of HACCP team in Sudanese beef processing plants. According to Mortimore and

Wallace (2000) a HACCP team members need to be provided with the ability to draw a flow diagram.

Table 8: Flow diagram in beef processing factories

*Nok: Not Ok.

4.1.3.2 Facility lay – out in beef processing factories Table 8 shows facility lay – out feature in the beef processing factories. One third of these plants have personal facilities and locker rooms. The Sudanese beef processing factories are not similar to Anderson and Dormedy (1999) who found that most of the American beef plants have personal facilities and locker rooms. For the second feature, two thirds of the factories plants have the possibility of cross contamination between raw materials and processing aids, intermediate and end products, personnel and waste, while the risks of cross contamination does not exist in only one third of the beef processing factories. It is established that process facilities are the tool and key for the enhancement of food safety (Bernard *et a.*, 1994). It is clear from the previous observation that the possibility of cross contamination, which will certainly lead to deterioration of products quality, is very high

4.1.3.3 On site verification of the flow diagram in beef processing factories Table 9 represents on site verification of the flow diagram in beef processing factories. The results revealed that all of the plants did not adopt the updating of the systematic process flow/engineering diagram and consequently, updating was not done on a yearly basis. It is clear that the absence of the flow diagram will certainly lead to absence of verification. This situation did not meet the requirement stated by Huss (2004) who pointed out the importance of a constructed flow diagram and its on - site verification and inspection during all hours (night shifts, weak end) for accuracy. These Sudanese beef processing factories did not cope with Troller (2003) who found that most of the British plants have scheduled verification on place

Table 9: On site verification of the flow diagram

On site verification of the flow diagram	Number of factories	OK		Nok	
		No.	%	No.	%
Updating the systematic process flow / engineering diagram to keep these as built.	6	0	0	6	100

Taking place at least on a yearly basis so as to allow for evaluation of product safety, risk and quality assurance aspects.	6	0	0	6	100

Nok: Not Ok.

5. Conclusions and Recommendations

5.1 Conclusions

From the outcome of the survey carried out for six meat plants manufacturing meat products in Khartoum State, the following conclusions relevant to HACCP system implementation in these plants, as follow:

*All these factories believe in company policy on product safety is willing to implement the HACCP system as a tool towards total quality assurance for their products.

*It seemed that it is still a long way to go for these meat plants to start implementing appropriate HACCP system which help them in market accessibility.

5.2 Recommendations

For meat factories, to start implementing food safety monitoring system such as HACCP, it is recommended to start first implementing food safety pre-requisite protocol such as good manufacturing practices (GMPs), and Sanitation Standard Operating Procedures (SSOP) which would obviously act as appropriate base for future implementation of the HACCP system.

Further efforts are needed for training the staff of these plants to help them on issues related to HACCP elements as well on other quality management requirements.

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APPENDIX (1)

HACCP Checklist

QUESTION…. .(OK) or (NOK)

1. Company Information 1.1General information

a. Name
b. Address of the site
c. Production process

1.2 Process control

1.2.1 Is a documented process control system available describing how the company assures safety
1.2.2 and quality of the products?
1.2.3 Are process control flow charts available covering all aspects which are relevant and
1.2.4 which are pertinent to the application legislation?

1.3 Responsibilities for product safety . . (OK) (NOK)

1.3.1 Is product safety included in the company policy?
1.3.2 ..Is it documented that the management is responsible for the quality /safety policy and
1.3.3 its documentation, and commitment and employee motivation?
1.3.4 Is the policy and its related objectives addressing product hygiene and acceptance of raw
1.3.5 materials and/or food production?

1.2.4 Is the documented HACCP system covering
a. product, groups of products?
b. production lines?
c. sites

1.2.5 Is the policy known and understood at (all) levels of

1.2.6 the organization?
1.2.7

1.4 HACCP Teams (OK) or (NOK)

1.4.1. Are HACCP teams identified and operational for maintaining the HACCP process control system?

1.4.2 Is sufficient expertise in the various fields present in these teams for setting up and
1.4.3 maintaining HACCP system?
1.4.4 Are criteria established for membership of HACCP teams?