

INTRODUCTION

Nowadays food quality and safety management systems in agribusiness and food industry are complex and dynamic. Global trade, competitive markets ,beside increasing public and private safety and quality requirements ,consumer trust and emerging hazards ,are consider as pressure factor. Which increase the need to design, control, improve, and assure production and preparation of healthy, authentic, and palatable food that is safe, and is produced in a sustainable way .Quality management systems (QMS) and food safety management systems (FSMS) is kind of effort agribusiness and food industry which need public and private assurance guidelines and standards like The hazard analysis and critical control points HACCP,BRC(British Retail Consortiuns),SQF(Safe Food Quality), GLOBAL GAP and ISO22000. (Abd Allah, 2018). Over all an effective HACCP system is one that lead production of safe food via systemic approach, many food companies around the world are already implemented or are in process implementing HACCP or an ISO 9000program. Implementing both systems is aim of some plants recently. (parbut, 2015). It is a generally held belief that HACCP is best applied by a multidisciplinary team, thus delivering a stronger food safety system than could be developed by individuals (Wallace, 2009).The Hazard Analysis and Critical Control Point (HACCP)system, as a new method of food safety assurance, in several countries, in particular in the industrialized countries.(Motarjemi, 1998) .The term is becoming widely recognized as a management tool capable of ensuring food safety and well known in food control and public health circles and is one which evokes food safety (Motarjemi, 1998Makiya and Rotondaro, 2002) . The HACCP system improves product safety by anticipating and preventing health hazards before they occur (silva, 2002). Implementing the HACCP concept includes food processing and the overall food chain, thus providing safe food to the consumer. Livestock products are easily contaminated

by pathogenic bacteria because there is enough protein and water activity for the bacteria to grow considered as 'high-risk foods'. (Mohammed, 2018 and Animal and Plant Sciences, 2017). A majority of cases of food poisoning are in fact caused by eggs and egg-based products, which account for about one third of foodborne illness outbreaks also, Poultry in particular chicken and minced chicken meat and Food eaten raw. (Principle of hygiene, 2012). The meat is one of the most important nutrients sources of protein in the human diet (Mohammed, 2018). During preparation and processing meat exposed to biological and chemical pollution through water sources, with slaughtering process or by worker processing and handling (ACMSF, 1995). On the other hands, controls of microorganisms during processing of poultry played an important role in determining the quality of end product. This control has ensured that the product did not present any diversity to the consumers health (Stephenj, 2000). Also in long carcasses shelf life in the unfrozen state (Amel, 2008). Two fundamental concepts must be considered during the slaughtering process to minimize the degree of contamination. First and foremost is the use of procedures which will minimize the degree of contamination on carcasses during the slaughtering process (Tompkin, 1994). HACCP is more effective system, because the emphasis of HACCP is upon prevention. In addition, HACCP combines prevention with detection at the food chain steps where food safety problems are most likely to occur.

OBJECTIVE:

The main objective of this thesis was investigation the status good hygienic practice in poultry in slaughtering process as primary step in application HACCP in broiler chain in Atbara city – river Nile – Sudan.

Specific objectives are:

1. To define the implemented level of food safety system in poultry meat in Atbara locality.
2. To determine the HACCP knowledge and skills in term of good manufacture producers.
- 3- Develop Hygienic Assessment System (HAS) guidelines to ensure quality and food safety in poultry production and processing chain in Atbara locality.
- 4- Reduce contamination below current levels by enhance Good HygienicPractice (GHP).

CHAPTER ONE

LITRETURE REVIEW

1.1: Food safety:

People right of health safety food is recognized through International Conference on Nutrition (ICN) in Rome in(1992/2014) by establishing and implementing effective food safety systems along the whole food chain (codex,5 2013; WHOfood safety , October 2017). (Motarjemi and Aferstein 1999) adopted that although food safety is primarily a health problem we need to involve other government and public sectors to improve food safety requires. Also food safety programs shared responsibility coordinating role with other sectors (codex5, 2013).Despite of the government's efforts to provide healthy food and safety, there is more than 1,80million people die every year from diarrhea transmitted by ,contaminated food or drinking water and the most vulnerable groups, are children under the age of five , older , pregnant women and diseased. In countries that Lack of hygiene Diarrhea caused by contaminated food and malnutrition is the leading cause of high infant mortality (WHO, 2007). (Mckenzie and Hathaway, 2006).

1.2: Food borne disease:

Food is essential to life but if contaminated can cause illness and even death. Fortunately, the latter only happens in a minority of cases, although the morbidity associated with the millions of cases of food related illness worldwide has significant social and economic consequences .A range of terms including food poisoning, foodborne illness and foodborne disease are encountered in the literature and can cause confusion (Roberts, 2002).Some foods are naturally poisonous or toxic (Brownsell *etal.*, 1989). Other foods may go through a prolonged and increasingly international process from farm/producer to the point of consumption. At each step there is the potential for contamination with

chemical, physical or microbiological hazards with or without growth of the latter. Food safety, synonymous with food hygiene, embraces anything in the processing, preparation or handling of food to ensure it is safe to eat. The food chain, like any other chain, is only as strong as its weakest link and the responsibility for food safety lies not only with producers and processors of food, but also governments and consumers themselves (Mead *et al*, 2000 and Griffith, 2006) Primary production should be managed in a way to ensure the safety of food for its intended use by adopting practices and measures under appropriately hygienic conditions. Where necessary. Environmental hygiene, personal hygiene, food source, storage and packages should be considered at all stages especially where high probability of contamination may exist and take specific measures to minimize. (CAC, 2003).

1.3: Importance of food safety:

Consumers should be offered a wide range of safe and high quality products. This is the essential role of the Market. The food production chain is becoming increasingly complex. Every link in this chain must be as strong as the others if the health of consumers is to be adequately protected. This principle must apply, so an effective food safety policy must recognize the inter-linked nature of food production. It requires by assessment and monitoring of the risks to consumer health associated with raw materials, farming practices and food processing activities, it requires effective regulatory action to manage this risk and it requires the establishment and operation of control systems to monitor and enforce the operation of these regulations. Each element forms part of a cycle: thus, developments in food processing can require changes to existing regulations, whilst feedback from the control systems can help to identify and manage both existing and emerging risks. Each part of the cycle must work if the highest possible food safety standards are to be enforced. (Brussels, 2000)

Food safety provides food which is safe and suitable for consumption. Ensure that consumers have clear and easily-understood information, by way of

labeling and other appropriate means. Protect their food from contamination and growth/survival of foodborne pathogens by storing, handling and preparing it correctly. Maintain confidence in internationally traded food (codex, 2003).

1.4: food safety approach:

Food safety and quality are best assured by an integrated, multidisciplinary approach, considering the whole of the food chain. Eliminating or controlling food hazards at source, i.e. a preventive approach, is more effective in reducing or eliminating the risk of unwanted health effects than relying on control of the final product, traditionally applied via a final 'quality check' approach. Approaches to food safety have evolved in recent decades, from traditional controls based on good practices (Good Agricultural Practice, Good Hygienic Practice, etc.), via more targeted food safety systems based on hazard analysis and critical control points (HACCP) to risk-based approaches using food safety risk analysis (MckenzieandHathaway, 2006).

1.5: HACCP system:

HACCP is a system based on a scientific approach that monitors food production, storage and distribution. It aims to prevent pollution rather than evaluating the final product. The system also shifts responsibility to the food producer to ensure that the product is safe to consume. (codex, 1994) .Hazards can be biological, chemical or physical' (Codex, 1993) But recently Codex define the hazard (the potential to cause harm this definition highlighting of HACCP place on food control. This preventative concept is important because it identifies the potential food safety problem areas, adds corresponding critical control action steps, tracks corrective measures and rechecks for safety in a systemic approach (Brosseau 2000). The intent is food safety from farm-to-table. The WHO depend HACCP as internationally agreed approach to food safety control (2007) .the Codex Alimentary Commission of the joint United Nations Food and Agriculture Organization (FAO)/WHO Food Standards

Programme (Codex 1993, 1997' and 2003) is published reference standard for the HACCP implementation. The successful application of HACCP requires the full commitment and involvement of management and the work force. It also requires a multidisciplinary approach; which include, expertise in agronomy, veterinary health, production, microbiology, medicine, public health, food technology, environmental health, chemistry and engineering, according to the particular study (*Anne, CAC 1997*) The efficacy of any HACCP system will nevertheless rely on management and employees having the appropriate HACCP knowledge and skills, therefore ongoing training is necessary for all levels of employees and managers, as appropriate. The application of HACCP is compatible with the implementation of quality management systems, such as the ISO 9000 series, and is the system of choice in the management of food safety within such systems. (*Anne, CAC, 1997*) Over all an effective haccp system is one that lead production of safe food via systemic approach (parbut 2015). In addition to all food safety management systems must be grounded in the elements that the ISO22000 standard deems as essential to guarantee the safety of food at every link in the food chain.

1.5.1: HACCP History:

The united states of America was the first country to develop a HACCP system in food-related authorities, such as the International Food Standards Committee for Microbiological Standards, the International Association of Dairy and Food Safety and environmental Hygiene (Kvenberg *etal.*, 2000).. HACCP was known for the first time in (1960) when Pillsbury Corporation cooperated with national aeronautics and space administration (NASA) to ensure safety food for astronauts (Bauman, 1990 ; Bennet and Steed, 1999; Yunus and Ray 2007). In 1971, critical point monitoring and good manufacturing practices were tested. In august 1972 the food safety companies, use the risk analysis in food safety systems. Even as far back as 1978, safe food was implicitly recognized in the Declaration of Alma Ata as one facet of the essential elements of Primary

Health Care. Provision of food and proper nutrition. Therefore, and contrary to prevailing views at that time, all countries and particularly those in greatest need should be concerned with food safety and not just food security (Codex, 5. 2013). At the end of (1980) HACCP system has been widely known at a national level as a tool to guarantee food safety (Guzewich, 1985; Kit and Patricia, 2008; Codex Committee on Food Hygiene; 1997). In 1992, this committee composed a HACCP document that they revised in 1995. The current revision added definitions and included sections on prerequisite and education programs. It also explained the application of HACCP principles and provided a decision tree to identify critical control points (National Advisory Committee on Microbiological Criteria for Foods, 1997 and Brosseau 2000). Updated food safety law in 2011 made the companies in the Food industry change drastically to comply with regulations and laws (Codex 5, 2013).

1.5.2: HACCP Plan:

The term HACCP program has been used interchangeably with HACCP plan by some, and indeed depending on the type of application and size of business HACCP plan may be the appropriate way to handle operations. Technically, the HACCP plan is restricted to the 7 steps of HACCP and its basic pre-requisite programs (sanitation standard operating procedures, good manufacturing practices, allergen standard operating procedures and environmental controls, etc...) (Marianne, 2013). Therefore, to a successful HACCP program and properly implemented, management must be committed to a HACCP approach. A commitment by management will indicate an awareness of the benefits and costs of HACCP and include education and training of employees. In addition to enhanced assurance of food safety, are better use of resources and timely response to problems (WHO and FAO, 1997). HACCP plan must address the unique features of the plant's process, equipment, layout, people and other factors. (Tompkins, 1994). Effective HACCP implementation is very important

to avoid the adverse human health and economic consequences of food-borne illness or food borne injury(Brian, 2006)

1.5.3: HACCP Principles:

The principles of HACCP have been described by Codex (1993) and in this issue of *Food Control* by Aferstein (1994). Additional information is available from ICMSF (1988), NACMCF (1992), ILSI Europe (1993) and others. The Principles of the HACCP System set the basis of requirements for the application, while the Guidelines for the Application provide general guidance for practical application, According to Codex Alimentarius, (2003).

1.5.3.1: Principle 1: Conduct a Hazard Analysis.

The definition of a hazard given by CAC is any biological, chemical, or physical agent in, or condition of food with the potential to cause an adverse health effect.

1.5.3.2: Principle 2: Determine the Critical Control Points (CCP)

CCP: A step at which control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level. The determination of a CCP in the HACCP system can be facilitated by application of a decision tree, which indicates a logic reasoning approach(*CAC/RCP, 1969*)

1.5.3.3: Principle 3: Establish critical limits for each CCP:

Critical Limit: A criterion which separates acceptability from unacceptability. Critical limit must be specified and validated for each Critical Control Point.

1.5.3.4: Principle 4: Establish a system to monitor control of the CCP:

Monitoring is the scheduled measurement or observation of a CCP relative to its critical limits. The monitoring procedures must be able to detect loss of control at the CCP. Most monitoring procedures for CCPs will need to be done rapidly because they relate to on- line processes and there will not be time for lengthy analytical testing(*Annex to CAC/RCP, 1969*)

1.5.3.5: Principle 5: Establish the corrective actions:

Corrective action: Any action to be taken when the results of monitoring at the CCP indicate a loss of control. Specific corrective action must be developed for each CCP in the HACCP system in order to deal with deviation when they occur. The action must ensure that the CCP has been brought under control (*Annex to CAC/RCP, 1969*)

1.5.3.6: Principle 6: Establish verification procedures:

Verification: The application of method, procedures, tests and other evaluation, in addition to monitoring to determine compliance with the HACCP plan. Establish procedures for verification. Verification and auditing methods, procedures and tests, including random sampling and analysis, can be used to determine if the HACCP system is working correctly. The frequency verification should be sufficient to ensure that the HACCP system is working effectively (*CAC/RCP, 1969*)

1.5.3.7: Principle 7: Documentation and record keeping:

Efficient and accurate record keeping is essential to the application of a HACCP system. HACCP procedures should be documented. Documentation and record keeping should be appropriate to the nature and size of the operation and sufficient to assist to verify that the HACCP controls are in place and being maintained. (*Annex CAC/RCP, 1969*)

1.5.4: Steps for HACCP Implementation:

- 1- Management Commitment.
- 2- Assembling the HACCP Team.
- 3- Training of the Personnel: trained in good manufacturing and handling for employee involved is sectional also education program should be created to enable constant updating (Cezari and Nascimento, 1995).

1.5.5: HACCP application in Poultry industry:

1.5.5.1: Poultry production and processing:

The main goal of farmers is to achieve high feed conversion and sufficient disease control to maintain a good health status and maximize the growth rate. (Tompkin, 1994). The control of microbial contamination during poultry presses is very difficult compare with other meat due to a number unique feature (Gabeer,*etal*, .2012). The implementation of the HACCP systems on broiler farms not only increasing productivity but also improving systemic farm management. Furthermore, reduce food poisoning caused by chickens (Nam, 2017). Risk FBD during production and processing is often related general hygienic principle(pre requesting) such as non-pot pal water ,lack of hygiene during handling and processing as well as secondary contamination (Ana, 2012). Codes of hygienic practice have been developed for the production of fresh meat and poultry (Codex, 1976, 1993a, 1993b) and for processed meat and poultry products (Codex, 1986; Tompkin, 1994). Training workers in the proper use of knives and equipment, providing adequate work space and time to perform each function correctly, providing a plant layout that favors microbial control, and selecting equipment which is readily cleanable is necessary to minimize the degree of contamination on carcasses during the slaughtering process (Tompkin, 1994). So that The use of HACCP for the meat and poultry industry must begin at the farm because certain safety concerns cannot be eliminated during the slaughtering process (Tompkin, 1994).

1-6: Food hygiene:

food hygiene is tool and condition that lead to control the risk and ensure the fitness of the consumer, another concept there are no food contaminants in preparation or consumption lead negative effects on the consumer health, while Food suitability is change in the product characteristic, taste, Odor and, texture .(codex 2003). Both food safety and food suitability must be applied in food

chain, to avoid the adverse human health and economic consequences of food borne illness, food borne injury, and food spoilage (food hygiene).

1.6.1: Hygienic factor in food process:-

Number of consideration must be taken for the products during prepared of raw materials for marketing such as origin, cleanliness, conformity, labeling and characteristics, also in put use packaging, plant protection products, etc. (annex.)

1.6.2: the general hygiene principles:

Dictated by the Codex primarily (2003) concern the following six points:

1. Hygiene measures related to production conditions (healthy operating, premises and packing station).
2. Measures for personnel hygiene (health status, personal cleanliness, clothing, access to facilities, etc.).
3. Hygiene measures related to facilities: cleanliness of equipment and apparatus, (storage material, sorting devices, grading devices, etc.).
4. Aspects related to handling, transport and storage of products.
5. Aspects related to control of operations (raw materials, water quality, etc.).
6. Aspects related to maintenance, cleaning and waste management.

The implementation of these general principles protect consumer from illness or injury , provide assurance for food to be human consumption, maintain confidence in internationally traded food, and provide health education programs which effectively communicate the principles of food hygiene to industry and consumers.(CAC/RCP ,1969).

1.6.3: Good hygienic practices (GHP):

The GHP are mandatory standards for all industries and food producing businesses. It consist of a set of procedures and quality standards of products or services in the food industry, including materials and utensils these products may get in contact with , to ensure that the customers are not exposed to any food-related risks (Akutsu *etal.*, 2005). In Sudan, Siham and Abdalla (2010)

recorded that the know of hygienic practices for all food worker is necessary to prevent the food and its products from contamination.

1-6-4: Good Manufacturing Practices:

Cover the fundamental principles, procedures and means needed to design an environment suitable for the production of food of acceptable quality (Stephenj, 2000).

1.7: Preregust programs:

Prerequisite programs is a Procedures, including Good Manufacturing Practices, that address operational conditions providing the foundation for the HACCP system.it is essential before HACCP application particular activities which are directed toward ensuring the necessary conditions exist for the prevention of potential contamination and cross contamination of food (Nagah, 2004 and Amel, 2008). (P R P) increase effectiveness food safety management by controlling general hygiene and environmental condition in food processing operation (WallaceandWilliams, 2001). Although Prerequisite programs are established and managed separately from the HACCP plan(Brosseau 2000)the success or failure HACCP application depend on correctly implemented prerequisite program(Wallace, 2009).Good manufacturing practices and sanitation standard operating procedures is the main prerequisite programs. These programs include the following aspects:

1.7.1: Facilities:

The establishment should be located, constructed and maintained according to sanitary design principles. There should be linear product flow and traffic control to minimize cross-contamination from raw to cooked materials. (NACMCF1997).

1.7.2: Supplier Control:

Each facility should assure that its suppliers have in place effective GMP and food safety programs. These may be the subject of continuing supplier guarantee and supplier HACCP system verification. (NACMCF1997.)

1.7.3: Specifications:

There should be written specifications for all ingredients, products, and packaging materials. (NACMCF1997.)

1.7.4: Production Equipment:

All equipment should be constructed and installed according to sanitary design principles. Preventive maintenance and calibration schedules should be established and documented. (NACMCF1997.)

1.7.5: Cleaning and Sanitation:

All procedures for cleaning and sanitation of the equipment and the facility should be written and followed. A master sanitation schedule should be in place. (NACMCF1997.)

1.7.6: Personal Hygiene:

Personal hygiene is critical in preventing contamination of food and food borne illness so that. All slaughter worker and other persons who enter the manufacturing plant should follow the requirements for personal hygiene such as wear hair nets, wash their hands before and after breaks, visits to the toilets and as necessary during production, clean and sanitize gloves, knives, aprons as necessary during production to minimize contamination (Brendan *etal.*, 2009).

1.7.7: Training:

All employees should receive documented training in personal hygiene, GMP, cleaning and sanitation procedures, personal safety, and their role in the HACCP program. The training must be followed by the practical application of knowledge (Marienne, 2013). Knowledge and understanding of the Principles of HACCP is normally achieved through training, which is believed to be a key aspect of HACCP (Wallace, 2009). A continuing education program should be created to enable constant updating (Cezari and Nascimento, 1995).

1.7.8: Chemical Control:

Documented procedures must be in place to assure the segregation and proper use of non-food chemicals in the plant. These include cleaning chemicals, fumigants, and pesticides or baits used in or around the plant. (NACMCF1997).

1.7.9: Receiving, Storage and Shipping:

All raw materials and products should be stored under sanitary conditions and the proper environmental conditions such as temperature and humidity to assure their safety and wholesomeness. (NACMCF1997).

1.7.10: Traceability and Recall:

It means the ability to identify all the stage of product include, the place of component ,origin and the storage in addition to handling, test of product and consumers (principle hygiene and food safety management) (NACMCF1997.)

1.8.11: Pest Control:

Effective pest control programs should be in place. physical structure and maintenance of the premises, water supply, handler health and personal hygiene,

pest control, sanitization of premises and equipment, calibration of instruments, quality control of raw material and ingredients, recall procedures, and measures related to consumer complaints (Brasil 1998 and Wallace 2009). Selected for this study because of the tremendous "growth" pressures that are affecting the food industry and the need for increased awareness of food safety issues by employees. The combination of rapid growth in the food service industry without adequate training and subsequent Awareness of implementation are situations that create an environment for increased food borne illness.

CHAPTER TWO

METHODOLOGY AND PROCEDURES

2-1: Purpose:

The purpose of this study is to study current situation level of hygienic assessment system (H A S) through knowledge, practice and attitudes (K A P) as prerequisite program in the HACCP application in broiler marketing chain, which is prime important or start point of food safety especially in small scale in Atbara locality. Where we have a long way to achieve HACCP program (Motarjemi and Aferstein, 1998) in small food businesses, the HACCP system has still not made headway. The findings may provide preliminary data.

2.2.: Study area:

This study was carried out in Atbara city, River Nile State, Sudan

2.3.: Study design:

This study examined Hygienic Assessment System (H A S) through knowledge, practice and attitudes (K A P) for:

- Top management, (producer)
- Slaughter worker.

Depending on previous study in Mozambique (Ana, 2012) hazard especially biological can occur from farm or slaughter. Many of the hazards attributed to food originate in the failure to respect hygiene rules at the place of production. This can be in the field or on the packaging line, or during storage or transport (principle of hygiene and food safety management). In broiler marketing chain the hazard (biological, chemical and physical) can occur from farm or during, after slaughter processing for this reason the study focusing at these two points.

Focusing GHP- KPA (knowledge, practice, attitudes) in slaughter processing which takes place at farm, there isn't slaughter house in Atbara locality area of the study.

2.3.1.: Sampling plan and data collection:

Distributed tow items of questionnaire, each items involve 30 responders of top manger producer and slaughter worker using interviewing survey and observation of sanitation measures during slaughtering process.

2.3.2. Questionnaire Design

The questionnaire consisted of a first set of 5 demographic questions (age, sex, education level, , type of system and duration of work.), followed by, 7 items related to general quality knowledge (Appendix 1).

Questionnaire comprised distinct parts; food safety knowledge, attitudes and meat hygienic practices.in the part of food safety knowledge, three answer option were provided (agree, dis agree and no idea) to statement of wash hand before work, using gloves and proper handle clean utensil decries the level of contamination .also the risk of poultry meat poison and zoonotic disease transfer by poultry meat (salmonella, typhoid ,,,etc.). The same three option for the part of food safety attitudes we can reduce the risk of contamination by (using protective mask, gloves, apron, etc....), training in food hygiene, evaluated worker health status and in proper slaughter reduce the quality of meat. The questionnaire evaluate implemented meat hygienic practice of slaughter worker during slaughtering process through personal hygiene (eat, drink and smoke during work also wear protective cloth in addition to release permission for thick workeSr especial (eye infection, cough, and influenza). In proper slaughter reduce quality of product

2-3-3: Data analysis:

Data were analyzed using SPSS software for windows, version 18,5descreptive statistics were provided to calculate, frequency, chi square and correlation values.

CHAPTER THREE

RESULT

3.1: Quality knowledge:

Questionnaire data collected from 30 broilers producers in Atbara locality about quality knowledge as base for the HACCP knowledge through score group (" high knowledge" ," middle knowledge" and " low knowledge" in score range ("70 to 50" ,"49 to 30" and "29 to 10") respectively) showed that the responders had high knowledge were 46.7%, had middle knowledge were 36,7% and had low knowledge were 16,3 (table1).

Table (1): Quality knowledge of 30 broilers producer in Atbara city

Score groups	Score range	Frequency	Percent	Cumulative percent
high knowledge	70- 50	14	46,7	46,7
Middle knowledge	49 – 30	11	36,7	83,3
low knowledge	29- 10	5	16,3	
Total		30	100	100

3.2: Demographic Characteristic:

Demographic characteristic data collected through the questionnaire about sex, age, education, duration of work and system of work. For producers mentioned those male participants were (83.3%) compare with 16, 7% were females (table2). Participants over 40 years were 60% is, from 30 to 40 years were 36.7% while participants from 20 to 30 years were 3.3% (table3). Results obtained about the education level said that high educated participants were 86.7% and secondary educated participants were 13, 3% (table4). Data about

duration of work recorded that participants had duration from 1 to 5 years were 16.5% , from 5 to 10 years were 50% and 33,3% in range (1- 5 years), 16,5% while participants have more than 10 years duration were 33.3% (table5). Also data showed that 60% of participants were using open system in contrast 40% were using semi close system (table6). These results showed strong positive association between quality knowledge for top management (producers) – educational level (table7).

Tables of Demographic characteristic of 30 broilers producer in Atbara city:

Table (2): Sex

Valid	Fragrance	Percent	Valid percent	Cumulative percent
Male	25	83.3	83.3	83.3
Female	5	16.7	16.7	16.7
Total	30	100	100	100

Table (3): Age

Valid	Fragrance	Percent	Valid percent	Cumulative percent
30-20	1	3.3	3.3	3.3
40-30	11	36.7	3.3	40.0
40>	18	60	60	100
Total	30	100	100	

Table (4): Education level

Valid	Fragrance	Percent	Valid percent	Cumulative percent
High	26	86.7	86.7	86.7
Secondary	4	13.3	13.3	100
Total	30	100	100	

Table (5): Duration of Work

Valid	Fragrance	Percent	Valid percent	Cumulative percent
1-5	10	33.3	33.3	33.3
5-10	15	50	50	83,3
10>	5	16.7	16.7	
Total	30	100	100	100

Table (6): Type of system

Valid	Fragrance	Percent	Valid percent	Cumulative percent
Open	18	60	60	60
Semi close	12	40	40	40
Total	30	100	100	100

3.3: Food safety knowledge and attitudes:

Questionnaire data concerning slaughtering process focusing on food safety knowledge, attitudes and meat hygienic practice, obtained from slaughtering process of thirty slaughter workers in Atbara, mentioned that 60% of the responders had high knowledge in food safety, 23.3% had mid knowledge and 13.7% had low knowledge (Table7). Also data illustrated that responders believed that washing hands before work minimize the risk of contamination were 83, 3%, while 16, 7% of them had no idea (Table8). Also 90 % of the responders were agreeing with using gloves for same purpose and 10% of them had no idea (Table9). Responders agree with proper cleaning and handlings of instruments to reduce the risk of contamination were 66.7%, while 33. % had no idea. (Table10) .Data showed that 36.7% of responders know that there is a risk of meat poultry poisoning, while 40% of them said there is no risk and the rest (23.3%) had no idea (Table11). Also results mentioned that the responders believed that there is a risk of zoonotic disease transfer through poultry meat were 36.7, in contrast 23.3% of them did not believe that while the rest (30%)

had no idea (Table 12). In addition results showed that 23.3 % of the responders agree with hygienic practice reduce the cost decries the quality, 26.7% disagree and 50. %had no idea (Table13). In food safety attitudes (86, 7%) of responder had excellent attitude compare with 13, 3% had bad attitudes(table 14) the study recorded that there was 60% of responder agree with using of protective clothes (gloves ,mask and apron) to reduce the risk of contamination , while 23% disagree with that and 16.7% had no idea (Table15). Also Responders agree with importance of training in food hygiene were 80%, while 6.7% disagree and 13, 3% had no idea (Table16). Results obtained mentioned that 43,3% of the responders were agree with evaluated health workers status before work, 10% of them disagree and % 46.7 had no idea (Table17). The study showed that 93,3% of the responders agree with the condition of in proper slaughter reduce the quality of meat, 3.3% disagree with that and 3.3% were had no idea (Table18). The study illustrated a positive association between food safety attitudes food hygiene trying $P < 0.000$ Table (19) and (20).

Table (7) :Food safety knowledge of 30 slaughter workers in Atbara city

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid high knowledge	18	60.0	60.0	60.0
mid knowledge	7	23.3	23.3	83.3
low knowledge	5	16.7	16.7	100.0
Total	30	100.0	100.0	

Table (8) : knowledge of wash hand decrease contamination :-

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	25	83.3	83.3	83.3
	no idea	5	16.7	16.7	100.0
	Total	30	100.0	100.0	

Table (9) : knowledge of Use gloves decrease contamination

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	27	90.0	90.0	90.0
	no idea	3	10.0	10.0	100.0
	Total	30	100.0	100.0	

Table (10): knowledge of clean utensil and proper handle

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	20	66.7	66.7	66.7
	Noida	10	33.3	33.3	100.0
	Total	30	100.0	100.0	

Table (11):Risk of poultry meat poisoning

		Frequen cy	Percent	Valid Percent	Cumulative Percent
Valid	Agree	11	36.7	36.7	36.7
	dis agree	12	40.0	40.0	76.7
	no idea	7	23.3	23.3	100.0
	Total	30	100.0	100.0	

Table (12): Zoonotic disease transfer by poultry meat

		Frequen cy	Percent	Valid Percent	Cumulative Percent
Valid	Agree	11	36.7	36.7	36.7
	dis agree	10	33.3	33.3	70.0
	Noidea	9	30.0	30.0	100.0
	Total	30	100.0	100.0	

Table (13): Implementation hygienic practice

		Frequen cy	Percent	Valid Percent	Cumulative Percent
Valid	Agree	7	23.3	23.3	23.3
	dis agree	8	26.7	26.7	50.0
	no idea	15	50.0	50.0	100.0
	Total	30	100.0	100.0	

Table (14): food safety attitudes of 30 slaughter worker in Atbara city

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	26	86.7	86.7	86.7
	Bad	4	13.3	13.3	100.0
	Total	30	100.0	100.0	

Table (15): protective cloth

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	18	60.0	60.0	60.0
	disagree	7	23.3	23.3	83.3
	no idea	5	16.7	16.7	100.0
	Total	30	100.0	100.0	

Table (16): Food hygienetraining

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	24	80.0	80.0	80.0
	disagree	4	13.3	13.3	93.3
	no idea	2	6.7	6.7	100.0
	Total	30	100.0	100.0	

Table (17): Work health status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	13	43.3	43.3	43.3
	disagree	3	10.0	10.0	53.3
	no idea	14	46.7	46.7	100.0
	Total	30	100.0	100.0	

Table (18): in Proper slaughter

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	28	93.3	93.3	93.3
	disagree	1	3.3	3.3	96.7
	no idea	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

Table (19): Association food safety attitudes and hygiene training

		food safety attitudes		Total
		Good	Bad	
food hygienetraining	Agree	23	1	24
	disagree	1	3	4
	no idea	2	0	2
	Total	26	4	30

Table(20): Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.216 ^a	2	.000
Likelihood Ratio	10.748	2	.005
Linear-by-Linear Association	3.169	1	.075
N of Valid Cases	30		

a. 5 cells (83.3%) have expected count less than 5. The minimum expected count is .27.

3.4: Meat hygienic practices during slaughtering process:

The study showed that 10% of the slaughter workers had good hygienic practices in in slaughtering process, in contrast to 90% of the workers had bad practices (Table21). There were 63, 3% of workers were eating and drinking during their work, 30% of them sometimes did and 6, 7% never did (Table 22).In addition to 43, 3% of the workers were smoking during their work, 20% of them sometimes did and 36.7% never did (Table 23). Also washing hands before work was always one by 22.6% of the workers, 67% of them were sometimes done and 5.6% were never did (Table24). the study found that 26,7% of responders always had thick leave permit ion When they were thick63,7% of them sometimes had and 10% never had (Table25). The responders using uniform (cap, boats, mask...) always were 6, 3%, while 50% of them were using sometimes and 43, 7% were never using (Table 26). There were not association between knowledge andattitudes (Table 27), knowledge andpractices (Table 28) and attitudesand practices concequal no correlation (Table 29)

Table (21): Meat hygienic practice during slaughtering process of 30 slaughter worker in Atbara city

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Good	3	10.0	10.0	10.0
Bad	27	90.0	90.0	100.0
Total	30	100.0	100.0	

Table (22): Eat and drink

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Always	19	63.3	63.3	63.3
some times	9	30.0	30.0	93.3
Never	2	6.7	6.7	100.0
Total	30	100.0	100.0	

Table (23): Smoke on work

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Always	13	43.3	43.3	43.3
some times	6	20.0	20.0	63.3
Never	11	36.7	36.7	100.0
Total	30	100.0	100.0	

Table (24): Wash hand

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Always	7	3.3	23.3	23.3
	Sometimes	21	0.0	70.0	93.3
	Never	2	.7	6.7	100.0
	Total	30	100.0	100.0	

Table(25): Thick leave

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Always	8	26.7	26.7	26.7
	Sometimes	19	63.3	63.3	90.0
	Never	3	10.0	10.0	100.0
	Total	30	100.0	100.0	

Table(26): Use uniform

		Frequency	Percent	Valid Percent	Cumulative Percent
	Always	2	6.7	6.7	6.7
	Sometimes	15	50.0	50.0	56.7
	Never	13	43.3	43.3	100.0
	Total	30	100.0	100.0	

Table (27): Food safety and attitudes association

		food safety knowledge		
		good knowledge	mild knowledge	poor knowledge
food safety attitudes	Good	16	6	3
	Bad	2	1	2
Total		18	7	5

Table (28) Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.389 ^a	2	.303
Likelihood Ratio	2.004	2	.367
Linear-by-Linear Association	1.881	1	.170
N of Valid Cases	30		

a. 4 cells (66.7%) have expected count less than 5.
The minimum expected count is .83.

Table (29) :Food safety and hygienic practice

		food safety knowledge			Total
		good knowledge	mild knowledge	poor knowledge	
hygienic practice	Bad	15	7	5	27
	Good	3	0	0	3
Total		18	7	5	30

Table (30): Chi- Square Tests

	Value	Df	Asymp. Sig. (2- sided)
Pearson Chi-Square	2.222 ^a	2	.329
Likelihood Ratio	3.285	2	.194
Linear-by-Linear Association	1.787	1	.181
N of Valid Cases	30		

Table (31) :Correlations

		food saftey knowledge	food saftey attitudes	hygenic practise
food saftey knowledge	Pearson Correlation	1	.255	-.248-
	Sig. (2-tailed)		.174	.186
	N	30	30	30
food saftey attitudes	Pearson Correlation	.255	1	.149
	Sig. (2-tailed)	.174		.432
	N	30	30	30
hygenic practice	Pearson Correlation	-.248-	.149	1
	Sig. (2-tailed)	.186	.432	
	N	30	30	30

CHAPTER FOUR

Discussion

The study showed that the responders who had high quality knowledge as a base for the HACCP were 46.7%, had middle knowledge were 36% and had low knowledge were 16%. That means the majority of the responders did not have enough knowledge to deal correctly with poultry meat practices and this disagrees with McKenzie and Hathaway (2006) whom said that food safety and quality are best assured by an integrated, multidisciplinary approach, considering the whole of the food chain. Eliminating or controlling food hazards at source, i.e. a preventive approach, is more effective in reducing or eliminating the risk of unwanted health effects than relying on control of the final product, traditionally applied via a final 'quality check' approach. The study mentioned that male participants were (83.3%) compare with 16, 7% females. Participants over 40 years were 60%, from 30 to 40 years were 36.7% while participants from 20 to 30 years were 3.3% these results are in contrast with (Ulusoya and Çolakoğlu, 2013) who reported that the most participants with their age less than 40 years, graduated and received training on food safety system. Results obtained about the education level revealed that high educated participants were 86.7% and secondary educated participants were 13, 3%. Data about duration of work recorded that participants had duration from 1 to 5 years were 16.5% , from 5 to 10 years were 50% and 33,3% in range (1- 5 years), 16,5% while participants have more than 10 years duration were 33.3% . Also data showed that 60% of participants were using open system in contrast 40% were using semi close system. These results showed no association between quality knowledge for top management (producer) and demographic characteristics in contrast with Auwalu, *etal*(2016). Who obtained male knowledge was higher than women, although women practice is best. This study mentioned that 60%

of the responders had high knowledge in food safety, 23.3% had mid knowledge and 13.7% had low knowledge. Also data illustrated that responders believed that washing hands before work minimize the risk of contamination were 83, 3 %, while 16, 7% of them had no idea (Table. 8). Also 90 % of the responders were agreeing with using gloves for same purpose and 10% of them had no idea. Responders agree with proper cleaning and handlings of instruments to reduce the risk of contamination were 66.7%, while 33. % had no idea (Table.10). Data showed that 36.7% of responders know that there is a risk of meat poultry poisoning, while 40% of them said there is no risk and the rest (23.3%) had no idea (Table.11). Also results mentioned that the responders believed that there is a risk of zoonotic disease transfer through poultry meat were 36.7, in contrast 23.3% of them did not believe that while the rest (30%) had no idea (Table.11).In addition results showed that 23.3 % of the responders agree with hygienic practice reduce the cost decries, 26.7% disagree and 50. %had no idea (Table.13). In food safety attitudes the study recorded that there was 60% of responder agree with using of protective clothes (gloves, mask and upron) to reduce the risk of contamination, while 23% disagree with that and 16.7% had no idea. Also Responders agree with importance of training in food hygiene were 80%, while 6.7% disagree and 13, 3% had no idea. Results obtained mentioned that 43,3% of the responders were agree with evaluated health workers status before work,10% of them disagree and 46.7 had no idea. The study showed that 93, 3% of the responders agree with in proper slaughter reduce the quality of meat, 3.3% disagree with that and 3.3% were had no idea. The study illustrated a positive association between food safety attitudes and food hygiene trying which agree with Siham and Abdalla (2010) whom recorded that the know of hygienic practices for all food worker is necessary to prevent the food and its products from contamination. The study showed that 10% of the slaughter workers had good hygienic practices in slaughtering process; in c contrast to 90% of the workers had bad practices. There were 63,

3% of workers were eating and drinking during their work, 30% of them sometimes did and 6, 7% never did .in addition to 43, 3% of the workers were smoking during their work, 20% of them sometimes did and 36.7% never did. Also washing hands before work was always done by 22.6% of the workers, 67% of them were sometimes done and 5.6% were never done. The study found that 26, 7% of responders always had thick leave permit ion When they were thick 63,7% of them sometimes had and 10% never had . The responders using uniform (cap, boots, mask, etc...) always were 6, 3%, while 50% of them were using sometimes and 43, 7% were never using. this results showed that the majority of workers did not follow the good hygienic practices which is agree with results recorded by Magda*etal*(2014) whom said that the low percent in good hygiene practice indicated that personal hygiene is not implemented which contrast with Siham and Abdulla, (2010) who explained that all personal working in contact with food and food products must be adhered to hygienic practices while on duty to prevent corruption of product. The study also agrees with Auwalu, *etal* (2016).The abattoir workers had a positive attitude. And good practice, but a low level of knowledge

Conclusion:

Quality and safety knowledge as base for the HACCP knowledge is weak and worker lack training to obtain skills in good practices to protect the poultry meat production chain in Atbara locality.

Recommendations

- 1- Quality and safety knowledge as base for the HACCP knowledge need more attention and appropriate action must be done to prevent hazards facing poultry meat production.
- 2- Empowerment of rules to let producers and workers follow the good practices requirements for personal hygiene, safety and quality of products, protected production chain.
- 3- Improve training and skills in production chain practices.
- 4- Extension and awareness activities should be done to improve the level of knowledge.
- 5- More studies and researches are needed to obtain more information help in understanding and managing the process in poultry production chain.

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APPENDIX

Questionnaire

Demographic Characteristic

- 1- Age (years): (>20) (20-30) (30 -40) (<40)
- 2- Education : primary () secondary () higher () .
- 3-Duration of work (year) :(1-5 ()) (5-10()) (< 10 ())
- 4-type of experience : by work () training () education ().
- Type of system : open () semi close ().

- Haccp knowledge of top management (producer)

<u>Statement</u>	<u>Yes</u>	<u>No</u>
1- the basic line of quality control in poultry process		
2-Type of hazard you face in your work		
Withdrawal period of the drugs of poultry meat .3-		
4- Workerpersonal hygiene .		
5-implementatin quality system insure product .		
6- Safety of product is one of my responsibilities .		
If yes you have ability to improve your work .		

Poultry slaughter worker:

Food safety knowledge of workers in poultry and slaughter worker:-

statement	Agree	Dis agree	No idea
Washing hands before work reduces the risk of contamination			
Using gloves during work reduces the risk of contamination			
Proper cleaning and handling of instruments reduces the risk of contamination			
risk for poultry meat poisoning.			
Some zoonotic disease transfer by eating poultry meat (typhoid –salmonella ,,,)			
Implement of hygienic practice reduce cost decries quality			

Food safety attitudes of workers in poultry slaughter worker:-

Statement	Agree	Disagree	No idea
reducing risk of contamination by using protective clothes (mask gloves – apron)			
Food hygiene training of workers is an important reducing risk contamination			
Health status of the of workers should evaluated before employment			
In proper slaughter reduce quality product			

Meat hygienic practices in poultry slaughterhouses

Statement	Always	Some times	Never
Do you eat or drink in your work			
Do you smoke in your work?			
Do you wash your hand after and before touch raw meat			
Use clean and sterile utensils			
Do you have a leave when you are sick			
Do you have uniform for work			