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Food Safety Management Practices of Small and Medium Sized Food Industry Enterprizes in Tanzania

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FOOD SAFETY MANAGEMENT PRACTICES OF SMALL AND MEDIUM-SIZED FOOD INDUSTRY ENTERPRIZES IN TANZANIA

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FOOD SAFETY MANAGEMENT PRACTICES OF SMALL AND MEDIUM-SIZED FOOD INDUSTRY ENTERPRIZES IN TANZANIA

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DEDICATION

I dedicate this work to the people of the United Republic of Tanzania and those who need this knowledge. I also, dedicate the study to my sons and daughters as well as my wife.

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The study aimed to investigate the food safety practices of HACCP and ISO2200 in food establishments in Tanzania, focused on knowledge (awareness) and management practices of food safety systems. The research randomly surveyed 200 food establishments from three regions in the country; only 113 managers completed the survey. Research conducted face-to-face by questioning knowledge (employees and managers), management practices (ISO 22000, HACCP and prerequisites programs, GMP and SSOP), and demographic information.

Employees indicated to have more knowledge on the use of GMP (64.3 %) than HACCP (22.9%) and ISO22000 (15.4%) and training of employees was GMP (73.9 %), ISO22000 (19.2 %) and HACCP (27.1%). This knowledge was also measured by frequency of training results, which indicated inadequacy of twice per year almost 31.4 % for manager, and every 3 months (29.1%) employees.

Management practices of food safety systems indicated HACCP practices were inadequately done by only 26.6 % of food establishments by validating quality assurance and monitoring systems. This also included the management pratices of barriers and benefits of food safety systems (ISO 22000 and HACCP). Barriers indicated poor confidence in suppliers to provide appropriate raw material (25.7 %), lack of government support (17.3 %) and the least 4% volume of paperwork. While, benefits indicated 68.6 % benefits as the highest with the lowest (22.7%) increase in product price. The improper

barrier implemenatation resulted into inadequate control of hazards under the HACCP program, only 40 % of the food establishments asserted all food in storage was protected from contamination.

Prerequisite programs in food establishments were fairly managed, over 80 % had well-designed draining systems within their food establishments.The least (35.5%) had written sanitation standard operation procedure for cleaning and disinfectants.

It is suggested that through job training, class training on food safety, and availability of resources, knowledge as well as management practices could be improved within food establishments. Further studies should focus on customer awareness, food vendors as well as single groups within the food industries.

Chapter One

Introduction

Early day Egyptian and Roman emperors controlled for food contamination by testing through slaves and dogs (Noterman & Mead, 1999). The current public health concept used in food safety systems to control for the contamination of food during industrial production was invented in 1959 by the Pillsbury Company. It was designed for testing food of the National Aeronautics and Space Administration (NASA). NASA aimed to protect from hazards such as food poisoning, crumbling, floating into instrument panels and contamination in the capsules' atmosphere. The Pillsbury Company compressed food bars with an edible coating and the concept prevented food from breaking apart and damaging electronic components in the capsules. It also allowed the food to be free of pathogens and biological toxins by using three initial principles (Ross, 2007; Stevenson, & Bernard, 1995):

- Identifying and conducting a hazard analysis.
- Determining critical control points to control any identified hazards.
- Establishing a system (procedures) to monitor critical control points.

The experience at NASA by Pillsbury and colleagues promoted two food safety principles and recognition of the concept. The principles are:

- Establish corrective actions to take when deviation occurs at a Critical Control Points (CCP).
- Establish critical limits to be enforced at CCP (Sperber & Stier, 2010).

In April of 1971 the Hazard Analysis Critical Control Point (HACCP) concept was introduced at the first national conference of food protection. First five hazard principles

of Pillsbury Company were those used in the concept to control contamination. In 1972, the HACCP was formalized and adopted by the US Food and Drug Administration; and in 1973 the FDA implemented the system to ensure safety in food production (Ross, 2007).

In 1997, the National Advisory Committee on Microbiological Criteria for Food (NACMCF) and the Codex Committee for Food Hygiene added two principles to HACCP, which made seven principles total:

- Establish procedures for verification to confirm that the HACCP system is working effectively.
- Establish appropriate procedures and record in documenting those principles and their application (Sperber & Stier, 2010).

The application of HACCP to control safety encouraged the International Organization for Standardization (ISO) to introduce ISO 22000:2005 (ISO, 2011). Its role is to monitor food safety in the manufacturing industry across all food chains around the world (Afoakwa, Brown, Frimpong & Asante, 2013). The standard incorporates HACCP systems and prerequisites (GMP and SSOP) and it works under five management criteria:

- Food safety management system
- Management responsibility
- Resource management
- Planning and realization of safe products
- Validation, verification and improvement of the food safety management system (ISO, 2005).

The use of HACCP and ISO 22000 have enabled food establishments to control food safety. Studies have defined food safety as a food that does not harm the consumers at the point of preparation or eating (Mensah &Julien, 2011). Harmful food is caused by physical, chemical and biological hazards such as bacteria, viruses, parasites, fungi and physical particles (sand and bottle particles) (Duan, Zhao, & Daeschel, 2011). Appendix I shows physical, chemical, and biological hazards as well as control measures (Kaferstein, Motarjemim, Gerald, & Quevado, 1999). Contamination in food is caused by poor personal hygiene, improper hand washing and cross contamination. Furthermore, poor time-temperature management (ambient temperature) in ready to eat food such as salad can cause contamination (McSwane at el, 2000). People eating contaminated food suffer from foodborne diseases such as salmonellosis-foodborne inflection, clostridium perfringens-toxin mediated infection and clostridium botulinum- intoxication inflection. It is reported 30% of people are affected by foodborne diseases in developed countries and an even greater number in developing countries (WHO, 2002). For example, in 2011 an E. *coli* outbreak occurred in Germany caused 1,534 people infected (Foley, 2013). Likewise, in Africa, De Waal and Robert (2005) found that 80,000 children die every year as a result of food borne diseases. Additionally, in 2003 the research of Henson (2005) showed the death rate due to foodborne disease per 1,000 people in countries such as Ethiopia was 10.73; in Zimbabwe was 40, and Tunisia was 41.

In food establishments, mismanagement of safety practices enables pathogens to grow and contaminate the food. Research of Hedberge et al. (1994) states that food handlers become sources of hazards to consumers as most of the outbreak problems are caused by failure to attend to sufficiently safe practices (Tomohide, 2010). It is estimated

that 10 to 20 % of disease outbreaks are from food establishments. For example, in China in 2002 more than 200 school children were sickened and 38 died due to contamination of bakery products (De Waal & Robert, 2005).

Several studies have described different approaches to tackle the problem of foodborne diseases. The Educational Foundation of the National Restaurant Association (1974) describes that control of contamination in food establishments should be accomplished by introducing safety practices at serving, purchasing and receiving, storage and preparation. In Tanzania, food safety was initially conducted through fermentation, the sun, and smoke drying. Fermentation takes place by putting food in a container for some hours/days, which changes its acidic content to enable the prevention of pathogens. With sun and smoke drying, the process removes water content from the product which discourages pathogens from growing. These methods were not efficient in controlling contamination and caused food to spoil (Chelule, Mokoena, & Gqaleni, 2010).

In 1978, the government provided law that regulates and controls food, drugs, medical devices, cosmetics, herbal medications and poisons. In 2003, the legislation was modified and improved in what is known as the Tanzania Food and Drugs Authority (TFDA) Act of 2003, which exists under the Ministry of Health and Social Welfare. The introduction of the law enabled the government to fight against the production of contaminated food. With these new regulations, registration of premises is required prior to meeting the requirements of the produced commodities. These include having adequate experts, maintenance of safety standards and suitability of the equipment and facilities which are used for regularly distributing the products. Other regulations include

consideration of food hygiene and the practice of sanitary activities and services during construction. Organizations in the food industry must register their product and describe composition before proceeding with manufacturing of the product; packaging and labeling must also be present before distribution. These regulations in Tanzania also adopted the use of ISO22000 and HACCP to control food contamination as explained in the Codex Alimentarius commission. The adoption is agreed by the World Trade Organization (WTO) and Sanitary and Phytosanitary Standard (SPS), which require the country comply with international standards (Henson, 2007; Tanzania Constitution, 2003). The use of these laws and regulations has not produced positive results, studies report several incidences of outbreaks in the country. The research of Musonda et al. (2003) indicates that foodborne illness is very high in Tanzania and contributes to a low life expectancy of 45 years. Häsler et al. (2014) report that food safety problems caused 2.2 million deaths annually (1.9 million of those are children) and Moyo et al. (2007) found that *E-coli* causes 22.9% of diarrhea cases in Tanzania. Vaagland et al. (2004) accounted for 24 case of sickness and 22 deaths from *Salmonella pathogen in* Mbulu area (Northern part of Tanzania).

The cause of the issue is explained by poor handling of food during preparation, preservation, production processes, packaging and labelling in hotels, restaurants and food industries (Jaffee at el, 2005). McSwane et al. (2000) point out that at any point of the food process there is potential for bacteria growth, viruses and other hazards that should be controlled. Another factor that causes hazards in food establishments is management's inability to detect potential risks, sharing of information and identification of safety strategies. These problems contributed to the ban of fish exports from Tanzania

to European countries (Musonda & Mbowe, 2001). According to Jordaan, Ham, and Akinnifesi (2004) the management practices of food safety systems is facing a tumultuous time in the country because most of the working environments do not accommodate food safety activities. These include the use of untrained workers in food industries such as fruit harvesting and processing enterprises, and limited awareness of hygienic practices common in the industry (World Health Organization, 2006).

Training on ISO22000 and HACCP has been conducted by government agencies and food establishments to improve safety awareness of employees, managers and stakeholders. Farmers/fishers, food handlers, food processors, wholesalers, retailers and consumers have been taught safety practices as well (Jaffee et al, 2005). In 2003, Kiwale demonstrated that safety practices have often been taught in the Nile perch fishing industry to increase export.

Problem Statement of the Study

Food safety management practices within the food industries of Tanzania has caused contamination and this has led to substantial illness for consumers. Studies indicate that most food contaminations are due to food mishandling and a lack of safety management practices (Friedman et al., 2004; Clayton & Griffith, 2004). These include inadequacy of well-planned facilities, a lack of sanitary conditions, management, and training; it also includes misuse of government regulations and laws (food codes) in the food industries. As a result, food illness for consumers and economic losses have been occurring (Walker & Jones, 2002). For example, Vaagland et al. (2004) accounted for 24 case of sickness and 22 deaths from *Salmonella pathogen in* Mbulu area. Also, Tanzania suffered economic losses when European markets rejected food exports until they met

required safety standards. The problem has also caused the country to lose tourists because food produced in Tanzanian hotels and restaurants does not meet safety standards. Because the country earns 12 percent of national GDP from tourism, studies have discussed the need for training of employees and managers to improve food safety controls. Smith (1994) claims that food handlers training on safety practices has become one of the strategies that increases safe production and offers long term benefits to food producers and manufacturers. For example, the government established food safety programs such as: Village Fish Safety and Quality Control Committees Strategies within communities. The program has been sustained by involving trained villagers to ensure food safety (Mosha, 2005).

Purpose of Study

The study aims to determine food safety practices of ISO22000, HACCP and Prerequisites (GMP and SSOP) in the food manufacturing and food service industries in Tanzania. Food safety practices can be divided into management practices and awareness of the food safety systems. Management practices includes ISO22000, HACCP and prerequisite (GMP and SSOP) practices (McSwane et al., 2000):

- With ISO 22000, the standard specifies the requirements for a food safety management guide to interact and communicate with a quality system (Amgar, 2002).
- The second data will be on HACCP practices, which is a process-oriented approach to ensure food safety by analyzing and controlling hazards at the production process (FAO 1996).
- The prerequisites of GMP and SSOP provide hygienic guidance and sanitary

procedures of managing safety in the premises. Employee and manager knowledge on food safety systems includes education, training and experience with the use of safety systems (ISO 22000, HACCP and prerequisites) in the food industry (McSwane et al, 2000). Training is key to being knowledgeable and to understand the contaminant and its control procedures. Use of safety systems is the overseeing of safety control processes in the production and distribution of food.

Significance of the Study

The study explains the causes of food safety problems in Tanzania. It also proposes to measure requirements to implement safety practices in order to prevent food contamination. Furthermore, the study will provide knowledge of food safety practices to the food producers and increase customer satisfaction.

Hypothesis

Employees and managers have inadequate knowledge on food safety systems in the food industry for hazard control. As a result, there is an inadequacy of managing practices of food safety systems to control contamination in food establishments.

Limitations

The study had several limitations:

- The study involved three regions Dar Es Salaam, Arusha and Mwanza
- The research participants were food establishment managers in about 200 food establishments.
- Participantion was voluntary and confidential
- Some participants were not willing to survey the research questions

Assumptions

The study was carried with the assumption that all information/data provided by the participants were true and accurate. It was also assumed that the data which were collected at the three regions in Tanzania were representative of the population.

Definition of Terms

- **Additive**. Any substance added to foods in processing or preparation that may become a chemical hazard, such as sulfites.
- **Biological Hazard**. The danger posed to food safety by the contamination of food with pathogenic micro-organisms or naturally occurring toxins.
- **Contamination**. The unintended presence of harmful substances or conditions in food that can cause illness or injury to people who eat the infected food.
- **Chemical Hazard**. The danger posed to food safety by the contamination of food by chemical substance, such as pesticides, detergents, additives and toxin metals.
- **Critical Limit**. The maximum or minimum value to which a physical, biological or chemical parameter must be controlled at a critical point to minimize the risk that the identified food safety hazard may occur.
- **Critical Control Point**. A point or procedure in a specific food system where loss of control may result in an unacceptable health risk.
- **Cross-contamination**. The transfer of harmful micro-organisms from one item of food to another by means of a nonfood-contact surface (human hands, utensils equipment), or directly from a raw food to a cooked one.
- **Monitoring Procedures**. A defined method of checking food during receiving, storage, preparation, holding, and serving processes.

- ***Escherichia cole***. Facultative, non-spore-forming bacterium that can cause gastroenteritis in humans.
- **Food**. Any substance intended for use or for sale in whole or in part for human consumption, including ice and water.
- **Food establishments**. An operation that stores, prepares, packages, serves vends or otherwise provides food for human consumption such as a restaurants, food markets, institutional feeding location or vending location or facilities that are involved in food distribution.
- **Hazard Analysis Critical Control Point (HACCP).** A food safety and self-inspection system that highlights potentially hazardous food and how they are handled in the foodservice environment.
- **Hazard**. Unacceptable contamination (of a biological, chemical, or physical nature); unacceptable microbial growth or unacceptable survival of micro-organisms of a concern to food safety or persistence of toxins.
- **PH**. A measure of acidity or alkalinity of a medium, such as food products and cleaning agents based on a scale from 1.0 to 14.0.
- **Physical Hazard**. The danger posed to food safety from particles or fragments of items that are not supposed to be in food, such as chips of glass, metal shavings, and toothpicks.
- **Water Activity**. The availability of moisture or water content in a medium.

Chapter Two

Literature Review

The issue of food safety has existed for a long time. Many researchers expressed their concern on poor handling of food processing and the emergency of foodborne illness as the main cause of the problem. In 2011, Gaaloul, Riabi, and Ghorbel described how ISO 22000 is used to manage control toxicological and microbiological in production of cereal in Tunisia. Manning, Baines and Chadd (2006) explained how HACCP principles have improved safety the in boiler meat production processes. The US Food and Drug Administration (US FDA), in 1969, introduced Good Manufacturing Practice (GMP) to control the food safety problem. The role of that program is to control the risk of contaminating foods with filth, chemicals, and microbes. Also, the FDA established Standard Sanitary Operation Practice **(**SSOP) to monitor daily operations in sanitary activities especially for meat and poultry (US. Department of Health & Human Service, 2014).

Management Practices of ISO 22000: 2005 in the Food Establishment

The ISO 22000 standard was established in 2005 by the International Organization for Standardization (ISO) (ISO Central Secretariat, 2011). The standard has become important to control food safety in the food manufacturing industry including: food suppliers, food producers and food additives. Also, it encourages organizations to analyze customer requirements, define processes required to maintain safety and keep them in control (Mamalis, Kafetzopoulos, &Aggelopoulo, 2009). Furthermore, it enables the organization to comply with regulation, statutory and other related issues regarding food safety. Such as food policies, planning, implementing, operating, maintaining and

updating food system (ISO, 2005). The ISO standard has emphasized the application of ISO/ TS 22004-2005 (contains guidelines for applying ISO 22000:2005) which involves managing the food manufacturing industry, primarily food production including: crop production, feed production, primary food processing, secondary food processing, wholesaling and distribution, and food retailing. Also, the standard operates in ingredients and additives, equipment production, cleaner production, packaging materials production and services providers (McSwane at el., 2000). The standard is practically capable to control hazards due to the harmonizing and integrating of various concepts to ensure safety in the food chain such as (Surak, 2007);

- Interactive communication
- Requirements for operational and specific prerequisite programs
- Requirement for HACCP as per principle of the Codex Alimentarius (an international commission established to develop food safety standard and guidelines)
- Requirement for management system

The use of the elements above enabled the standard to affect the food safety concept to the food industry applying them (Nygren, 2006). Firstly, the interactive communication which is among those elements insists that the organization interacts with other partners such as the supplier, the producer, regulatory bodies, the customer and manufacturer, which lead the organization to identify the effect at each stage (Nygren, 2006).

Furthermore, the standard is designed to integrate HACCP (Codex Alimentarius) for analyzing the hazard counted in all food producers (Faergemand & Jespersen, 2004)

that led the organization to identify contamination in food before being consumed. Since managing food safety is a large issue all over the world, it needs accountability. Therefore, the ISO 22000 recommends the organizations to implement adequate management requirements which can control hazards in food for consumers. It should also work within the framework of a structured management system and incorporate into the overall management activities of the organization (Faergemand & Jespersen, 2004).

The standard requires the organization to use prerequisite programs in preventing, removing and reducing filth in food operations. Prerequisite programs (PRPs) provide the foundation for hazard analysis and critical control point (HACCP) to work in food control. Prerequisite programs are based on Good Manufacturing Practice (GMP) and Sanitary Standard Operation Procedures (SSOP) (Surak, 2007).

Furthermore, the standard has provided management requirements, which enhance the food manufacturing to structure a required management system in the food along the food chain (Chontales, Tsarouchas, & Lagodimos, 2009). The principle supply chain concept states that the organization, " develop a supply chain-wide technology strategy that supports multiple levels of decision making and gives a clear view of the flow of product, service and information" (Anderson, Britt, & Favre, 2007, p.7). In other words the ISO 22000: 2005 as a food safety management system should be consistent along the food chain. Moreover, ISO 22000 has been applied as a management process to guard the appropriate use of specifications for food safety standard.

The standards has incorporated ISO/TS 22002-1(deals with specific prerequisites for food manufacturing) as a prerequisite guidance tool for designing, operation and continuous improvement (GMP, and SSOP) as an integral part of food safety

management. The standard has also been applied for determining the acceptable hazard levels by integrating HACCP criteria (Chontales, Tsarouchas, & Lagodimos, 2009).

ISO 2200 ensure food safety by using five mentioned management requirements to trace and control food safety in organization. This is because it gives the food production industry a clear overview of the root of disease-causing pathogens (Marler, 2007). These management requirements are:

Food safety management system. It requires the organization to build a capacity of identifying and controlling all hazards happening in the industry for safe consumption. It also suggests channeling the information regarding food safety to the entire food chain. The aspect required in the organization (ISO, 2005):

- Ensures the documents remain legible, readily identifiable and meet international standard.
- Ensures that relevant documents of external origin are identified and distribution is controlled
- Approves document for adequacy prior to use to ensure organizational effectiveness on food safety.

Managing responsibility. Explaining the importance of commitment in food safety. The section discusses the criteria required for managing of food safety by a team leader. Also, it discusses that adequate external and internal communication of the organization enabled the organization to trace safety requirements including statutory, regulatory authority, suppliers and contractors' requirements (ISO, 2005).

Resource management. This aspect suggests the organization to prioritize its resources development to increase safety control through:

- Identifying the necessary competencies for personnel whose activities have an impact on food safety
- Provision of training to ensure personnel have the necessary competencies
- Evaluation of implementation and the effectiveness (ISO, 2005)
- Tracing is designed to protect consumer from food safety risk, fraud, and quality issues (Caporale, Giovannin, Di Francesco, & Calistri, 2001). ISO (2005) insists on identifying contamination of incoming material from the immediate suppliers and initial distribution route of the end product. The standard introduced ISO 22005:2007 family to be more focused on tracing the feed and food chain. The advantage of the food traceability system is to minimize the impact of a food safety incident and reduce the risk of food contamination (Caporale, Giovannin, Di Francesco, & Calistri, 2001).

Planning and realization of a safe products. This includes establishing necessary programs required to control safety. The aspect also explains the implementation of preliminary steps to enable hazard analysis, flow diagrams, process steps and control measures to establish the HACCP plan. The section covers the design of processes that affect the food safety and the measures that can be taken to control the hazard effect in food (Chontales, Tsarouchas, & Lagodimos, 2009).

Validation, verification, and improvement of the food safety management system. This part includes validation of control measure combination, control of monitoring and measuring, food safety management system verification, and improvement. The requirement identifies the control measure and compliance required to ensure safety in the food industry.

Mamalis, Kafetzopoulos, and Aggelopoulos (2009) proclaim the advantage of ISO 22000:2005 because it is a system that distributes resources inside of food chain organizations. Furthermore, the system recommends better documentation and adequate utilization of prerequisites to manage food safety.

The ISO 22000:2005 standard has become a paramount of food safety management tool because it provides management concepts to achieve food safety. The HACCP system is an integral part of the standard to identify hazards and has improved the efficiency of ISO 22000:2005 (ISO, 2005).

Management practices of Hazard Analysis Critical Control Point (HACCP) in Food Establishment

HACCP is a preventive system which has been used to ensure the production of safe food (Stevenson & Bernard, 1995). In the Codex Alimentarius (alinorm 97/13A) recommends that HACCP controls safety at the source, product design and process control, and the application of good hygiene practices during production processing including labelling, handling distribution, storage, sale, preparation, and use (FAO & WHO, 1995). This system involves training of employee in food safety manufacturing and personnel hygiene. Researchers have argued that the development of HACCP is depend mainly on training. Training has enabled employee to acquire enough knowledge to implement and use the system (Karaman at el., 2012). The implementation of HACCP has many barriers, such as lack of knowledge, resources, lack of technical experts, and limited personnel (Stevenson & Bernard, 1995). The application of food safety has increased the benefit to the industries, researchers have briefed that high quality and safety are some advantage of HACCP application (Karaman at el., 2012).

HACCP manages to control contamination by using seven principles. These principles are arranged and organized to determine and identify hazards found in the food and the cost- effectiveness;

Principle 1. Hazard analysis. This is the identification of hazards found in the food. The industry has used the principle to analyze potential hazards in the food. The principle gives the framework of initializing into the analysis by identifying the hazard, determining the present hazard and the considering preventive measures required to improve the effect (McSwane, Rue, & Linton, 2000). The principle ensures safeness of the incoming raw material to reduce contamination in food instead of testing the final food products. The analysis includes:

Properties of food: Identifying potentials hazards in the raw materials, water activity and pH value that support bacteria growth (National Assessment Institute, 1994). Also, it analyzes the potentially hazardous food, evaluation of how serious the hazard and the like hood of their occurrence (Schothorst & Jongeneel, 1999).

Food processing/ preparation**:** The pre and post flow of food operation has to be analyzed to determine what might cause hazards in food. This includes purchasing and delivering of raw materials and also includes storage which covers the environmental lining food processes (National Assessment Institute, 1994).

Volume of food prepared: This refers to sizing of density and quantity of food to be produced/ prepared. This is because quantity and rating of heating, cooling and time needed to control hazards (National Assessment Institute, 1994).

Principle 2. Determination of critical control points (CCPs*).* These are points where control of any identified hazard can be prevented, eliminated or reduced to

acceptable levels. The CCPs control depend on the type of food industry. The hazard control is done at different processing stages of food industry. The principle determines hazard characteristics at each critical control point in the process of food production. It also gives the parameters (time, temperature, acidification, pH and salt concentration) to consider: determination of existing preventative measure at every stage, consideration lists of the steps required to eliminate or reduce the likely occurrence of a hazard to acceptable level. Also, it examines if CCPs can be measured or observed as well as appropriate actions which can be taken when the controls are not met (Mcswane et al., 2000). Below figure 2, is an example showing how a Critical Control Point at a step is carried out when food is processed from one step to another.

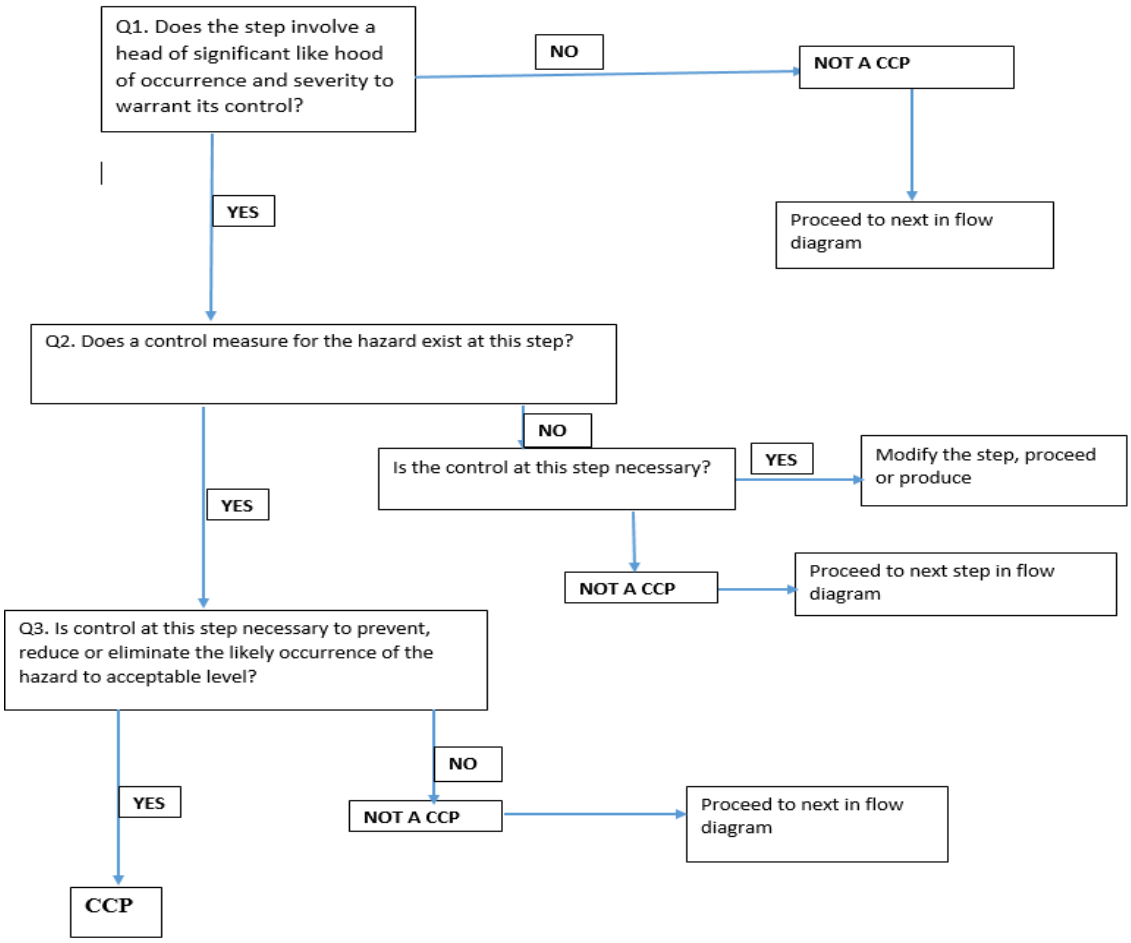

Figure 1. Hazard analysis at a receiving step (Schmidt & Newslow, 2007)

Principle 3. Establishment of critical limit (CL). The food manufacturing industry produces based on a standard set for the process at a particular product. Processing of food without temperature or a time range might result in food contamination. Critical limit is a step whereby control limits are established to block hazards as indicated in Appendix II. The limit sets upper and lower boundaries of a food safety to control contamination (McSwane, Rue, & Linton, 2000). Exceeding this boundary can cause development of a hazard. The control limit enables the organization to prevent, eliminate and reduce the acceptable hazard level. McSwane, Rue, and Linton

(2000) pointed to the temperature, time, water activities (wA), and acidification pH as factors in food contamination, so these parameters are required to be controlled for food safety, as appendix II.

A study by the WHO (2006) indicates that the growth of pathogens is significantly high when food is kept at room temperature. Holding food below 5 Celsius and above 60 Celsius lowered down or stopped the growth. Additionally, cooling or freezing does not kill microorganisms but limits growth. The growth happens when the temperature is high and ceased when the time temperature reaches 50 Celsius. Figure 2 indicates the suggested critical limit of temperature required to achieve food safety.

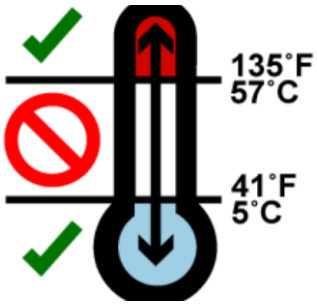

Figure 2. Temperature range for food safety (World Health Organization, 2006).

The critical limits are categorized into three areas:

Chemical limits: includes the following naturally occurring and added. Naturally occurrences are like shellfish toxin, antibiotics and growth of hormones. Added critical limits are things such as lubricants, sanitizers, and other chemicals added. Another group is additives, and these are things such as vitamins, color, and preservation substances (Moberg, 1992).

Physical limits: identify physical contamination which cause hazards in food. Such physical limits are metal detectors, magnets, screens and proper installation of the

equipment within the food manufacturing industry. It may also include verification of calibration of the equipment in the industry (Moberg, 1992).

Biological limits: The limit used to control prevent microbiological hazards of bacterial virus or parasites. To ensure product safety, microbiological control at the CCPs will need to be monitored and verified by established critical limits. Normally, parameters used to control microbiological pathogens are time, temperature, water activities (wA) and acidity level pH (Moberg, 1992).

Principle 4. Monitor procedure of CCPs. The principle developed to determine management performance of whether the critical limits are effective (Schmidt & Newslow, 2007). It involves identifying a responsible individual to make observations, and monitor critical control point under acceptable limit. The principle also provides documentation that explains how the HACCP plan has been controlled with three purpose (McSwane, Rue, & Linton, 2000):

- Monitoring is essential to food safety management because it tracks the operation of the system and helps the organization to take corrective measures when errors occur.
- It enables determination of the loss and deviation occurring at a CCP limit.
- It provides a written documentation useful during verification stages of the HACCP plan (Stevenson &Bernard, 1995).

Principle 5. Establishing corrective action. This principle eliminates failure at critical limits and ensures there is no contamination. The stage is useful to determine errors happening during hazard control. The principle requires the organization to (McSwane, Rue, & Linton, 2000):

- Establish a system that allows and promotes rapid response when deviations occur from critical limits.
- Correct and eliminate the cause of the deviation and restore process control
- Maintain accurate documentation and records
- Identify affected products and determine appropriate disposition.

Principle 6. Establishing recording keeping and documentation. In order for HACCP to be effective all information about hazards with the associated food item should be recorded that clearly explains how HACCP was controlled (McSwane, Rue, & Linton, 2000). The record has to include: Records which validate the HACCP plan including recording that support the rationale used to establish critical control points, critical limits, monitoring procedures and frequencies, corrective action procedures. Furthermore, the record has to show procedures verifying the control measures used to prevent hazards, including records that facilitate daily hazard control. The copy of certificate for members attended HACCP training should be recorded as well (Schmidt & Newslow, 2007).

Principle 7. Establishing verification procedures. This is the process of confirming that HACCP systems are performing according to the plan. Primary components of verification are:

- Verifying critical control points and critical limits in preventing, eliminating and reducing the hazard to acceptable levels (Schmidt & Newslow, 2007). It confirms appropriate selection of CCP and CL to control hazards in food. It includes calibration equipment used to control hazards such as a thermometer and pH meter. The

perfection of CCP and CL verification involves the recording of monitoring and corrective measures that ensures free hazardless in food.

- Verifying the overall effective performance of an HACCP plan, the HACCP team has to function in accordance with the defined plan and use. This will include the explanation of the use of prerequisite programs in the HACCP plan. Example are written standard procedures and other programs as well as auditing records. (Stevenson & Bernard, 1995)
- Verification of proper periodic documentation on procedures used to control hazards and the workings of the HACCP plan (Stevenson & Bernard, 1995).

In summary, product safety depends on monitoring rather than on verification. Monitoring methods must be rapid and repeatable while verification tests are reproducible and accurate. Monitoring is used to keep the situation under control and verification ensures the effectiveness of the HACCP plan. The results of verification are used to confirm that the safety objectives are met and can be used for improvement of CCPs (Schothorst & Jongeneel, 1999).

Good Manufacturing Practice (GMP)

The system works under FDCA section 402 clause 3 and 4. Clause 3 specifies that food has been manufactured under unfavorable conditions that contribute to contamination in food. Clause 4 states that food can be contaminated during packaging or when done under unsanitary conditions causing infection (U.S.Department of Health & Human Service. (2014). The clause recommends the food manufacturing plants to consider appropriate parameters to ensure food safety for human consumption.

Good Manufacturing Practices provides guidelines which stipulated at 21 CFR part 110 of U.S. Food and Drug Administration to implement safe conditions in the food manufacturing industry. GMP can be defined as the set of requirements of food and drinks that enhance the organization to reduce filth in food. Moreover, GMP are requirements and procedures that stipulate the hygienic criteria of the manufacturing industry. Also, it explains the hygienic design of equipment and facilities, control operation, maintenance and sanitary practices. Under US FDA 21 CFR 110, requires GMP to contain safety guidelines on the following topics: personnel practice, building and facilities equipment and utensils, production and process control (Linton, 2001; Somwang, Charoenchaichana, & Polmade, 2013; U.S.Department of Health, & Human Service, 2014). The system explains how each of those can be used to ensure food safety in the food manufacturing industry. GMP requires the food manufacturer industry to ensure that products meet food safety, quality and legal requirements, using appropriate manufacturing operation controls. The existence of GMP in the industry enables organizations to avoid cross-contact by segregation using cleaning, separate utensils, line dedication, equipment and storage dedication (McSwane at el., 2000).

Personnel practice. It describes the requirements needed to control disease, work on cleanliness, and duties of supervision. Also, it explains the importance of education and training or experience in sanitation. Including a person coming into direct contact with materials, finished products to wear appropriate outer garments, gloves, and hair restraints to maintain adequate cleanliness (Somwang, Charoenchaichana, & Polmade, 2013).

Building and facilities equipment gives the guidelines of implementing of services required to ensure that the safety of food is met. It also defines the design, setting up, construction and treatment of plants and grounds to enhance sanitary operations. This includes maintenance of roads, installation of equipment and waste systems (Somwang, Charoenchaichana, & Polmade, 2013).

A study by the National Assessment Institute (1998) found that, "food service establishment to be clean and safe, the facilities must be constructed with good ventilation and plumbing system. These system lower the chances of contamination in the food service area" (p. 117).

Sanitary operations describes the requirements on pest control, cleaning and sanitizing, storage of toxic materials, and sanitation of food-contact surfaces. It says that any sanitary operation has to be done to ensure there is no contamination. It also, maintains food hygiene and avoids contamination of food contact surfaces, food packaging materials and unsafe protection covers such as clothes and gloves (Somwang, Charoenchaichana, & Polmade, 2013).

Equipment and utensils are tools used in processing, holding, transferring and filling. The act requires appropriate design to prevent corrosion, buildup of materials or adulteration with lubricants. Moreover, it discusses cleaning and sanitizing portable equipment and storing of utensils avoid splash, dust, and other contamination (Somwang, Charoenchaichana, & Polmade, 2013).

Production and Process control refers to cleaning, good repair, and ensuring sanitary conditions of equipment used for processing, transferring, and filling the utensils and containers for holding raw and bulk materials. Also, it recommends raw materials, in

a process sample, and finished products are tested to identify what they are and their compliance with specification for physical, chemical properties and microbial contamination as well as other chemical contaminations (Somwang, Charoenchaichana, & Polmade, 2013).

Standard Sanitary Operation Practice (SSOP)

These are written procedures recommended by the Code of Alimentarius and the US FDA implemented in food establishments to prevent direct contamination or adulteration in food through pre-operation and operation process (Barron, Fraser, & Herring, 2011**).** Food process facilities which are not well cleaned and sanitized can be a source of pathogens that causes illness. These include bacteria virus and parasites. An unsanitary food process in the plant causes cross contamination of pathogen from one facility to another. Because of that the SSOP system recommends the manufacturing plants to clean all areas in contact with food**.** Code Alimentarius explains the insurance of effective ways to control pests, waste management, and implementation of cleaning and sanitation procedures. The system involves a series of steps for cleaning and sanitizing to prevent the product from adulteration. SSOP is always designed to fulfill particular needs of a plant; it is not the same at every facility but depends on the type of product produced. SSOP requires the industry to maintain, monitor and develop sanitary standard operating practices and to record appropriately the procedure used to examine sanitary practices.

Food Safety in Tanzania

The contamination problem in food establishments has affected many food types in the country such as meat, fish, and other varieties of food products. The research of Henson and Musonda (2005) indicates that Nile perch fish, the fish caught from Lake

Victoria has experienced poor food safety due to hygienic practices in the processing facilities. The problem results in from existence of *salmonella* bacteria in the exported fish products (World Bank, 2005). Due to this, the country has established facilities to test procedures in the laboratory to control that food contamination. According to Kussaga, Luningi, Tiisekw, and Jacxsen (2014) regarding cluster products, contaminated occurs due to inadequate packaging which lead to failure to meet safety standards (requirements). Microbiological bacteria are then able to grow and contaminate the food.

The contamination has also observed in milk products. In milk, the research of Nonga, Ngasala, and Mtambo (2015), shows on assessment of raw milk quality and stakeholder awareness on milk borne health risks in the city of Arusha and the Meru District. The contamination is mainly caused by poor HACCP practices during milk treatment. Milk was inadequately boiled and packaged to protect against pathogen growth and development. The hygienic practices also contaminated product due to poorly cleaned container that were used to keep milk. Also, included poor handling, which caused milk spoilage and particle contaminants (Nonga Ngasala & Mtambo, 2015).

Food Safety in Other African Countries

The contamination problems has also faced many other African countries. In South Africa several studies have discussed the issues related to food borne diseases in the community. Most causes involve the hygienic practices that fail to control contamination in the food establishments. Kubheka, Mosupye, and Von Holy (2001) indicate high risk of hazard is due to management practices such as poor food preparation and lack of hygiene practices. For example when food was cut, and mixed with dirty utensils, then left uncovered at the table, this promoted food contamination. Likewise

food was left at the ambient temperature that can cause bacteria growth. Von Holy and Makhoane (2006) in South Africa report the same case but describes the need for training on food hygiene practices for food handlers. The research in Nigeria reportes that most of the food problems are aso caused by hygiene practices and facilities. Some areas lack toilet facilities, adequate water supply, and proper drainage systems. The purchase of raw materials and ingredients in the open markets has contributed to contamination. This problem has caused several deaths in Nigeria; an outbreak of food poisoning in Ibadan resulted in 20 deaths from *salmonella typhimurium* and a case of food poisoning for three families in Kano was caused by yam flour consumption. The investigation indicated that the use of lethal substances for preserving the yam flour may be the cause (Omemu &Aderoju, 2008).

The literature describes practices of food safety systems such as ISO22000, HACCP and Prerequisites. It primarily gives overviews on how food hazards are generally controlled in the food establishments. Most studies have described cause of food hazard in fish, cluster and milk. Other countries in Africa have addressed the cause of food hazards as poor hygienic practices. Due to limited research on food safety of food establishments in Tanzania, the aim of this study is to investigate the food safety management practices of food safety systems.

Chapter Three

Methodology

Description

This research used a quantitative survey to determine food safety management practices of ISO22000 and HACCP and their prerequisite programs (GMP and SSOP) in the food manufacturing and service industries in Tanzania. The survey was administered using a selection of samples from specific food establishments identified by the Tanzania Food and Drugs Authority.

Questionnaire Development

The survey questionnaires were mainly divided into three categories: questionnaire measuring knowledge of employees and managers on ISO 22000, HACCP and prerequisite (GMP and SSOP), management practices of food safety systems (ISO 22000, HACCP, GMP and SSOP) and demographic information.

Knowledge of Food Safety Systems

- Use of food safety systems in food establishments

This section had four questions each with multiple parts. Question IV was multiple choice with (1-6) items examining the type of food safety management systems used to ensure safety. Question V was multiple response with items (1-5) asked about the training with food safety management systems. Question VI (a) and VI (b) were multiple choice questions concerning the frequency of training with managers and employees on food safety systems.

Questionnaires on Management Practices of Food Safety Systems

These measured how the food safety systems function in the food establishment to control food hazards. The section included:

- Management of HACCP practices in the food establishment

Question X was multiple response with items (1-3) verifying the performance of HACCP and question XI was also multiple response with items (1-3) validating the performance of HACCP.

- Barriers and benefits of food safety management systems

Question XII was multiple response with items (1-10) assessing barriers to implementing HACCP. The questionnaire focused on the implementation of the HACCP and was designed to collect information from the food establishment with food safety systems. The questions were divided into seven parts; question XVI was a multiple response question with items (1-6) asked the benefits of implementing food safety management systems in the food company.

- Hazards control under HACCP program

Question XIV was multiple response with (1-6) items asked hazard control by food establishments that implement HACCP program to ensure foods were from contamination

- Management of prerequisite programs in food establishments

The survey questionnaire asked about the performance of the prerequisite program used in the industries and it included three questions. Question XVII was multiple responses with (1-5) items asked about the building guideline that ensured food safety in the industry. Question XVIII was multiple choice with (1-3) items measured

daily sanitary operations performed in the industries. Question XIX was multiple response with (1-6) items on operations used to prevent food contamination in food industries.

Demographic Information of the Industries

The demographic questions were constructed to rank the number of the participants involved in the survey and were designed into multiple/single choice format; it consisted of six questions. Question I had multiple response, asked about food type(s) produced in the industry. Question II was a multiple responses question, measured the number of employees in the industry. Question XX was a multiple response question, measured age of the participants. Question XXI, another multiple response, asked about gender of the participants. Question XXII asked the level of education of the respondents and question XXIII, the last one, measured the experience of the participants in food industries. Question IX, a yes or no question, asked if the company used HACCP to control hazards.

Participants

The research was conducted in three regions: Dar- Es Salaam, Arusha and Mwanza because these regions have more food manufacturing industries and were likely to produce important variations in this research. The results found from those three regions were expected to generalize results of the entire country. The research identified a sample of 560 food industries of the satisfied list of Tanzania Food and Drugs Authority (TFDA). A sample of 200 food establishments from the list were selected to generalize the result because almost that number were easily found in those surveyed three regions.

The study collected the data from managers and employees with different numbers of employees in the food establishments (1-10, 11-30, 31-50, 51-100, and 101-500). Each categorical group had at least 30 participants and selected randomly from the sample of 200 participants and 113 food establishment were surveyed. Food safety management practices in the food establishments were evaluated. The research surveyed professional managers with multi-disciplinary experiences because those participants were knowledgeable and a relevant representation of the food establishment. The research was conducted within a variety of food types: fish and sea food, meat/beef, poultry, baked goods, juices, wheat flour, coffee and leaves, biscuits and pork.

Data Collection

The researcher distributed seventy surveys in each region. He contacted the participants either by phone or face to face and he made phone calls to ask for the return of the questionnaires. The researcher also went to the facilities and talked to managers face to face to ask if they could participate in the survey. Most industries in Tanzania did not had proper working phone lines, hence it was difficult to reach people by phone. The researcher gave consent for the participants to take four to five business days to complete the surveys and after that, the researcher visited the food industries to collect the data. In order to find reputable industries that could provide positive results, the researcher spent 10 days in each area to collect data.

Data Analysis

The collected data was entered and analyzed by using Microsoft Excel to obtain descriptive statistics of frequencies of responses, means and standard deviations.

Microsoft Excel was also used to prepare tables and graphs of all variables in the study in order to quantify the qualitative responses.

Chapter IV

Results and Discussion

Demographic Characteristics of the Respondents

The survey was given to 200 managers in food establishments and 113 (57%) survey responses were collected back. The demographic data were collected regarding types of food products, the number of employees, age, gender, education level, and employee experience as presented in Table 1. The results revealed that 15.4% of the food companies produce fish and seafood. The size of the companies that responded to the survey are classified by the number of employees as follows: 17.9% of the companies employ less than 10 people; 70.6% employ between 11 and 100 and 10.7% employ between 101 and 500 people. The majority of the participants (57.1%) are between ages 30 and 45, while participants with age 60 or above are very few at 0.9 %. Of the respondents, 50 % are males. Level of education indicates that 51.8 % of the participants hold a high school diploma or less, while 22.4% have either a bachelor or graduate degree. 49% of the participants have 6 to 10 years of experience which is the highest score.

Table 1.

Demographic Characteristics of Food Establishments and Employees.

Characteristics		Frequency	(%)
Products types			
	Fish and seafood	47	(15.4)
	Baked goods	43	(14.1)
	Coffee and tea	13	(4.3)
	Juice	39	(12.8)
	Vegetable	33	(10.8)
	Poultry	39	(12.8)
	Flour	14	(4.6)
	Pork	28	(9.2)
	Other	4	(1.3)
Number of employees			
	<10	20	(17.9)
	11-30	46	(41.1)
	31-50	28	(25.0)
	51-100	5	(4.5)
	101-500	12	(1.3)
	500+	0	(0.0)
Age			
	18-29 years	20	(17.9)
	30-45 years	64	(57.1)
	46-60 years	22	(19.6)
	60 above years	1	(0.9)
Gender			
	Male	56	(50.0)
	Female	42	(37.5)
Education level			
	Less than high school	13	(11.6)
	High school diploma	45	(40.2)
	Technical certificate	23	(20.5)
	Bachelor	19	(17.0)
	Graduate degree	6	(5.4)
Experience			
	<5 years	28	(25.0)
	6 to 10 years	55	(49.1)
	11 to 20 years	18	(29.1)
	20< years	7	(6.3)

Use of Food Safety Systems in Food Establishments

The food safety systems that are used to ensure food safety in food establishments are presented in Figure 1. The results indicated that the food safety system that has been used the most is the prerequisite program GMP (64.3%). The use of HACCP and ISO22000 in the food establishments was 22.9 and 15.4%, respectively. The trend indicated that food establishments with large numbers of employees (> 30) use the food safety management systems HACCP and ISO22000 to control food contamination, while those with few employees depend only the prerequisite programs GMP and SSOP.

The food safety systems that have been used in food establishments to train employees are indicated in Figure 2. The results found that employees are mostly trained on GMP (73.9%), while ISO22000 (19.2%) and HACCP (27.1%) have been less used to train employees. While, GMPs have been used for employee training at high frequency in all food establishments, HACCP and ISO22000 have only been used for training in food establishments with 30 and more employees.

The frequency of training improves food safety knowledge of managers and employees. Table 2 shows the frequencies of training managers and employees on the food safety management systems. The research found that the highest frequency of training managers was twice per year (31.4%), while once every three months was the lowest (18.5%). Also, 30.7% of managers have been trained once per year and 18.8% have indicated that they have never been trained. When employees were asked about the frequency of their training, 29.1% indicated once every three months, 26.8% once per year, and 26.1% twice per year. Meanwhile, food establishments were not training employees indicated 27.4 percent.

Most of the food establishments are not training their employees and managers on food safety systems, which caused lack of food safety knowledge to employees and managers. In 2005, Taylor and Kane found that low use food safety systems causes poor knowledge for managers to control food hazards. Bas et al. (2006) described that the government of Turkey was not able to control food hazards because only 4.7% of the food business had HACCP knowledge. Youn and Sneed (2003) indicated lack of HACCP knowledge caused food hazard problems in 70% of school foodservices. In 2004, UK government increased hazard control by imposing HACCP system knowledge in 30% of food establishment. Also, the study of Karaman, Cobanoglu, Tunalioglu, and Ova (2012) explained that lack of management training resulted in lack of knowledge (39.3%) on the use of food safety systems. The research of Worsfold and Griffith (2003) stated that management of food safety system was impaired by unsuitable level of training. This includes contents of materials required for training and not well reviewed materials to fit the intent (Chukwuocha et al., 2009). In order to control food hazard FAO (1996) and NACMCF (1998) organizations have provided guidelines that recognize the need for training of managers and employees. Also, food safety training strategy is used to increase long term benefits to the food industry (Smith, 1994). Nel, Lue, Buys, and Venter (2004) explained that knowledge in food safety system helps to control food contamination.

Almost all food establishments operated inadequately in terms of the frequency of training for managers and employees, which affected their knowledge of food safety systems. These findings were almost consistent with the study of Kok (2009), in which training on food safety were three times per year at 24%, biannual (32%) and annual

(44%) in Turkey. Those results reflected the weakness of using and maintaining food safety systems in the food establishments. Chukwuocha at el. (2009) indicated that problems of food safety occurred in a metropolis in South Eastern Nigeria was caused by a great number of food handlers who were less trained. Macheka et al. (2013) explored that lack of financial supports constrains training in developing countries.

Peter et al. (2003) defined that enough time is needed for training to increase employees' and managers' knowledge to manage food safety. Ziggers and Trienekens (1999) discussed that adequate safety control of hazards can be influenced by high frequency training and practical use. Kok (2009) in the research in Turkey described that, training conducted at 63% improved 80% of food safety systems. Also, Peter, Jose, Jackson, and Denise (2003) indicated often training at 67% improved food safety knowledge and changed attitude and behaviors of employees and managers (Seaman & Eves, 2010).

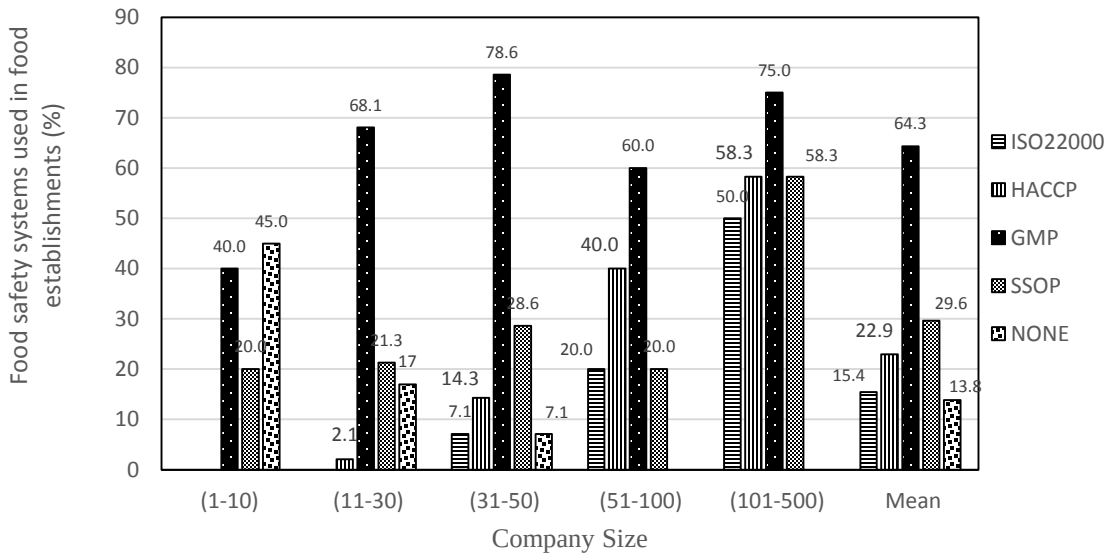

Figure 3. Food safety systems used by food establishment to ensure food safety. Company employees grouped as follow: 1-10, 11-30, 31-50, 51-100 and 101-500

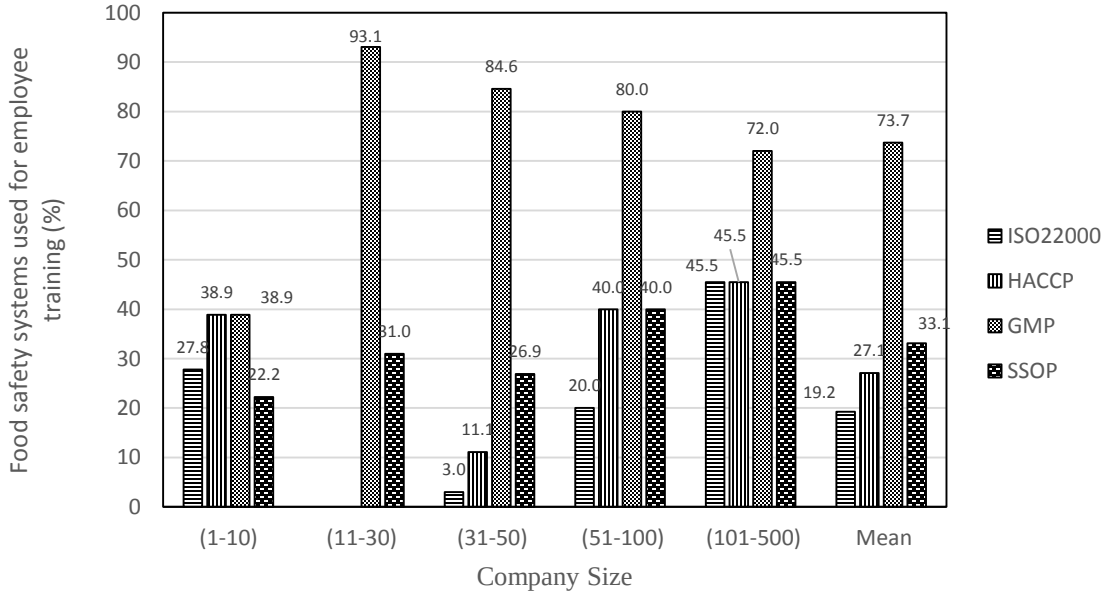

Figure 4. Food safety systems used to train employees. Company employees grouped as follow: 1-10, 11-30, 31-50, 51-100 and 101-500.

Table 2.

Frequency of managers and employee training on food safety management systems.

Characteristics	Company size					Mean (%)	SD
	1-10	11-30	31-50	51-100	101-500		
Manager							
Once per year	17.9	35.0	55.6	20.0	25.0	30.7	15.4
Twice per year	14.3	20.0	29.6	60.0	33.3	31.4	17.8
Once every three months	28.6	15.0	7.4	0.0	41.7	18.5	16.7
None	39.3	27.5	7.4	20.0	0.0	18.8	15.7
Employees							
Once per year	21.4	17.5	18.5	60.0	16.7	26.8	18.6
Twice per year	10.7	22.5	40.7	40.0	16.7	26.1	13.6
Once every three months	25.0	32.5	29.9	0.0	58.3	29.1	20.8
None	39.3	27.5	11.1	0.0	0.0	15.6	17.4

The findings indicated that food establishment with HACCP in place were 15 of 121 surveyed food establishments.

Management of HACCP Practices in Food Establishments

The documentations used by food establishments to verify HACCP performance are shown in Table 3. The documentations used by food establishments help rectify the management practices of HACCP in the food industry. Almost 50% of the food establishments either used documented industry procedures or CCP validation to verify HACCP performance. The least (19.8%) were recording and analyzing quality assurance data/measurement to improve food safety management system. The results also indicate that food establishments with more than 101 employees have frequently used documentations to verify HACCP performance compared with those of few employees.

The results that describe validation of the performance of HACCP are presented in Table 4. Approximately 26.60% was the highest number of the food establishments who validated quality assurance and monitoring systems. The validation of the supplier

points and validation of employees' intervention systems were 15.5% and 12.2% respectively. Overall, the result indicated few responses in HACCP validation, mostly in the food establishments with <50 employees.

The sixth principle of HACCP requires food establishments to verify and validate for hazard control in the food establishments (Schmidt & Newslow, 2007). The validation and verification processes enable the food establishments to control hazards because it ensures of food safety and confirm that the HACCP system is working effectively (Leaper & Richardson, 1999). In this study, most of food establishments indicated inadequate verifying and validating processes, which hindered the management practices of food safety systems. Taylor and Kane (2005) described that lack of verification and validation processes of the CCP's result in limiting HACCP methodologies to control food hazards. It is very importance to have control measures in place for catching potential problems before the affects at the final products, which gives management's confidence in the system (McEachern, Bungay, Ippolito, & Lee-Spiegelberg, 2001).

Table 3.

Documentations used to verify the performance of HACCP safety system in food establishments.

Documentations	Company size					Mean (%)	SD
	1-10	11-30	31- 50	51-100	101-500		
Industry procedures used to validate against the HACCP	5.0	0.0	14.3	40.0	66.7	25.2	27.8
CCP validation used to improve food safety management systems	0.0	0.0	10.7	60.0	58.3	25.8	32.5
Recording and Analysis quality assurance data	5.0	2.2	7.1	20.0	75.0	19.8	30.5

Table 4.

The validation of HACCP performance in food establishments to control food hazards.

Validations	Company size					Mean	SD
	1-10	11-30	31-50	51-100	101-500		
Validation of suppliers points of measure	5.0	0.0	10.7	20.0	41.7	15.5	16.4
Validation of employees intervention systems	0.0	0.0	7.1	20.0	33.7	12.2	14.5
Validation of quality assurance monitoring systems	5.0	2.2	10.7	40.0	75.0	26.6	30.9

Barriers and Benefits of Food Safety Management Systems (ISO 22000 and HACCP)

Table 5 represents barriers that prevent food establishments from implementing food safety systems (HACCP and ISO22000). The participants have indicated that poor confidence of supplier to provide appropriate raw material (25.7%), lack of government support (17.3%), and cost (16.3%) were the most obstacles for implementing HACCP and ISO22000. Volume of paperwork (4%) and time (6.1%) were the lowest barriers. Surprisingly enough, only 9 and 9.1% of the participants thought management commitment and lack of knowledge about food safety systems, respectively, were the barriers for the implementation of ISO22000 and HACCP in food establishments. Furthermore, food establishments with more than 100 employees indicated poor confidence of suppliers (24.9%) as the top obstacle for implementing HACCP and ISO22000, whereas companies with less than 10 employees thought training of employees (15%), as the top obstacles.

When employees were asked about the benefits of implementing food safety management systems (ISO2200and HACCP) in food establishments (Table 6), they

indicated that increased product safety (68.6%) and increased product quality (68.5%) were the top benefits. The compliance with regulation requirements was only 34.9 percent and the lowest (22.7%) was the increase of product price.

Karaman, Cobanoglu, Tunalioglu, and Ova (2012) in Turkey found that lack of knowledge was the most (46.5%) barrier for implementing food safety systems (HACCP and ISO22000), while in this study lack of knowledge was 9.1%. Most studies in Turkey described low scores for lack of knowledge of managers and employees as barriers of food safety systems. Lack of knowledge has hindered food handlers to identify different barriers of food establishments and limit the implementation of food safety systems. On the other hand, Bas, Yüksel, and Çavuşoğlu (2007) have indicated that lack of knowledge (83.5%), financial cost (88.7%) and lack of person training (91.3%) were the most barriers for implementing HACCP and ISO22000. In the study of Macheka et al. (2013) in Zimbabwe, the barriers were consistent with the findings of this study, lack of commitment from managers (16.7%), enforcement of food safety policy (13.3%) and lack of financial resource (26.7%).

Increased product safety and increased product quality were the most benefits of implementing food safety management systems (ISO2200and HACCP) for food establishments. This study findings are slightly lower than of Karaman, Cobanoglu, Tunalioglu, and Ova (2012) study in Turkey. The findings of Karaman et al. (2012) found that increased product quality was 82.1%, while this study was 68.5%, which implied importance HACCP implementation. Product safety have been a concern for most of the countries. Yeung and Morris (2001) explained that the perception of food safety risk has led to consumers and producers to improve effectives and efficiency of the

food supply chain. Regulations and laws have been put to safe guide the food industries. These include principles and guidelines that provided by Codex Committee for conducting microbiological risks (Stringer, 2005).

The importance of HACCP implementation was also observed in the study of Maldonado et al. (2005) who found that food industries with HACCP had 43% increased sales, food industries planning to implement HACCP had 34% increased sales and industries without HACCP had only 18% increased sales.

Table 5.

Barriers that prevent food establishments from implementing food safety systems.

	Company size						
Barriers	1-10	11-30	31-50	51-100	101-500	Mean (%)	SD
Supplier confidence to provide appropriate raw materials	5.0	22.9	10.3	20.0	66.7	24.9	22.2
Training of employees involved in food safety	15.0	16.7	13.8	0.0	8.3	10.7	6.0
Lack of knowledge on safety systems (HACCP & ISO22000)	0.0	10.4	6.9	20.0	8.3	9.1	7.2
Lack of prerequisite	0.0	31.3	10.3	0.0	16.6	11.6	13.0
Lack of management commitment	0.0	14.6	13.8	0.0	16.6	9.0	8.2
Lack of government support	0.0	29.2	24.1	0.0	33.3	17.3	16.1
Lack of motivation	0.0	6.3	6.9	40	8.3	12.3	15.8
Cost	0.0	6.3	6.9	60.0	8.3	16.3	24.6
Time	0.0	4.2	10.3	0.0	25.0	6.1	10.1
Volume of paperwork	0.0	0.0	0.0	20.0	0.0	4.0	8.9

Table 6.

Benefits of implementing food safety management systems in food establishments.

Benefits	Company size					Mean (%)	SD
	1-10	11-30	31-50	51-100	101-500		
Increase product safety	55.0	70.0	71.4	80.0	68.6	68.6	9.1
Increase product quality	70.0	55.3	82.1	60.0	75.0	68.5	10.9
Reduction of production cost	20.0	36.2	53.6	80.0	25.0	42.9	13.9
Comply with regulatory requirements	25.0	34.0	39.3	60.0	50.0	41.7	13.7
Increase sale	40.0	57.4	75.0	60.0	50.0	56.5	12.0
Increase product price	50.0	14.9	14.3	40.0	16.7	27.2	16.7

Hazards Control under HACCP Program

Table 7 describes the hazard control by food establishments that implement HACCP program to ensure foods are from contamination. Over 40% of the food establishments indicated that all food in storage is protected from contamination. Also, food received only from approved suppliers (28%) and the HACCP procedures were done at every step in the production process (38.9 %) in the food premises. Thirty eight percent of the food establishments trained food handlers appropriately to control hazards. Only 14.5% promptly discarded contaminated foods. These results indicate that HACCP program was not properly implemented.

Bas et al. (2007) claimed that food received only from approved suppliers was 87%, while in this study, only 28% of food establishments received food only from approved suppliers. Participants of this study also described that food establishment handlers were slightly trained (30.8), compared to (79.1%) of Bas et al (2007) study in Turkey. The findings indicated insufficient hazard control to most of the control aspects have caused inadequate managing practices of food hazards in the food establishments in

Tanzania. Keep records of the quality assurance data and promptly discard contaminated food were the least score. Keeping records of the quality assurance has great role that explains all the procedures done to control hazard and validate HACCP plan (McSwane, Rue, & Linton, 2000).

Table 7.

The control aspects of hazards that ensure food is free from contamination when HACCP is implemented in the food establishments.

	Company size						
Control aspects of Hazard	1-10	11-30	31-50	51-100	101-500	Mean (%)	SD
Food received only from the approved suppliers	15.0	10.6	25.0	40.0	50.0	28.0	16.8
HACCP procedure are done at every step in the production process	50.0	0.0	17.9	60.0	66.7	38.9	28.5
Contaminated food is promptly discarded	0.0	10.6	25.0	20.0	16.7	14.5	9.6
All food in storage is protected from contamination	5.0	17.0	53.6	40.0	75.0	40.7	29.7
Food handlers are trained appropriately	5.0	17.0	53.6	20.0	58.8	30.8	23.7
Keep records of the quality assurance data	0.0	2.1	14.3	0.0	50	13.3	21.4

Management of Prerequisite Programs in Food Establishments

Prerequisite programs are procedures, including GMPs and SSOP, which address operational conditions providing the foundation for HACCP. The responses on buildings and facilities guidelines that apply in food establishment to ensure food safety are indicated in Table 8. Over 80% of the participants indicated that they have well-designed draining system within the food establishment, followed by building wall, floor, and ceiling (69.8%) are easy to clean, and building allows enough lighting ventilation and movement (66.2%) to ensure food safety in food establishments. The least (40.5%) was the designing and maintenance of road around the building to enable loading and

unloading without creating contamination to food product. Food establishments with employees more than 50 have shown that they follow building guidelines than those with less than 50 employees.

Table 9 shows practices in food establishments that improve daily sanitation. The results indicate that 62.2 % of the food establishments had cleaning and sanitary programs that were simply done every day with records. On the other hand, only 36.7% of food establishments provided check sheet for workers to verify that sanitary operations have been processed and only 36% have used written sanitation standard operation procedures. Overall, these results indicate that most food establishments did not practice proper daily sanitary operations.

The good manufacturing practices that have been performed in food establishments to prevent food contamination are indicated in Table 10. The results indicate that over 75% of food establishments cleaned and maintained their internal and external areas and 74% of had the proper disposal of sewage and waste water. However, only 37% of the food establishments had restroom facilities with adequate ventilation. Overall, food establishments with more than 50 employees implement good manufacturing practices more than those with less than 50 employees.

Building guidelines were fairly performed on the food establishments. Most food establishments with fair guidelines control somehow working environments. Bas at el. (2006) reported that a well-designed layout for the food facilities and equipment was very important for eliminating and preventing hazards. More findings with improved build guidelines were reported in the study of Karaman at el. (2012), drainage adequate (50.9%), adequate of ventilation (74.9%) and lighting system adequate (50.9%). Bas et al.

(2006) found proper hand washing sink was located food preparation area at 5.5%, walls floor, ceiling, lighting adequate for food production at 28.4%, area properly ventilation, clean and maintained at 12.8%, and premise maintained inside and outside at 63.3%.

The results indicated sanitary operations setbacks in many the food establishments in the world. On the other hand, a well-designed and good structured premises, including hygiene training to food handlers suggested to control food hazard in food establishments. Youn and Sneed (2003) study indicated importance of person training (95%), standard operation for cleaning and sanitation (91%) and written procedure for cleaning and sanitizing all equipment (72%) in food production to hygiene practices in the food establishments. Bas et al. (2007) indicated 56.3% of food establishments have basic training, while (93%) of directors do not have hygienic practice manual.

Table 8.

Building guidelines applied to the food company to ensure food safety at the production plant.

	Company size						
Building guidelines	1-10	11-30	31-50	51-100	101-500	Mean (%)	SD
Wall, floor and ceiling are easy to clean	25.0	61.7	82.2	80.0	100.0	69.8	28.5
Draining system is well designed around and within the plant	50.0	70.2	85.7	100.0	100.0	81.2	21.3
Ground does not allow or hold contamination	55.0	59.6	67.0	60.0	83.3	64.9	11.1
Roads around the building are designed and maintained to loading and unloading	10.0	8.5	32.1	60.0	91.7	40.5	35.4
Building allows enough lighting, ventilation and movement	55.0	53.3	24.9	80.0	100.0	66.2	23.3

Table 9.

Practices that food establishments perform to ensure daily sanitary operations.

Sanitation Practices	Company size					Mean (%)	SD
	1-10	11-30	31-50	51-100	101-500		
Cleaning and sanitation programs are done every day with records	70.0	83.3	85.7	40.0	33.3	62.3	24.4
There is a check sheet for workers to verify all that have been processed	30.0	25.5	21.4	40.0	66.7	36.7	17.8
Written sanitation standard operation procedures for cleaning and disinfectants	0.0	8.5	17.9	60.0	91.7	35.6	38.9

Table 10.

Operations done in food establishments to prevent food contamination.

Operations to prevent contamination	Company size					Mean (%)	SD
	1-10	11-30	31-50	51-100	101-500		
Hand washing sink with hot and cold water	10.0	35.4	62.1	80.0	66.7	50.8	27.9
Employees wear uniform & approved clothes	25.0	56.2	69.0	100.0	91.7	67.6	30.4
External & internal of the premises are clean	50.0	66.7	75.9	100.0	83.3	75.2	18.6
Sewage and waste water in the premises are clean	32.0	70.8	75.9	100.0	91.7	74.2	26.3
Restroom facilities have adequate ventilation	5.0	20.8	31.0	60.0	66.7	36.7	19.4
Technical equipment maintenance & calibrate	30.0	43.8	41.4	100.0	100.0	63.0	34.1

Chapter V

Conclusion

This study aimed to determine food safety management practices of ISO22000, HACCP and their prerequisite programs (GMP and SSOP) in the food establishments. Two hypothesis were developed for the study: 1) lack of food safety knowledge to employees and managers on food safety systems in the food establishment and 2) Inadequacy of the managing food safety practices of food safety systems on controlling food contamination in the food establishments.

Based on the first hypothesis, it was concluded that food safety systems (HACCP and ISO22000) were inadequately used. Training on food safety systems was conducted mostly on prerequisite GMP and slightly on HACCP and ISO22000. Trainings were implemented infrequently. Therefore, there was a lack of knowledge to managers and employees to control food hazards in the food establishments.

In reference to the second hypothesis, it was advocated that the verification and validation of HACCP were inadequately performed. Barriers of implementing food safety systems were identified on lack of knowledge, poor confidence of supplier to provide appropriate raw materials, and government supports among many others were defined in the study. The study also observed improving product safety and quality, reduction of production cost and increased sales as benefits of food safety system implementation. Hazards controls under HACCP program were found inadequate for the control aspects to ensure food safety in the food establishments. In summary, the findings indicated inadequacy of management practices of food safety systems in the food establishment.

The major problem of food safety in Tanzania has been caused by the lack of knowledge of food safety management systems. In order to control the food hazards, food establishments and government should put measures in place that improve the effects. In-job and in-class training should be conducted to improve knowledge of employees and managers. Education and training are required for effective management of HACCP practices. Resources such as human resources, money, equipment monitoring and training aids should be obtainable for successful management of food safety practices. Also, it should be a provision of laws and regulations that guide food safety production in the food establishments.

Recommendation for Further Studies

This study was focused on managing the practices of food safety management systems in the food industries. It explained only determination of employees's and manager's knowledge of food establishments. Further studies should also focus on customer awareness. This study involved several industry groups, but results have found that almost all groups have poor food safety management practices, so furture studies should also focus on a single group of food industries to gain more insight. Due to tendency of more people in the country to eat at food vendors' places, it suggested further study to consider those places as well as.

Appendix I: Appendix I: physical, chemical, biological hazards and preventions

Causative Agent	Types of illness	Symptoms onset	Common food	Prevention
		Biological Hazards		
Escherichia coli 0157:H7	Bacterial infection or toxin-medial infection	Bloody diarrhea followed by kidney failure and hemolytic uremic syndrome (HUS) in severe cases (12-72 hrs.)	Undercooked hamburger, raw milk, unpasteurized apple cider, lettuce	Practice good food sanitation, handwashing; properly handle and cook food
Salmonella	Bacterial infection	Nausea, fever, vomiting, abdominal cramps, diarrhea (6-48hrs)	Raw meats, raw poultry, eggs, milk, daily products	Properly cook foods avoid cross contamination
Clostridium perfringens	Bacterial toxin-mediated infection	Intense abdominal pains and severe diarrhea (8-22hrs.)	Spices, gray, improperly cooked food (especially meats and gravy dishes)	Properly cook, cool and reheat food
Bacillus cereus	Bacterial intoxication or toxin-mediated infection	Diarrhea type abdominal cramps (8-16hrs) 2 Vomiting type: voting, diarrhea, abdominal cramps (30 min-6 hrs.)	Diarrhea type: meats milk vegetable 2 Vomiting type: rice starchy food grains cereals	Properly heat, cool and reheat foods
		Chemical Hazards		
Scombrotoxin	Seafood toxin originating from histamine producing bacteria	Dizziness, burning feeling in the mouth, facial rash or hives peppery taste in mouth, headache, itching, tears eyes, runny nose (1-30min)	Tuna, mahi-mahi, bluefish, sardines, mackerel, anchovies, amberjack, abalone	Purchase fish from a reputable supplier; store fish a low temperature to prevent growth of histamine-producing bacteria; toxin IS NOT inactivated by cooking
Mycotoxin	Intoxication	1 Acute onset-hemorrhage, fluid buildup 2 Chronic onset-cancer from small doses over time.	Moldy grains, corn, corn products, peanuts pecans, walnuts and milk	Purchase food from a reputable suppliers; keep grains and nuts dry; and protect production from humidity.
		Physical Hazards		
Fragment of glass, metal pieces, human hair and jewelry				Wash raw food, don't wear jewelry during food preparation, sieves and magnets.

Appendix II: Refrigerated Storage of foods and Critical Limits of temperature and time

Food	Recommended temperature (F/C)	Maximum storage period	Comments
Meat			
Roast, steaks, chops	2-36/ 0-2.2	3 to 5 days	wrap loosely
Ground and stewing	32-36/0-2.2	1 to 2 days	wrap loosely
Variety meats	32-36/0-2.2	1-2 days	wrap loosely
Whole ham	32-36/ 0-2.2	7 days	may wrap tightly
Poultry			
Whole chicken, turkey, ducks	32-36/ 0-2.2	1 to 2 days	wrap loosely
Stuffing	32-36/ 0-2.2	1 to 2 days	covered container
Fish			
Fatty fish	30-34/ -1.1- 1.1	1 to 2 days	wrap loosely
Fish-not iced	30-34/ -1.1-1.1	1 to 2 days	wrap loosely
Eggs			
Eggs in shell	40/4.4	1 week	do not wash, remove from container
Leftover York/white	40-45/ 4.7-7.2	2 days	cover yolks with water
Dried eggs	40-45/ 4.4-7.2	1 year	same treatment as egg in shells
Dairy Products			
Fluid milk	38-39/ 3.3-3.9	5 to 7 days after date on carton	Keep covered and in original container.

Butter	38-40/ 3.3-4.4	2 weeks	waxed cartons
Hard cheese	38-40/ 3.3-4.4	6 months	cover tightly to preserve moisture
Fruit			
Apples	40-45/ 4.4-4.7	3 days	room temperature till ripe
Avocados	40-45/4.4-7.2	3 to 5 days	room temperature till ripe
Banana	40-45/ 4.4-7.2	3 to 5 days	room temperature till ripe

Appendix III

INFORMED CONSENT DOCUMENT

Project Title: Food Safety Management Practices in Tanzania
Investigator: Bright Kahindi-Architecture and Manufacturing Sciences - 270 303 6836

You are being asked to participate in a project conducted through Western Kentucky University. The University requires that you give your agreement to participate in this project.

You must be 18 years old or older to participate in this research study.

The investigator will explain to you in detail the purpose of the project, the procedures to be used, and the potential benefits and possible risks of participation. You may ask any questions you have to help you understand the project. A basic explanation of the project is written below. Please read this explanation and discuss with the researcher any questions you may have. You should keep a copy of this form for your records.

1. **Nature and Purpose of the Project:** The purpose of this project is to collect data to find methods to improve practices of food safety management systems in order to control food contamination during the production of food in those industries.

2. **Explanation of Procedures:** Participants are asked to complete a questionnaire. The time to complete the questionnaires will be 20-25 minutes.

3. **Discomfort and Risks:** There are no anticipated risks or discomfort to the participants in this research.

4. **Benefits:** There is no direct benefit gained in the study but the subject may receive awareness on food safety practices. The study may inspire the food producers to get trained on the safety system, and upon request you may be provided the researcher findings in a formal report.

5. **Confidentiality:** The survey does not ask for identifiable information, and it is requested that you do not write your name or company name on any forms to assure anonymity.

6. **Refusal/Withdrawal:** Refusal to participate in this study will have no effect on any future services you may be entitled to from the University. Anyone who agrees to participate in this study is free to withdraw from the study at any time with no penalty.

You understand also that it is not possible to identify all potential risks in an experimental procedure, and you believe that reasonable safeguards have been taken to minimize both the known and potential but unknown risks.

Your continued cooperation with the following survey implies your consent.

THE DATED APPROVAL ON THIS CONSENT FORM INDICATES THAT
THIS PROJECT HAS BEEN REVIEWED AND APPROVED BY
THE WESTERN KENTUCKY UNIVERSITY INSTITUTIONAL REVIEW BOARD
Paul Mooney, Human Protections Administrator
TELEPHONE: (270) 745-2129

WKU IRB# 15-222
Approval - 11/18/2014
End Date - 5/20/2015
Expedited
Original - 11/18/2014

Appendix IV: Questionnaires

Marked is given (1): Unmarked is given (2)

Groups: 1: (1-10) 2: (11-30) 3: (31-50)

4: (51-100) 5: (101-500) 6. 500+

Question 1: Which type of product(s) does your company produce/ manufacture?

A: Fish and sea food **D**: Meat beef **G**: Poultry

B: Baked goods **E**: Juice **H**: Wheat flour

C: Coffee and tea leaves **F**: Vegetables **I**: Pork

J: Other products, please specify_____

Question 2: How many employees are in your industry/ company?

1:1-10 **2**:10-30 **3**:30-50

4: 60-100 **5**:100-500 **6**: 500+

Question 3: Which of the following food safety systems used in your company to ensure safety? Mark all that applied.

C: Good manufacturing practices (GMPs)

D: Sanitary Standard operation procedures (SSOP)

A: International organization Standard (ISO 22000:2005)

B: Hazard analysis critical control point (HACCP)

E: None

F: Other: please specify

_____
_____
_____
_____

Conducting of food safety management aims to prevent, identify and reduce food borne hazards. The aspects below have used to measure the performance of food safety systems.

Question 4: Which of the systems below does your company trains employees to ensure and improve food safety? Choice all that apply.

A: International organization Standard (ISO 22000:2005)

B: Hazard analysis critical control point (HACCP)

C: Good manufacturing practices (GMPs)

D: Sanitary Standard operation procedures (SSOP)

E: Other hygiene practices: please specify

_____
_____
_____
_____
_____

Question 5: How often does **management** get trained in the food safety management system?

1: Once per year **2:** Twice per year

3: One every three months **4:** none

Question 6: How often do management train **factory employees** in the food safety management system?

1: Once per year **2:** Twice per year

3: One every three months **4**: none

Question 6: Mark the food partner (s) which the company collaborate with.

A: Statutory and regulatory body **C:** Customers

B: Suppliers **E:** None

F: Other: please specify

_____
_____
_____
_____
_____

Question 7: Does your company have Hazard Analysis Critical Point (HACCP) program?

1: Yes: If yes, please answer question 11

2: No: If no, please go to question 14

Question 8: Which documentation does your company have to **verify** the performance of the HACCP safety system? Mark all the aspect (s) that apply

A: Documented industry procedure used to validate against the HACCP

B: Point validation used to improve food safety management system

C: Record and analyze quality of assurance data/measurements

Question 9: Which of the following are done by company to **validate** the performance of HACCP in controlling the hazards? Mark all the aspect that apply

A: Validation of supplier points of measures

B: Validation of employees' intervention system

C: Validation quality assurance monitoring system

Question 10: Which **Barriers** does your factory face that food safety?

A.Supplier confidence to provide appropriate raw materials

B.Training of employee involved in food safety

C.Lack of knowledge about safety systems (ISO 22000, and HACCP)

D.Lack of prerequisite programs

E.Lack of management commitment (staff turn-over).

F.Cost

G.Time

H.Lack of government support

I.Volume of paperwork

J.Lack of motivation

K.Other: please specify

_____

_____

_____

_____

Question 11: If your company is implementing HACCP, What control aspect (s) ensure the food is free from contamination during production process? Mark the appropriate aspect (s).

A.Food received only from the approved suppliers

B.HACCP procedures are done at every steps in the production process

C.Contaminated food is promptly discarded

E.Food is stored away from chemical, physical and biological contaminants

F.All food in storage is protected from contamination

G.All food handlers are trained

H.Keep records of the monitoring data

Question 12: What are the benefits (incentives) of implementing food safety management systems in the company? Please mark the appropriate aspects

A.Increase product safety **B.**Comply with regulatory requirements

C.Increase product quality **D.** increase sales

E.Reduction production of cost **F.**Increase product price

G.Other, please specify

_____
_____
_____
_____
_____

Question 13: Which of the building guidelines apply to your company to ensure food safety at the production plant? Mark which are appropriate.

A.Wall, floor and ceiling of the industry are easy to clean

B.Drainage system is well designed around and within the plant

C.Ground does not allow contamination

D.Roads around the building are designed and maintained to enable loading and unloading do not cause contaminants

E.Building allows enough lighting, ventilation and convenient movement.

F.Other: please specify

_____
_____
_____
_____
_____.

Question 14: What practices/ measures does your company perform to ensure that daily sanitary operations are done? Mark all which are appropriate.

A.Cleaning and sanitation programs are simply done every day without record.

B.There is check sheet for workers to verify all have been processed.

C.Worksheet containing accurate and current information.

D.Written standard operation procedures for cleaning and disinfectants equipment and facilities to verify standard and threshold.

E.Other, please specify

_____
_____
_____
_____
_____

Question 15: Which operations are done in the company to prevent food contamination? Mark all which are appropriates elements

A.A hand washing sink has pressured hot and cold water and accessible all times.

B.Employees wear uniforms and approved clothing

C.Exterior and internal of the premises is clean and well maintained.

.Sewage and waste water is disposed properly.

E.Restroom facilities have adequate ventilation.

F.Technical equipment maintenances and calibrated.

Question 16: What is your age?

1.18-29 years **2.**30-45 years **3** 46-60 years **4**.60+ years

Question 17: What is your gender? **1.** Male **2** Female

Question 18: What is you highest degree or level of education you have completed?

1. Less than high School **2.**high school Diploma **4**.Technical certificate

5. Bachelor degree **6.**Graduate degree **7.** Doctor Degree

Question 19: What is your experience in this industry?

1. Less than 5 years **2.** 6 to 10 years

3.11 to20 years ☐**4.** More than 20 years

Thank you for your participation and contribution

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