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IMPLEMENTATION OF THE HAZARD ANALYSIS CRITICAL CONTROL POINT (HACCP) SYSTEM IN A FAST FOOD BUSINESS

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ABSTRACT

The hazard analysis critical control point (HACCP) system, created to prevent disease hazards caused by food and to provide food safety, has gained increasing importance in food and beverage businesses (FBBs). This part of the food industry can benefit at economic and human levels from the establishment and the effective management of such a system.

The contribution first reviews the concepts and explains the methodology underlying the HACCP system. The different stages necessary to establish an efficient HACCP system in FBBs are outlined. In the concluding part, an exemplary implementation of the system in a fast food business is described.

Key Words: HACCP; Food safety; Hazard and risk analysis; Critical control point; Critical limit

INTRODUCTION

Food and beverage businesses (FBBs) have various responsibilities with regard to food safety and nutrition, which go beyond offering service to their

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guests. Therefore, FBBs have started to implement the hazard analysis critical control point (HACCP) system. The aim of this approach is to provide standards in hygiene and sanitation when producing and presenting food and to minimize all risks during this process. The implementation of HACCP involves different stages, which exhibit peculiar features but are closely linked to each other.

The purpose of this contribution is to structure the framework of the HACCP system in a way that enables its implementation in FBBs. In the first part, the concepts underlying HACCP are covered, essential definitions are given, and features, developments, and potential contributions of the system are described. In the second part, the specific stages necessary for establishment and management of HACCP by a food and beverage business are discussed. In the final implementation chapter, the process is subject to a detailed review for a selected product of a fast food business implementing HACCP.

DEVELOPMENT OF THE HACCP SYSTEM

Food safety is of increasing importance in the food and beverage industry. The main reason is the susceptibility of the products to microbiological, physical, and chemical hazards.[1] Every year millions of people in developed/developing countries are falling ill because of the food and beverages they consumed. For instance, two-million children lose their lives as a result of food-related diseases.[2] Thirty percent of the whole population in developed countries catch diseases of food origin every year. In the United States, 76 million cases appear on an average every year. Of these, 325,000 have to be hospitalized and 5000 result in death.[3]

As part of their efforts to minimize contaminations, FBBs have recently tended to change their approach, i.e., they move away from quality control at the level of the end product towards quality assurance based on HACCP.[4]

HACCP is a systematic approach—the aim of which is to determine the hazards related to food, to identify critical control points (CCP), and to put them under control.[5] It is a risk-based food safety assurance system that concentrates prevention strategies on known hazards. Advocates of HACCP argue that the system can focus on the critical stages from producer to consumer in a cost-effective manner. It concentrates on raw material and process control rather than on structure and layout of food premises.[6]

The term HACCP was first used in 1960 by Pillsbury Company in cooperation with NASA and the U.S. armed forces for a process to produce safe food. NASA requested a program to guarantee "zero defect" in order to ensure the safety of food to be consumed by astronauts who fly to space.[7,8] Examining the process of space food production and identifying possible risk sources like the humans involved, the food and the process applied, Pillsbury Company has developed HACCP as a quality control system.[5]

After its general introduction in 1971, the main interest of applications of the system were microbiological hazards;[9] it has been used since 1973 in auditing establishments producing low-acid preserved food.[5]

At the beginning of 1980s, the HACCP system was adopted by big businesses. In its 1985 "Green Book" the National Academy of Science recommended the HACCP system to be used in food producing businesses. In the late 1980s and early 1990s increased consumer awareness relating to perceived unsatisfactory food safety standards and resulting from a sharp increase in reported food-borne illness and some high-profile food poisoning outbreaks demonstrated the importance of systems such as HACCP.[10] In the following years, studies conducted by various international institutions, e.g., International Commission for Microbiological Standards for Foods (ICMFS), International Association of Milk Food and Environmental Sanitarians (IAMFES), significantly supported widespread HACCP implementations. In 1991, an implementation guide prepared by a group of the Codex Alimentarius Commission (FAO/WHO) with directions from the Food Hygiene Committee accelerated HACCP practices.[7,8]

In the European Union (EU) a legislative framework related to food safety, mainly focusing on the concept of hazard analysis, the identification of hazards, and the implementation of procedures to control such hazards has been implemented in recent years.[11] The concepts of this framework are in agreement with the principles of the HACCP system.[12]

Parallel to the earlier-mentioned development, various models have been elaborated in different countries for the implementation of HACCP in food industry. Specific models have been proposed for businesses of different types and sizes.

In 1996 the Food Safety and Inspection Services (FSIS) of the United States Department of Agriculture (USDA) introduced its regulations "Pathogen Reduction: Hazard Analysis and Critical Control Point (HACCP) Systems; Finale Rule".[23]

In 1999 WHO and the Ministry of Health, Welfare and Sports, The Netherlands published a report called "Strategies for Implementation of HACCP in Small and/or Less Developed Businesses." (see Ref. [13])

As part of its Food Safety Enhancement Program, the Canadian Food Inspection Agency published "HACCP Curriculum Guidelines" and recommended a generic model of 12 steps.[14]

Another example is the HACCP document prepared by the National Advisory Committee on Microbiological Criteria for Foods (see Ref. [15]). This committee formed a study group about HACCP in 1995. The main aim was to compare current HACCP documents with a HACCP guideline prepared by CODEX Committee on Food Hygiene. The newly improved HACCP documents include concise definitions and summarizing information. They also describe necessary prerequisite programs, education and training, and implementation and

maintenance of HACCP plans. The documents focus not only on microbiological food safety but also on chemical and physical risks.

IMPACT OF HACCP TO FOOD AND BEVERAGE BUSINESSES

The HACCP system can have a significant impact on the production management in FBBs.

- It provides a general system to ensure food safety.
- It helps to put microbiological, chemical, and physical hazards under control.[16]
- It presents standards and a common terminology for production processes, control procedures, and documentation as a guide for all FBBs and thus supports the efforts of auditing institutions.
- It gives the possibility to measure the performance of a business using the safe production of food as evaluation criterion.[9]
- It provides a careful review of all the processes from supply of raw materials to delivery of end products to customers and thus constitutes a pro-active rather than a re-active approach.[9]
- It reduces customers' complaints and increases their satisfaction.
- It is much cheaper and safer than the systems in which the businesses are traditionally subject to quality control tests.
- It eventually improves food production by the required documentation and monitoring.
- It causes the personnel to be given training, awareness, and care necessary for food safety.[9]
- It is easily understandable and flexible; as its focus is on specific hazards of food production, it gives response to problems on time.
- It can be performed together with other quality studies.[17]
- It gives businesses the possibility to compare themselves with others as regard to food safety.
- A full participation of all the employees from every department is required for the implementation of HACCP system. In this way HACCP raises employees' motivation and relations.[18]

ESTABLISHMENT AND MANAGEMENT OF HACCP IN FOOD AND BEVERAGE BUSINESSES

Preparation Efforts for Establishment of HACCP System

As soon as the top management of the business makes a decision on the implementation of HACCP system, a preliminary study including prior

information and food safety as well as an analysis of the present situation are necessary. The following stages have to be followed:

Top Management Will Take a Mission for Food Safety

The success of HACCP system depends on the fact that the top management will be aware of the responsibility to ensure food safety. This responsibility should be documented as a part of "Mission and Vision of the Company," i.e., it should be officially integrated into the company's policy. This will be considered as a commitment of the top management to implement HACCP.

Prior Information

At this stage the top management should be comprehensively informed of:

- meaning and importance of food safety;
- risk of the goods and services the business produces and their possible effects;
- contents, contributions, and implementation process of HACCP system.

An investigation by Adams and Morrell[19] on the knowledge of hotel managers of food safety showed that they have insufficient information on:

- current laws about food safety;
- understanding and implementation of new regulations on food safety;
- requirements of food safety regulations;
- principles of HACCP;
- importance of customers' protection and the ways to produce safe food.

The prior information will give the top management a general viewpoint on the HACCP system. However, sectoral practices, legal requirements, and internationally relevant verdicts and conventions should be subject to a detailed review at later stages.

Announcement of Transition Decision to Internal and External Environment of the Business

Implementation of a HACCP system will bring fundamental changes to all stages of production and service. From the very beginning, the support of the employees should be assured; the transition decision should be communicated to the internal and external environment of the business. The reason for transition to HACCP, the change it will create, and its contribution should be explained to all parties related to the subject.

Formation of a HACCP Team

Formation of an HACCP team is one of the most important steps to establish HACCP efficiently. Members of the team should be well informed and experienced with the foods to be produced and the production process itself. The team should comprise food engineers, microbiologists, food and beverage managers, maitres d'hôtel (at hotels), chefs, sanitation, and quality safety experts.[15] The members may not only be recruited from the staff of the business but also from external specialists. The number of people in the team depends on the size of the business. The HACCP team will be responsible for implementation of all necessary preparation and planning to establish the system, and also for management, coordination, and audit.

Current Situation Analysis of Food Safety

The legal food safety system of the country where the business is located should be considered in detail. In the European Union (EU), "the Green Paper" published by EU Commission provides a framework for food policies in member countries, and "Agenda 2000" should be carefully considered. One of the four main headlines of Agenda 2000 was "Reform on a Common Agriculture Policy." One of the objectives specified by the Commission related to the policy was "improving food quality and safety for consumers." It will also be beneficial to know about 93/43/EWG EG principles of EU. "The Food Hygiene" specified in these principles is equivalent to the HACCP system.[17]

Standards and practices of other businesses in the sector as regard to food safety should be investigated and reviewed. Businesses that have adopted the HACCP system may be investigated in more detail.

All the requirements and rules of HACCP system should be learned. There has not been a common world-wide accepted standard on implementation procedures of the HACCP system; there are different implementation models in the countries and sectors. The FBBs (i.e., hotels, restaurants, cafeterias, pubs, etc.) may choose the most appropriate model suitable to the legal frame and to their own requirements.

The HACCP team should review the current practices on food safety up to the present. In light of the discussion previously, the HACCP team should identify the problems in the business, e.g., inappropriate conditions in certain units, complaints from customers or fines imposed as punishment for offending food safety laws. This analysis will give the business a chance to discover its strong and weak sides as regards the implementation of the system. For businesses with a high proportion of qualified employees who are open for innovations and changes, it will be easier to start HACCP. In a business with opposite features more intensive efforts of training and orientation will be necessary to gain participation and support for HACCP implementations.

Describing the Product and Identifying Presenting–Delivering Conditions

Descriptions should be provided for each product or product group produced in a business. Hamburger, chips, freshly squeezed orange juice, and ice cream in a fast food business are examples of products with completely different features as regard to the production and service. For this reason, various forms can be developed to describe these products in the HACCP system. The forms will consist of basic and characteristic features for the related products.

Specifying the Place Where the Product Will Be Used and Identifying Customers

After describing the product, the HACCP team will identify the final point(s) where the product will be sold. For example, in a self-service fast food restaurant hamburgers will be sold at bench, whereas at hotels it can be served on the beach, around the pool bar or in the rooms. Another point to be considered by the HACCP team is the type of potential customers.

Preparing and Correcting a Flow Diagram to Define Production and Service Processes

The purpose of a flow diagram is to create a clear and simple scheme about the steps of the process. The flow diagram should include all the steps in the process, which are under the control of the business but it must not be too complicated. The diagram should take into consideration information from the employees at every level, including those who plan food production, those who work in the production, and those who make internal and external audits.

Planning the HACCP System

All the preparatory efforts explained earlier should be carefully considered when planning the implementation of the HACCP system in the next stage.

Specification of Potential Hazards for Products and Their Production

The main purpose at this stage is to identify potential hazards for products and the production process involved. A list of potential hazards including possible illnesses and diseases should be made.[15] Some of the identified hazards can be put under control, whereas others cannot be controlled or are difficult to control. At this point the HACCP team should try to find controlling measures revising the hazards that seem difficult or impossible to put under control.

The process for hazard analysis consists of two steps. The first step is "brainstorming." The HACCP team should identify biological, chemical, and physical hazards related to the food and list them. The following main areas should be covered:[15]

- content of the food;
- procedures to be used for the production process;
- microbial status of the food;
- building design;
- equipment design and usage;
- sanitation;
- employees' health, hygiene, and training;
- resistance conditions of the product before consumption;
- service conditions;
- purpose of use of the food;
- potential consumers.

The second step after listing the potential hazards is "hazard evaluation." In this step the HACCP team decides which of the potential hazards are included into HACCP planning. Each potential hazard should be evaluated as regards to its severity and the probability it may occur.

Specification of Critical Control Points

Critical control points are location, operation, procedure, or process where control can be carried out to remove the hazards for food safety or to reduce them to an acceptable level.[20] Specification of CCP depends on the possibility of a hazard occuring and the evaluation of its effectiveness level. It may not be necessary to prepare separate CCP for each hazard. However, an effort should be given for all the hazards to be deviated, prevented, or decreased.[14]

In addition to the CCP, operational control points (OCP) may be determined. Examples are: health of the team members, their hand-washing habits, clothes, audit before operation, knife-grinding tools, grilling procedures, use of sanitation materials and equipment. The CCP identified for a hamburger product in the fast food business are as follows:

- product delivery temperatures;
- deep freezer temperatures and meat freezing box;
- cooler temperatures;
- shelf-life of cold products;
- clam-shell grills;
- surface temperature of clam-shell grill;
- internal temperature of cooked meat;
- keeping hot;
- multiplex water system, reverse osmosis apparatus, UV-lamp.

A tool to identify CCP by the HACCP team is the "CCP Determination Decision Tree." An example is given in Appendix 1. It should always be kept in mind that CCP identification is the most important step of a HACCP system[21] and CCP should be carefully documented.

Determining Critical Limits for Each Critical Control Point

Critical limits are minimum and/or maximum values to which a biological, chemical, or physical parameter must be controlled at a CCP to prevent, eliminate, or reduce to an acceptable level the occurrence of a food safety hazard.[15,17,21,22]

These limits show if the identified hazards can be put under control or not. Critical limits may be determined for factors like temperature, time, physical dimensions, humidity levels, water activity, pH, salt content, chlorine rate, or protective materials. Control limits can be taken from literature, legal provisions, or from comparable standard procedures.[23]

Improving Monitoring Procedures

Monitoring is systematic and planned observation to make sure that CCP are under control.[21] The staff to monitor the process can be chosen from the production department or the quality safety department. Monitoring can be performed continuously or at certain intervals.

Determining Deviations and Corrective Procedures

When monitoring results show that criteria are not met, appropriate and immediate precautions should be taken to correct the deviations. For example, corrective actions may be re-heating or re-operating, increasing the operation temperature, extending operation time, decreasing pH, changing equipment of measurement, changing equipment of process and maintaining, extra training for employees, revising HACCP documents, change in process flow, etc. Procedures should be improved for corrective actions. The procedures should define who is responsible for corrective actions in HACCP system, in which cases corrective actions will be taken, which resources are used for information, when corrective actions are started, implemented, monitored and completed.[21]

Creating Verification Procedures

Verification is the effort to determine whether the HACCP plan is valid and whether the system operates as planned. The HACCP plan is scientifically and technically evaluated. It is determined whether the plan defines all the hazards

related to safety, whether it is efficiently implemented, and whether the hazards can be put under control.

Keeping Records and Documentation Procedures

All stages in the process should be documented in order to enable retrospective observation, verification, and validation of the HACCP system. A recording procedure should be prepared documenting the methods applied and the procedures followed.

Training Employees About the HACCP System

After the main preparatory procedures are completed, the complete staff should be trained. Businesses have accepted that the most efficient way is to start the training at the top managers' level and to gradually move down in the hierarchy.[24] Those who will be directly employed in the process should be given detailed training, the rest of the staff may be given general information only. The formal training programs carried out in the business should be enriched with information on hygiene.[25]

Assignment of Duties to the Staff

All members of the HACCP team will be responsible for effective implementation of the HACCP system. In addition, HACCP representatives should be determined from different units of the business to support active implementation of the system. Their duties include:

- to provide communication with the HACCP team;
- to provide internal coordination about HACCP activities;
- to audit the unit under their responsibility to make sure the system will work;
- to train the staff;
- to carry out monitoring activities on the system and to keep records;
- to take corrective actions in case of deviation and to keep related records;
- to be responsible for improvement of the HACCP system.

Implementation of the HACCP System

The system can be implemented after the described stages of preparation, planning, and training have been completed. It is important that the supporting role

of the top management becomes obvious. Another point essential for successful implementation of the system is to establish awareness about food safety in the business. This can only be achieved by continuous training, auditing, and awarding.

Control and Improvement of the HACCP System

Verification and reliability of activities to plan the system can best be tested during implementation. In light of the data collected and the problems faced during implementation, not only the HACCP plan but also current practices should be revised and re-arranged with necessary precautions.

IMPLEMENTATION AT A FAST FOOD BUSINESS

Purpose of Implementation

The objective of this chapter is to demonstrate the implementation of the HACCP system at different stages in a fast food business as it has been theoretically explained in the chapters earlier, and to present a guiding sample about food safety for FBBs. Implementation has been followed for one of the international fast food chains using a questionnaire, which has been filled during a face-to-face interview with the restaurant manager. The general implementation of the HACCP system in the business was investigated using only one product (hamburgers) as an example in the questionnaire. The reasons to select hamburgers as study objects may be listed as follows:

- Hamburger is the main product of the business.
- There are various materials in its content.
- It is the most consumed product in the business.
- It carries risk factors related to food safety.
- It is operated under more than one sub-process during production.
- Its risk related to food safety in sub-processes is quite high.

Before answering the questions, operation of the restaurant, daily working routine, physical equipment, workflow, and procedures have been observed under the manager's supervision. The current practices about the HACCP system have been especially monitored during the observation.

Findings from the Implementation

Findings for Description of the Product

The description form is given in Table 1.

Table 1. A Hamburger Description Form

General Information	
1. Name of the product	Hamburger and other two products[a]
2. Consumption type	Ready to eat
3. Package	Hamburger bag, Styrofoam box, paper bag for outside use, pasteboard for children's use
4. Maximum time and conditions between production and consumption	10 min in keeping cabins
5. Sales point	Sales bank
6. Customers of product	Local people and foreign passengers
7. Its consumption type desired by customers	In the restaurant as soon as possible
8. Label type and instruction conditions	No
Contents	
1. Main materials consisting of product	Frozen one-tenth/fourth meat, frozen bread, lettuce, catch-up, mustard, onion, pickle, salt, and mayonnaise
2. Extra materials used for product	Gluten and calcium, 5% sugar (bread)
3. Other materials	Packages (trays, packing materials)

[a] Not to announce the name of the business, specific names of the products could not be written clearly.

Flow of Production Process

The flow of hamburger production process prepared as a result of the interview and observations can be seen in Fig. 1.

Product-Hazard Analysis

1. Hazard analysis for contents of product and the product itself
   - The product has content possible to cause Salmonellosis or diseases due to enteropathogenic *E. coli*.
   - The water used may lead to microbiological hazards.
   - There are potential microbiological and physical hazards (such as hair, jewelry, tap of sauce bottle) at production stage of the product.
   - There may be bacteria and viruses in the product.
   - There may also be bacterial growth when the product is kept for use.
2. Hazard analysis for building design
   - The building plan can cause both microbiological and physical hazards (such as insects, vermin).

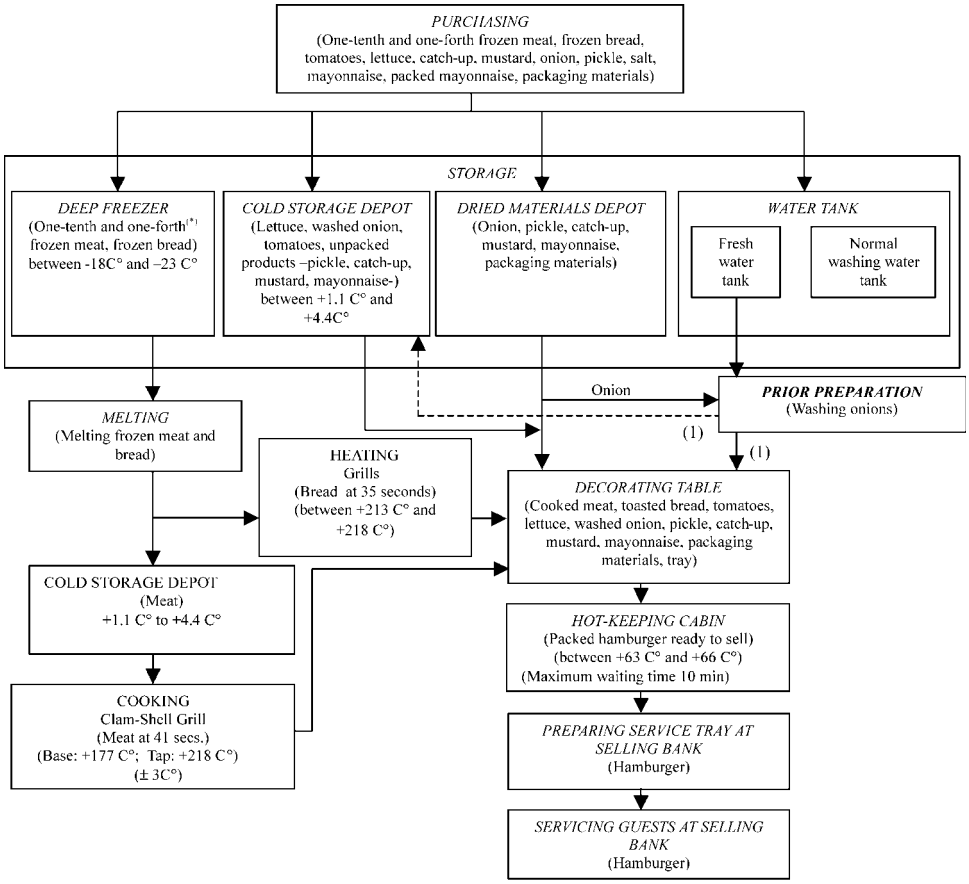


Figure 1. Hamburger production process flow diagram. (1) Some of the washed onion is sent to decorating table (maximum keeping time 2 hr), while the rest is sent to cold storage depot (for maximum 1 day). (*) One-tenth (1/10) and one-fourth (1/4) are used to define different types of standard hamburger meatballs.

- It can cause microbiological and physical hazards to appear from movements of people and equipment.

3. Hazard analysis for equipment design and use
   - The equipment does not allow a time/temperature adjustment.
   - The equipment is insufficient.
   - The equipment tends to frequently break down.
   - The equipment is difficult to clean.
   - Some parts of the equipment are open to physical hazards (i.e., some parts may fall and break).
   - The equipment does not possess safety apparatus (i.e., metal detector, magnet, electrical filter, thermometer).
4. Hazard analysis for packaging

- Packaging methods and the materials used may cause microbiological hazards.
- Lack of consumer's instructions on the package.

5. Hazard analysis for sanitation
   - Problems with sanitation of building and equipment.
   - Cleaning procedures.
6. Hazard analysis for employees' health, hygiene, training, and internal communication.
   - Employees may get contagious illnesses (e.g., flu, cold, virus infections, and contagious skin diseases).
   - Employees may not know or implement the rules about hygienic conditions that will affect product safety directly or indirectly.
   - Employees may lack information about factors to provide product safety.
7. Hazard analysis for keeping conditions between service and consumption of products
   - If conditions are inappropriate for keeping (i.e., temperature, time, place, and equipment), products are open to microbiological hazards.
8. Hazard analysis for consumers
   - If the consumers have insufficient information on hamburgers, like all other kinds of food, they may cause microbiological, chemical, and physical hazards (e.g., if the product is kept for a very long time at consumption, re-heated, given to babies, consumed by people who are allergic to proteins).

Use of the HACCP System in Providing Food Safety

In this chapter the implementation of the HACCP system in a fast food business is given as an example. The application of the HACCP system to provide food safety in the course of production and sale of Hamburgers, the major products of the business, has been followed.

Tables 2–10 outline the CCP determined by the business, the hazards identified in the production process, and the precautions taken. Operational control points, which are not evaluated to be CCP by the business but are very effective for food safety, have been defined in Tables 11–18.

At every level of the process the essential steps, i.e., CCP, hazards appearing at these points, aimed values and critical limits, precautions taken, frequency of hazards, records taken, corrective actions to prevent the hazards in case of deviation, and verification methods, have been identified by the business.

Table 2. CCP 1—Product Delivery Temperatures

Critical Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Implementation Frequency	Implementation Methods	Implementation Records	Implementation Responsibility	Corrective Actions	Verification Methods
CCP 1 Product delivery temp. (RECEIVING STAGE)	Melting Less cooking Heat changes affecting microbe growth	− 18°C or colder (AV) − 15°C or hotter (CL)	Control at every buying product	Measuring internal temperature in the vehicle with digital thermometer (− 19°C) (AV) Control of product packages with a pyrometer[a] (measuring temperature inside the parcels dipping a pyrometer (− 16 to 17°C) (AV)	Recording delivery temperature from company driver (one copy the transporting company and one the company)	Restaurant manager Shift manager	Refusing delivery Informing quality control department at the center Informing delivery centre	Audit of records Audit of training Audit of operations Audit of monitoring

[a] The name given to needle pinned thermometer.

Table 3. CCP 2—Deep Freezer Temperatures and Meat Freezing Box

Critical Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Implementation Frequency	Implementation Methods	Implementation Records	Implementation Responsibility	Corrective Actions	Verification Methods
CCP 2 Deep freezer temperatures and meat freezing box (STORING STAGE)	Melting Less cooking Heat changes affecting microbe growth	− 18°C or colder (AV) − 15°C or hotter (CL)	(1) *For equipment being continually operated*: At start At shifts At closing (2) *For equipment operated daily*: At start At closing	(1) *At start*: Writing thermometer value of the equipment Measuring internal air temp. of equipment Measuring the product temperature (2) *At shifts and closing*: Writing thermometer value of the equipment Measuring and recording product temperature if out of standards Storing if equipment is at accurate temperature	Daily safe food control list	Shift manager	Calling for service when temperature falls under standards Not using the product when deep freezer loses heat Informing the shift manager in case of an emergency	Calibrating equipment according to calibration and maintenance procedures and keeping its situation Audit of records Audit of training Audit of operations Audit of monitoring

Table 4. CCP 3—Cooler Temperatures

Critical Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Implementation Frequency	Implementation Methods	Implementation Records	Implementation Responsibility	Corrective Actions	Verification Methods
CCP 3 Cooler temperatures (STORING STAGE)	Bacteria growth	+1.1 to +4.4°C (AV) +7°C and over (CL)	(1) *For equipment being continually operated*: At start At every shift At stop (2) *For equipment operated daily*: At start At closing	(1) *At start*: Writing the thermometer value of the equipment Measuring internal air temperature of equipment Measuring the product temperature (2) *At shifts and closing*: Writing the thermometer value of the equipment Measuring and recording product temperature if out of standards Storing if equipment is at accurate temperature	Daily safe food control list	Shift manager	Calling for service when temperature falls under standards Not using the product when deep freezer loses heat Informing the shift manager in case of an emergency	Calibrating equipment according to calibration and maintenance procedures and keeping its situation Audit of records Audit of training Audit of operations Audit of monitoring

Table 5. CCP 4—I. and II. Shelf-Life of Cold Products (Time)

Critical Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Implementation Frequency	Implementation Method	Implementation Records	Implementation Responsibility	Corrective Actions	Verification Methods
CCP 4 I. and II. Shelf-life of cold products (time) (STORING STAGE)	Bacteria growth Cross contamination[a] Foreign materials	Expired (CL) Unlabeled (CL) Untapped bowl (CL) Wrong or inappropriate bowls (CL)	(1) *At start*: Before getting products from main store	Visual investigation of storing conditions Control of date labels on opened or melted products Control of the rule "first in first out"	Daily safe food control list Waste records	Shift manager	Dropping the products I and II shelf-life of which is expired Dropping the products stored in inappropriate ways	Auditing the records for calibration studies Auditing training Auditing operations Auditing monitoring

[a] Cross contamination, carrying bacteria from a nonbacteried place.

Table 6. CCP 5—A Clam-Shell Grills

Critical Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Implementation Frequency	Implementation Methods	Implementation Records	Implementation Responsibility	Corrective Actions	Verification Methods
CCP 5-A Clam-shell grill (COOKING STAGE)	Bacteria growth Foreign materials Metal materials	Product selection key in the right place Temperature adjustment: Base: +177°C Tap: +218°C Grill beginning time (for 1/10 meat) 41 sec Grill clean Teflon clean Spatula and scrapers clean and sharp Grill legs fixed correctly	At start	Visual investigation	Daily safe food control list	Shift manager	Adjusting the grill to the product to be cooked Changing the teflon Grinding tools of the grill Making team members believe the importance of their responsibility	Calibrating equipment according to calibration and maintenance procedures Control the grill every 6 months Audit of records Audit of training Audit of operations Audit of monitoring

Table 7. CCP 5—A Surface Temperature of Clam-Shell Grill

Critical Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Implementation Frequency	Implementation Methods	Implementation Records	Implementation Responsibility	Corrective Actions	Verification Methods
CCP 5-A Surface temperature of clam-shell grill (COOKING STAGE)	Bacteria growth	Temperature adjust of meat: Base: + 177°C (AV) ± 3° (CL) Tap: +218°C (AV): ±3°C (CL)	At start	Measuring surface temperature of grill before cooking Measuring when temperature sign is lit Front, middle, and back parts of the surface to be at least 174°C Tap temperature together with teflon to be 215°C	Daily safe food control list	Shift manager	Adjusting surface temperature Not using the grill until management approve that all heating elements and thermostats work properly Calibrating the grill as soon as possible Recording corrective actions Calling for service if heat controls are not OK	Calibrating equipment according to calibration and maintenance procedures Control the grill every 6 months Audit of records Audit of training Audit of operations Audit of monitoring

Table 8. CCP 5—B Internal Temperature of Cooked Meat

Critical Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Implementation Frequency	Implementation Methods	Implementation Records	Implementation Responsibility	Corrective Actions	Verification Methods
CCP 5-B Internal temperature of cooked meat (COOKING STAGE)	Bacteria growth	69°C and over (goal 69–71°C) Meat is not purple Meat does not lose water Meat no dries Surface of meat gets no icy	Measuring internal temperature of meat at the most suitable time before crowd of day in eight meats	Controlling if the meat in side coolers of grill are at correct state Placing grilled meat on crowns, respectively Controlling internal temperatures of 4 pieces of meat taken from far ends Measuring temp. of 1/10 meat as soon as it is picked up from grill and put in the bread Measuring its temp. 30 sec later To make sure meat is cooked well, controlling internal color of a piece of possibly coldest meat (much ice or dryness may cause less cooking)	Daily safe food control list (recording temp. of the meat with lowest heat)	Shift manager	Sustaining corrective actions until internal temp. of meat reaches intended degree Controlling surface temp. of grills Adjusting cooking time If meat is not cooked or is cooked less: Controlling state of meat in deep reezer Not using products in the stocks Informing all shift managers of necessity of special precautions and controls about the conditions of meat appropriateness	Calibrating equipment according to calibration and maintenance procedures Control the grill every 6 months Audit of records Audit of training Audit of operations Audit of monitoring

Table 9. CCP 6—Keeping Hot

Critical Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Implementation Frequency	Implementation Methods	Implementation Records	Implementation Responsibility	Corrective Actions	Verification Methods
CCP 6 Keeping hot (KEEPING HOT STAGE)	Bacteria reproduction	Between + 63 and + 66°C	At start of equipment All day long	Reading indicators Making sure if indicators work properly (with a pyrometer) Not storing the products before equipment reaches correct temperature	Daily safe food control list	Shift manager	Making sure if hot-keeping cabin at correct temp. Adjusting temperature accurately Not using the cabin and calling for service	Calibrating equipment according to calibration and maintenance procedures Audit of records Audit of training Audit of operations Audit of monitoring

Table 10. CCP 7—Multiplex Water System and RO (Reverse Osmosis) Apparatus—Ultra Violet (UV) Lamp

Critical Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Implementation Frequency	Implementation Method	Implementation Records	Implementation Responsibility	Corrective Actions	Verification Methods
CCP 7 Multiplex water system and RO apparatus (STORING STAGE)	Microbiological contamination from water	RO apparatus to be working and functional Water tank to be clean	At start	Controlling with the list given by company Cleaning the water tank appropriate with procedures	Daily safe food control list Service maintenance chart of RO apparatus	Shift manager	Informing the producer company or service in case of a problem Supplying the tank with water enough for one day If problem is not solved, calling the manufacturer or service for water	Investigating service maintenance charts Audit of records Audit of training Audit of operations Audit of monitoring

(*continued*)

Table 10. Continued

Critical Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Implementation Frequency	Implementation Method	Implementation Records	Implementation Responsibility	Corrective Actions	Verification Methods
UV lamp (STORING STAGE)	Microbiological contamination from water	UV lamps to be working and functional (life expectancy of UV lamp is 10 months) Turning on/off the lamp very often shortens its life (3–4 times a day). Lamp type: start 60.000 μW sec/cm^2; finish 30.000 μW sec/cm^2	At start	Controlling if lamp works	Daily safe food control list	Shift manager	Informing equipment department at once Using water always from approved sources	Audit of records Audit of training Audit of operations Audit of monitoring

Table 11. OCP 1—Team Members' Health

Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Observation Frequency	Orientation	Orientation Records	Implementation Responsibility	Corrective Actions	Verification Methods
OP 1 Team members' health (OPERATION)	Cross contamination	Contact between no injury or skin infection with food Condition that team members will take breaks in case of coughs or sneezes Team members have legal health documents	Everyday At employing or when asked (for health cards)	Observing employees before working Keeping working records for employee	No	Shift manager	Sending sick employees home Making sure employees bandage their wound with water-resistant materials Sick employees work no contact with customers and food	Audit of records Audit of training Audit of operations Audit of monitoring

Table 12. OCP 2—Hand-Washing

Control Points	Hazard Identification	Aimed Values (AV) Critical Limits (CL)	Observation Frequency	Orientation	Orientation Records	Implementation Responsibility	Corrective Actions	Verification Methods
OP 2 Hand-Washing (OPERATION)	Cross contamination Foreign materials	Clean hands and nails before starting to work Washing hands before touching food Washing hands after: Using toilets; touching chemical materials; cleaning; storing; rubbish; money; breaks; hand shaking	Daily	Monitoring working habits of employees	No	Shift manager	Telling employees about how accurate cleaning protects health of customers and employees themselves and it will give customers a positive image	Audit of records Audit of training Audit of operations Audit of monitoring

Table 13. OCP 3—Team Members Clothes

Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Observation Frequency	Orientation	Orientation Records	Implementation Responsibility	Corrective Actions	Verification Methods
OP 3 Team Members Clothes (OPERATION)	Cross contamination Foreign materials	Clean uniforms and aprons Hair collected with hats or caps in preparation places No jewellery—bracelet, earring, etc.—(wearing rings and bracelets prevent washing hands)	Daily	Monitoring working habits of employees	No	Shift manager	Telling employees about how accurate cleaning protects health of customers and employees themselves and it will give customers a positive image	Audit of records Audit of training Audit of operations Audit of monitoring

Table 14. OCP 4—Audit Before Operation

Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Observation Frequency	Orientation	Orientation Records	Implementation Responsibility	Corrective Actions	Verification Methods
OP 4 Audit before operation (OPERATION)	Cross contamination Foreign material Bacteria reproduction	Starting with daily sanitized kitchen and equipment Chemical stored Fire keeping filters in the right place	At start	Audit	No	Shift manager	Cleaning and sanitizing the places touched by equipment or food before starting work Making sure that restaurant is a safe working place	Audit of records Audit of operations Audit of monitoring Audit of approvals

Table 15. OCP 5—Grinding Tools

Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Observation Frequency	Orientation	Orientation Records	Implementation Responsibility	Corrective Actions	Verification Methods
OP 5 Grinding tools (OPERATION)	Foreign materials Metal pieces	Grinding spatula and graders outside kitchen Cleaning tools before kitchen	As often as possible	Monitoring working habits of employees	No	Team and management	Making employees understand their responsibility Training employees again	Audit of records Audit of training Audit of operations Audit of monitoring

Table 16. OCP 6—Grilling Procedures

Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Observation Frequency	Orientation	Orientation Records	Implementation Responsibility	Corrective Actions	Verification Methods
OP 6 Grilling procedures (OPERATION)	Bacteria can live	Appropriate setting of meats (with a scheme)	As often as possible	Monitoring working habits of employees	No	Team and management	Making employees understand their responsibility Training employees again	Audit of records Audit of training Audit of operations Audit of monitoring

Table 17. OCP 7—Use of Sanitation Materials

Control Points	Hazard Definition	Aimed Values (AV) Critical Limits (CL)	Observation Frequency	Orientation	Orientation Records	Implementation Responsibility	Corrective Actions	Verification Methods
OP 7 Use of sanitation materials (OPERATION)	Bacteria growth	Preparing the mixture with right rates Cleaning and sanitizing surfaces Rinsing well if necessary Washing four (washing in boiled water, detergent, rinsing, and keeping in disinfected water for at least 1 min, respectively)	As often as possible	Monitoring working habits of employees	No	Team and management	Making employees understand their responsibility	Audit of records Audit of training Audit of operations Audit of monitoring

Table 18. OCP 8—Equipment Sanitation

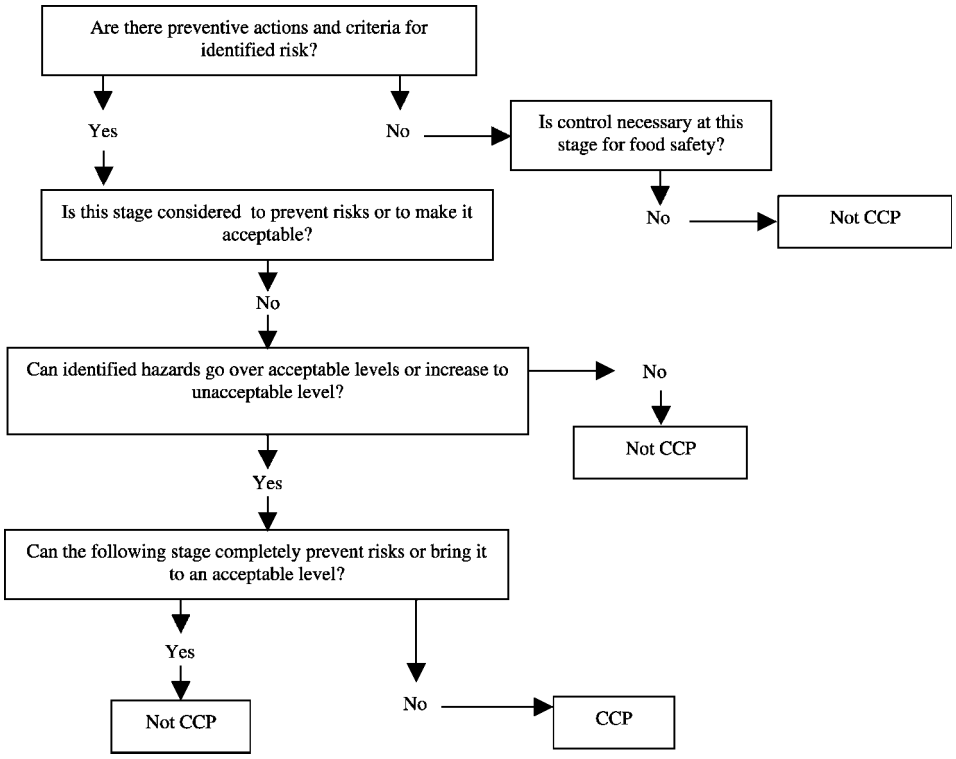
Control Points	Hazard Identification	Aimed Values (AV) Critical Limits (CL)	Observation Frequency	Orientation	Orientation Records	Responsibility	Corrective Actions	Verification Methods
OP 8 Equipment sanitation (OPERATION)	Bacteria reproduction	Sanitising water filters Sanitising grills	As often as possible Everyday (for grill)	Monitoring working habits of employees Controlling worn surfaces, wrong coats, rusted surfaces, and loose and lost screws	Daily safe food control list Maintenance cards	Shift manager	Cleaning and sanitizing the equipment Changing broken parts	Audit of records Audit of training Audit of operations Audit of monitoring

CONCLUSION

HACCP is an extremely efficient system to provide FBBs with tools to ensure food safety. The system can be applied at all levels from production of the products to service and consumption.

The system will assist fast food businesses to tackle the issue of food safety in a systematic way, to train employees, suppliers, and customers. It may help to gain prestige in the sector. Starting from the transition process, however, all the steps have to be carefully planned, organized, implemented, and audited to get the ultimate benefits of the HACCP system.

APPENDIX 1: CCP DETERMINATION DECISION TREE[21]



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