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Regulatory Compliance with HACCP Standards for Argi-Food Businesses: The Case of KAMELO FOOD Company

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Abstract:

Purpose: *This study concentrated on analyzing hazards, identifying, and implementing Operational Prerequisite Programs (PRPO), along with Critical Control Points (CCP).*
Design/Methodology/Approach: *HACCP Hazard Analysis and Critical Control Points has become synonymous with ensuring food safety, representing a systematic and preventative approach widely recognized and embraced. This method excels in eliminating biological, chemical, physical, and allergenic hazards through anticipation and prevention rather than relying on analysis and inspection of the final product. To implement this project, we have chosen a qualitative approach through action research method.*
Findings: *The implementation aligns with the formal requirements outlined in the interministerial decree 7th decree dated on December 1st, 2020, which establishes the conditions and methods for implementing the (HACCP) system.*
Practical Implications: *Upon completion of our study, we successfully identified a singular CCP which is the presence of physical hazards (such as metal or glass) and established five PRPOs in order to enhance the operational management.*
Originality/Value: *Numerous studies have explored the HACCP method within the agri-food sector, and pertinent research has been carried out across various domains, including the medical field, with a specific focus on radiotherapy centers. In conducting the literature review, our emphasis was on two pivotal topics, the HACCP method and his impact on hygiene which is an original research to the best of our knowledge.*

Keywords: *HACCP, Biscuit production line, CCP, PRPO, product quality.*

JEL Classification: *L150.*

Paper type: *Applied research article.*

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1. Introduction

Within the Algerian food industry, companies' endeavors in ensuring food safety vary in accordance with their strategic objectives. These efforts may progress from conforming to regulatory HACCP standards to the adoption of the Food Safety Culture (Achour, Ferroukhi, and Chibani, 2023). In Algeria, consumers are now better informed and more discerning about the quality of the food they purchase.

Consequently, there is a demand for self-regulation by industry operators and the establishment of a legal framework (Executive Decree No. 17-140, dated on April 11th, 2017), delineates the hygiene and sanitation conditions throughout the entire process of releasing food products for human consumption. This regulatory framework encompasses various stages, including production, importation, manufacturing, processing, storage, transportation, and distribution at both wholesale and retail levels—from primary production to the ultimate consumer (officiel jornal of the algerian republic N7, P6 2017).

For the present applied research, we were interested in the implementation of the HACCP method according to the interministerial order of 15 Rabie Ethani 1442 corresponding to December 1st, 2020 setting the conditions and modalities for the implementation of the method of analysis of hazards and critical points for their control (HACCP). To conduct our study, we selected KAMELO FOOD CAMPANY, specifically focusing on its biscuit production line (PALMITO).

This decision is particularly well-founded given that the company has incorporated the HACCP method into its quality program, aligning with the interministerial decree mentioned above. Therefore, we needed to address the following issue:

How can we implement the 12 steps of the HACCP method in accordance with the interministerial decree, across the entire production chain? In order to address this question, we opted for action research, using three main research methods.

We recall that the object of this applied research is: The implementation HACCP method according to the interministerial decree mentioned above, setting the conditions and modalities for the implementation of HACCP at the level of KAMELEO FOOD CAMPANY, leader factory in the biscuit market in Algeria.

2. Literature Review

Numerous studies have explored the HACCP method within the agri-food sector, and pertinent research has been carried out across various domains, including the medical field, with a specific focus on radiotherapy centers (Fahad *et al.,* 2022; Doménech *et al.,* 2011; Mao *et al.,* 2022; Bleichner *et al.,* 2019). In conducting the literature review, our emphasis was on two pivotal topics: the HACCP method and his impact on hygiene.

2.1 The HACCP Method

The study conducted by Fahad *et al.* (2022) offered technical insights into the development and application of HACCP method. The authors defined HACCP as "a scientific and systematic approach to food safety that identifies and controls specific food safety hazards." They underscored that the implementation of HACCP serves as a symbol of product quality and safety, ensuring consumer satisfaction.

The study illustrated that HACCP establishes the standard for food safety control, with several countries, including the United States, Japan, the United Kingdom, and European Union member states, as well as international organizations like WHO, FAO, and the Codex Alimentarius Commission (CAC), adopting the HACCP method and enforcing stringent criteria for food imports.

Furthermore, the authors highlighted the adaptability of the HACCP method, noting its ability to address changes in technological advancements, modifications in equipment design, and adjustments in procedures for handling non-conformities.

An additional investigation (Paul *et al.*, 2019) aimed to identify Critical Control Points (CCPs) and determine Operational Prerequisite Programs (PRP) and Operational Prerequisite Operating Programs (PRPO) within a biscuit factory in Bangladesh. The authors utilized an alternative visual method and decision analysis, incorporating planning and risk analysis.

The study's findings indicated that the implementation of the HACCP method had a favorable impact on the biscuit factory, contributing positively to both the microbiological quality of the final product and overall hygiene/quality management (Paul *et al.*, 2019). The authors reached the conclusion that implementing the HACCP method equips food manufacturers with efficient preventive measures for ensuring food safety and management.

Moreover, the documentation and records generated through this method serve as valuable tools for tracing the source of contamination. This capability not only prevents the continued production of substandard products but also leads to a reduction in the consumption of material, financial, and time resources.

The aforementioned study Paul *et al.* (2019) sought to depict the intricate systemic characteristics of the global food system through a qualitative approach using the STAMP method. In contrast to viewing accidents as the culmination of a series of events, the STAMP model perceives them as outcomes stemming from the absence of constraints imposed on system design and operations across various sociotechnical levels. The study concludes that a well-constructed and feasible HACCP plan has the potential to drive food factories to enhance their management practices and elevate employee safety awareness.

Within the same context, another study Maryland *et al.* (2019) aimed to furnish technical insights into the development and application of Hazard Analysis and Critical Control Points (HACCP) in a prominent cake manufacturing enterprise in Dhaka, Bangladesh.

The authors discovered that, to validate the efficacy of the HACCP plan, the food safety team formulates an audit strategy specifying the objective, methodology, frequency, and responsibilities of the audit activities. Comprehensive records and documentation are generated to serve as evidence of the system's effective operation.

Furthermore, employing diverse document formats to monitor the control of specific actions ensures that appropriate corrective measures have been implemented. This documentation typically encompasses deviations, associated corrective activities, and inspections conducted at clearly defined intervals (Maryland *et al.*, 2019).

Other researchers (Amores *et al.*, 2011) identified significant weaknesses in the implementation and effectiveness of prerequisites and HACCP in food establishments, covering 1350 small and 66 medium-sized organizations, including restaurants, hotels, and cafeterias in a region of Valencia, Spain, during the period 2007-2010.

The authors concluded that food companies exhibit a commendable level of self-control, with major non-conformities that could impact product safety being nearly nonexistent. However, official inspection audits revealed substantial weaknesses in the implementation of food safety management systems. Structural design, cleanliness, and hygiene were consistently the most frequently detected non-conformities across companies of varying sizes. Moreover, 99.6% of the sampled items exhibited acceptable microbiological (Amores *et al.*, 2011).

2.2 The Impact of HACCP on Hygiene

The investigation conducted by Djekic *et al.* (2016) sought to examine the impact of implementing the HACCP method on process hygiene in food establishments in Serbia. The study involved the collection of a total of 73,428 samples spanning a seven-year period, from 2008 to 2014. Samples were obtained from three types of surfaces, namely food contact surfaces (FCS) and cooling systems (CF).

The findings from their analyses indicated a positive trend in enhancing process hygiene within food establishments in Serbia following the enforcement of legislation mandating the implementation of HACCP. During the pre-HACCP period, significant statistical differences were observed in hygiene classes and types of food establishments for all three surfaces. Post HACCP implementation, food handlers exhibited a consistent level of hygiene, with notable differences observed primarily between take-out establishments (indicating poorer hygiene) and other food establishment categories. Institutional food services received the highest

hygiene ratings. The overall results demonstrated an improvement in process hygiene, with a reduction of at least 0.7 log10 CFU/cm2 for food contact surfaces (FCS) and over 1 log10 CFU/cm2 for cooling systems (CF) following the HACCP requirement.

In that monographic study, we will draw insights from the contributions of various authors, with a specific focus on the managerial aspect, which is crucial for ensuring effective follow-up in implementing the requirements after adopting the HACCP method (Fahad *et al.*, 2022; Paul *et al.*, 2019; Suvasish *et al.*, 2018; Maryland *et al.*, 2019).

Several constraints in the implementation of HACCP may stem from internal company factors, considering key issues identified in the food industry, such as a lack of staff knowledge about the system and its procedures, resistance to staff change (e.g., reluctance to wear personal protective equipment, adoption of new working methods), training challenges, the diverse range of products, workloads, and the prevalence of part-time workers (3x8 schedules). Additionally, external factors, such as the unavailability of government or industry support, may contribute to these constraints (Maryland *et al.*, 2019).

Implementing HACCP in agri-food industry is often perceived as challenging due to the complexity associated with extensive documentation requirements and the necessity for additional economic resources, such as investing in resin surfaces (which managers may view as an expenditure without a clear return on investment). Consequently, integrating efficient tools like HACCP would facilitate the management of hygienic processes and enhance traceability.

3. Originality and Scope of Research

In Algeria, studies on the impact of the HACCP method and its management implications within agri-food companies are non-existent, we believe that we have the opportunity to discover these aspects within the framework of our study. To define the scope of our research, we used the 5W1H tool, which gives us the possibility of filling in the following questions

Table 1. *Scoping the project by the 5W tool*

What	**Implementation of the HACCP method**
Who	HACCP Team including Mr Hamza KALA as a trainee practitioner
Where	KAMELO FOOD COMPANY, Biscuit production line “PALMITO”
When	Internship period March-May 2023
How	Through three codex Alimentarius standards, national regulation in force, ISO 22002-1
What for	For the control of hazards related to the manufacture of foodstuffs

Source: *Our study.*

4. Methodological Approach

Action research, with its two cycles of intervention in presented bellow. In the first, the researcher attempts to exchange with the company's employee, using the HACCP method and regulation as basis for exchanges. In the second, he sets up and leads temporary the HACCP team, throu the outcome elements of his applied research. Indeed, the implementation of the HACCP method is based on the collaboration between the different actors in order to manifest an effective HACCP plan.

In the context of our study, we have opted for the qualitative approach that is the most appropriate and adequate to respond to our problem and research objective, which is to apply the HACCP method for the control of food safety. The qualitative approach is based on several tools and techniques for analysis and data collection. Below are the ones we will use (Jean-Marie *et al.*, 2015):

- **Interview**

The interview is a technique designed to collect, with a view to their analysis, discursive data reflecting in particular the conscious or unconscious mental universe of individuals. In our case, we used interviews, which are absolutely the most widely used type of interview in social research.

We conducted one-on-one interviews with the various managers as well as the production agents, The main objective of the interviews is to estimate the degree of understanding and importance of HACCP to ensure product food safety from raw material to finished product.

For a respectful and friendly approach with interviewees, assuring them that the purpose of the research was academic and not intended to judge people, while maintaining a professional approach. The responses were recorded directly on the chck list and we also made phone calls to validate the responses with the HACCP project manager. The interviews were conducted in a variety of locations, such as managers' offices and production rooms. We simply asked for permission orally to conduct the interviews, and we adopted The following table lists the interviewees:

- **Analysis of Internal Company Documents**

The collection of data concerning the company was done by a formal request to the internship tutor sent by email as well as the taking of photos of some documents not available in digital version. The analysis of the internals' company documents with reference to the evaluation of PRPs, concerning HACCP was based on the as well as observation (JORA, Decret exècutif n° 17-140, 2017; JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE N° 07, 2021).

Table 2. *List of Interviewees*

N	Service	Post occupied by the interviewee	Date of the interview	Duration of the interview
1	Quality	HACCP Project Manager	01/03/2023	60 min
2	Quality	Quality Control Manager	05/03/2023	45 min
3	Logistics	Inventory Manager	08/03/2023	30 min
4	Production	Production Manager	15/03/2023	30 min
5	Production	Production Agent	05/03/2023	25 min
6	Production	Production Agent	15/03/2023	15 min

Source: *Own study.*

We analyzed the company's internal documents such as the production diagram, physicochemical and microbiological analyses as well as the follow-up sheets. We received his documents following a request to the HACCP project manager which was communicated by email.

The documents we consulted and analyzed were mainly:

- Health, safety and environmental monitoring sheet.
- Raw Material Analysis Bulletins
- Manufacturing Diagram
- Finished Product Analysis Bulletins
- Finished Product Description Sheet

- **Observation**

Observation is a tool that serves to collect relevant data about an object, this process is guided by a terminal goal that requires attention and intelligence (Jean-Marie *et al.*, 2015). In order to interpret and better perceive the food safety situation throughout the production chain within the KAMELO FOOD host organization and its internal environment and taking into consideration the direct contact with the employees of the area, as well as the HACCP approach which requires risk analysis and the application of good hygiene and manufacturing practices.

Thanks to the observation, we were able to detect the non-conformities of each area with the aim of developing action plans to address them. Knowing that every anomaly and remark was recorded by taking notes and photos. Observation was an essential element that allowed us to observe the field and to have answers to questions not mentioned by the interviewees. The observation allowed to highlight information on some checklist requirements that we before observed and noted the observed phenomena.

5. Data Collection Tools

Our checklist is inspired by the ISO 22002:2009 standard and the Algerian regulations, it was developed by us supervised by an expert in the agri-food field, in the form of a table that contains all the chapters and then the modalities of the conformity assessment as well as the weak points and recommendations (see Appendix 1). To collect data properly we have developed only one guide in the form of a checklist, consisting of three parts:

- Introduction and presentation: This phase is an introduction where we introduced ourselves.
- Explanation of the purpose of the study: In this phase we explained the purpose of our study.
- Conducting interviews: This phase consists of asking questions about HACCP, PRP satisfaction.

We commenced the interview with an introductory presentation, including the first and last name, as well as detailing the area of expertise. Subsequently, we delved directly into the core of the discussion by elucidating the interview's objectives and posing questions centered around the HACCP domain.

The preparation of the checklist in the first place consists of 10 chapters for the conformity assessment of existing GMPs in the company in order to design an action plan to comply with PRPs that satisfies and helps to carry out the method well HACCP for an effective approach in the second place to comply with Algerian legislation.

5.1 ISHIKAWA Diagram

This diagram also known as the cause/effect diagram (5M) and fishbone. This diagram is based on a brainstorming done beforehand and the different possible causes are then classified into five categories, called 5M (Paul *et al.,* 2019).

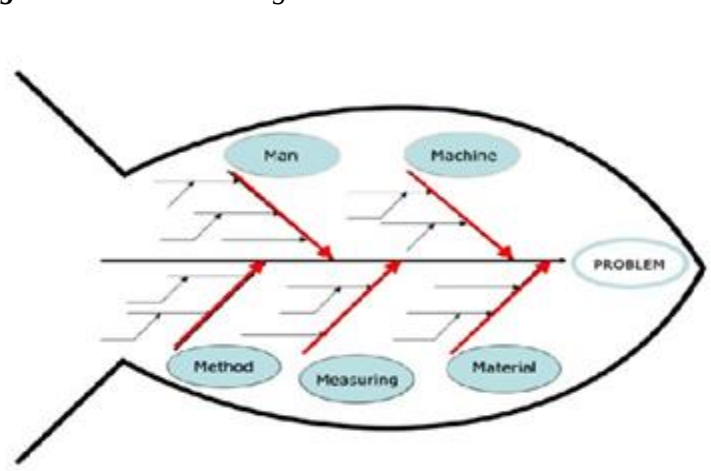
5.2 Grading Method

The SDA team's estimation of the criticality of the hazards was based on two parameters.

- The seriousness (G) of the hazard from the point of view of the consumer's health
- The frequency (F) of occurrence of the hazard.

The following Table 3 provides a synoptic breakdown of the criteria for choosing the severity and frequency ratings.

Figure 1. *ISHIKAWA diagram*



Source: *Paul et al., 2019.*

Table 3. *Severity and Frequency Rating Criteria*

Gravity	Frequency	NOTE
Serious	**Important**	**5**
Average	**Average**	**3**
Controllable	**Ignorable**	**1**

Source: *KAMELO FOOD's hazard analysis methodology*.

Hazard Analysis is defined as CI = (severity of the hazard) x (frequencies of occurrence of the cause of the hazard) or C = G x F.

The following Table 4 provides an essential matrix for determining the criticality threshold:

Table 4. *Hazard Criticality Determination Matrix*

Frequency

Sever
moderated
tolerated

1	2	3	4	5
2	4	6	8	10
3	6	9	12	15
4	8	12	16	20
5	10	15	20	25

Severity

Source: *Own study.*

Depending on the severity and frequency of the risk, a classification can be made as presented above. A green zone characterizes ignorable risks, orange zone presents a medium risk category that should be monitored. The critical zone is the one in red, important risks.

A criticality of less than 15 results in a GMP. If it is equal to or greater than 15, the step is considered a "preventive" measure that may be a control measure. The results of the diagnosis and assessment of the conformity of the prerequisite programs with the regulatory requirements, are presented in Appendix 1. This assessment was based on a scoring grid. In fact, we gave each practice a numerical value to calculate the percentage of satisfaction, using the following formula:

$$\text{Pourcentage de satisfaction} = \frac{((EC*1) + (EPC*0.5) + (ENC*0)) * 100}{NTE}$$

EC = EPC compliant requirement = can compliant requirement
ENC = NTE Non-Compliant Requirement = Total Number of Requirement
Reading of results: compliant = 1; partially compliant = 0.5; Non-compliant = 0.

6. Results

The results obtained revealed that the company meets the requirements at 52.98% which is considered an acceptable rate. The results also show low rates that require improvement actions. The results are as follows:

- 3 chapters had a percentage between 20%-50%.
- 3 chapters had a percentage between 50%-70%.
- 4 chapters had a percentage between 70%-100%.

The results are summarized in Table 5 below:

Table 5. *Synthesis of the diagnostic and evaluation results of the prerequisite programs*

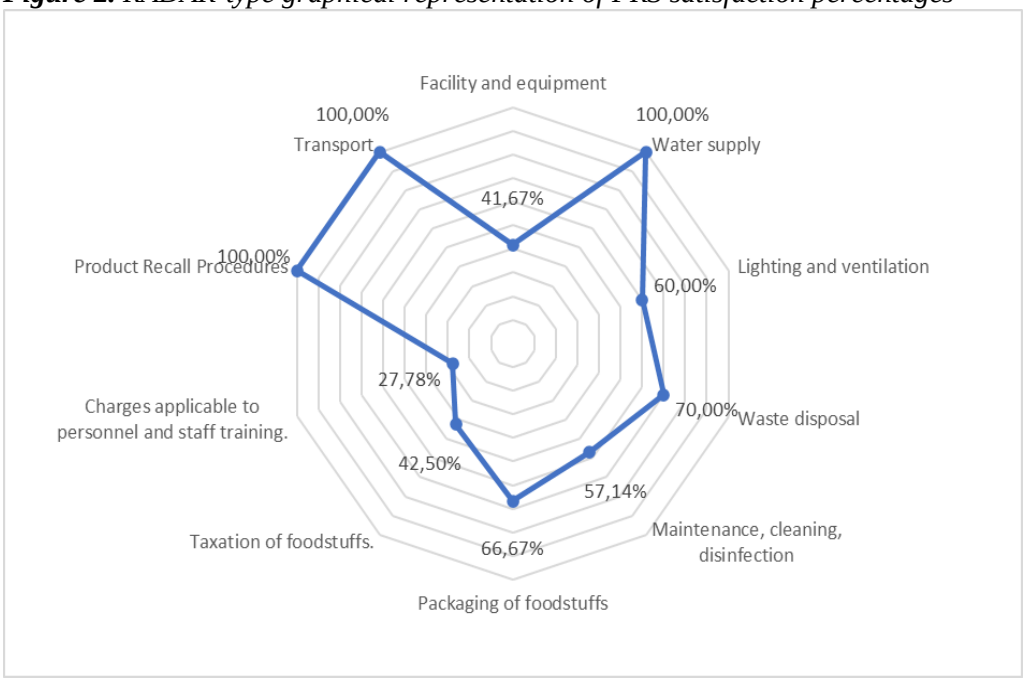
		1	0,5	0		
Chapter Number	**Chapter Title**	**EC**	**EPC**	**ENC**	**NBE EXG**	**%**
1	Facility and equipment	6	8	10	24	41,67%
2	Water supply	3	0	0	3	100,00%
3	Lighting and ventilation	2	2	1	5	60,00%
4	Waste disposal	3	1	1	5	70,00%
5	Maintenance, cleaning, disinfection	4	0	3	7	57,14%

6	Packaging of foodstuffs	2	0	1	3	66,67%
7	Taxation of foodstuffs.	8	1	11	20	42,50%
8	Charges applicable to personnel and staff training.	2	1	6	9	27,78%
9	Product Recall Procedures	2	0	0	2	100,00%
10	Transport	6	0	0	6	100,00%
Total	All Chapters	38	13	33	84	52,98%

Source: *Own study.*

For a better visualization of the results obtained, we diagram them through the following radar:

Figure 2. *RADAR-type graphical representation of PRS satisfaction percentages*



Source: *Own study.*

The following results represent the satisfaction rates obtained by our investigation:

Chapter 1: Facilities of the establishment

The diagnosis and evaluation of the first prerequisite program relating to the establishment and its equipment focused on 24 requirements, of which the satisfaction percentage is 41.68%. In relation to this PRP, the company fully implements 6 requirements (compliance), partially 7 requirements (partial compliance) and does not apply 11 requirements (non-compliance).

Chapter 2: Diagnosis of the Water Supply

The diagnosis of the second PRP relating to the water supply focused on 3 requirements, of which the percentage of Satisfaction is 100%.

Chapter 3: Lighting and Ventilation Diagnostics

The results of the lighting and ventilation diagnosis, the company fully applies 3 requirements (compliance), partially 1 requirement (partial compliance) and does not apply 1 requirement (non-compliance), with a satisfaction percentage of 60%.

Chapter 4: Waste Disposal Scheme

The diagnosis carried out at the company level concerned the disposal of waste, the company fully applies 3 requirements (compliance), partially 1 requirement (partial compliance) and does not apply 1 requirement (non-compliance) which satisfies a percentage of 70%.

Chapter 5: Maintenance, Cleaning, and Disinfection Diagnostics

Compared to this GWP, the company fully applies 4 requirements (compliance) and does not apply 3 requirements (non-compliance) with a percentage of 57.14%.

Chapter 6: Diagnosis of Packaging and Packaging of Foodstuffs

The results of the diagnosis relating to the Perception applicable to foodstuffs, it focused on the evaluation of 3 requirements, the company fully applies 2 requirements (compliance) and does not apply 1 requirement (non-conformity) whose satisfaction percentage is 66.67%.

Chapter 7: Perception diagnosis applicable to foodstuffs

The results of the diagnosis relating to the Perception applicable to foodstuffs, it focused on the evaluation of 20 requirements, the company fully complies with 8 requirements (compliance), partially complies with one requirement (partial compliance) and does not apply 11 requirements (non-compliance) out of a total percentage of 42.50%.

Chapter 8: Perception Diagnosis applicable to personnel and staff training

The diagnosis and evaluation at the Perception applicable to personnel and personnel training is based on 9 requirements, the company fully applies 2 requirements (compliance), partially 1 requirement (partial compliance) and does not apply 6 requirements (non-compliance) of which two are compliant, one is partially compliant and 6 are non-compliant, which satisfies 27.78% of the latter.

Chapter 9: Diagnosis and Evaluation of Product Recall Procedures

Three requirements have been considered for diagnosis and assessment, all of which are compliant.

Chapter 10: Transport Diagnosis and Assessment

The diagnosis carried out at the company level concerns the last prerequisite program relating to transport is based on 6 requirements are all compliant.

6.1 Implementation of the HACCP Method

In this second section we will set up the HACCP method after having defined the scope of the study and then starting by composing the HACCP team for its implementation, first the five preliminary steps then the seven principles of HACCP constitute the 12 steps of HACCP.

Phase 1: The first five preliminary steps

- Step 1: Definition of the scope of the study, preliminary stage:

For practical and efficiency reasons, it is recommended that the HACCP study scope be delineated as follows:

Unit Name KAMELO FOOD
Product concerned BISCUIT PALMITO
Fields of study:

- Upstream limit
- Downstream limit

Receipt of raw material

- Upstream limit
- Downstream limit:

Storage of finished products in pallets

The premises where it starts and ends the study:
Where does it start.
Where the raw material premises are located.
Where end:
Finished product storage rooms.
Date of study March-May 2023

Nature of the hazards to be considered:

- Physical Hazards
- Chemical hazards.
- Microbiological hazards.
- Allergens

Creation of the HACCP team:
KAMELO FOOD has set up a HACCP team in charge of food safety in accordance with the requirements of the interministerial decree of 1 December 2020 on the system for the analysis of hazards and critical points for their control. This team is made up of company members with the knowledge and expertise to develop the HACCP plan, compile and evaluate the technical data, identify hazards and critical points for their control.

The team is designed to allow for rapid and complementary interventions by following a communication plan (meetings and briefing). The documents identify the members who need to be informed of the results of tests or controls, and they are consulted in a timely manner to take the necessary action.

Mr Hamza KALA as practitioner trainee, takes part in team activities, the HACCP team was able to work together to carry out this approach, this multidisciplinary team was able to involve all stakeholders in order to lead to a complete implementation in all departments concerned.

The HACCP team is composed of:

Technical Director: Ensure the effective implementation of the HACCP method and deployment of the quality policy. Exercises the necessary authority on all aspects concerning food safety (validation of corrective actions, provision of material and human resources, etc.)

HACCP Project Manager: Manage the hazard analysis, the determination of critical limits, the monitoring system and establish corrective actions in case of deviations. Ensure that the HACCP method remains effective and complies with the chosen standards. Organize the work of the HACCP team for the continuous improvement of the system and implementation of corrective and preventive actions. Responsible for system documentation and verification of records.

Quality Controller: Ensure monitoring procedures and GHP. Ensure the application of monitoring and completion of follow-up sheets.

Production Manager: Ensure the application of preventive and corrective actions related to production. Completion and validation of follow-up sheets. Ensure operational procedures. Enforce monitoring. Implement preventive actions to prevent the monitoring of non-conformities, implement corrective actions and control non-conforming products.

Purchasing Manager: Ensure that all procedures related to the procurement and delivery of FPs are followed in accordance with HACCP system requirements

The Research Practitioner: Ensure the necessary documentation of the HACCP method. Drawing up the production diagram. Collaboration in the establishment of the HACCP plan. Collaboration in Hazard Analysis

- Step 2: Finished Product Specification (See Appendix 2)

- Step 3: Determining the use of the finished product

• Intended Use:

Consumed immediately after opening

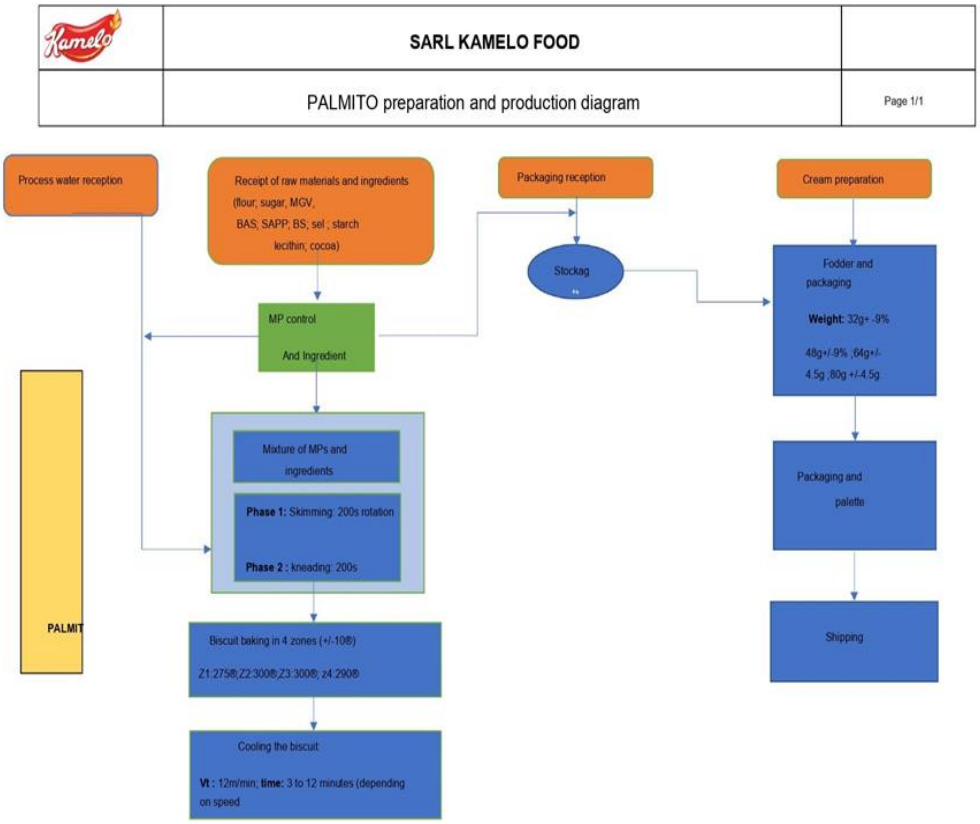
• Target Population:

All age groups except gluten intolerant and soy lecithin.

- Step 4: Establish a Flow Diagram

- Step 5: On-site confirmation of the production operations diagram

Figure 3. *PALMITO Product Manufacturing*



Source: *PALMITO Product Manufacturing Diagram*

Quality Manager and the members of the HACCP team thoroughly checked the production diagram on the production line on site to supplement it with information relating to technological parameters (time, temperature,...).

The manufacturing diagram thus established has been validated in accordance with the HACCP method prescribed by the interministerial order of 15 Rabie Ethani 1442 corresponding to December 1, 2020 setting the conditions and modalities for the implementation of the method of analysis of hazards and critical control points (HACCP).

Phase 2: Applications of the Seven Principles of HACCP

This phase corresponds to the implementation of the 7 principles of the HACCP method. These steps are considered the most important because they form the basis of the HACCP method.

- Step 5: Principle 1: Hazard Analysis Process.

6.2 Allergen Identification

As part of a HACCP (Hazard Analysis and Critical Control Points) analysis, it is important to identify potential allergens that could be present in raw materials and ingredients used in the food manufacturing process. The allergens contained in the PALMITO product are indicated in bold:

Table 6. *PALMITO Product Allergen Table*

Allergen hazards	
Agent	- **Cereals containing gluten and products made from these cereals**. - Milk and milk-based products (Milk protein, Lactose intolerance). - Eggs and egg products. - Fish and fish products. - **Soybeans and soy products.** - Crustaceans and crustacean products. - Lupin. - Mustards and mustard products. - Celery and celery products. - Molluscs and shellfish products. - Sesame seeds. - Peanuts and peanut products. - Nuts. - Sulphur dioxide more than 10mg/kg.
Reasonably foreseeable danger	- Yes
Acceptable level	Absence
Regulatory/Bibliographic References	Executive Decree No. 05-484 of 22 December 2005 (JORA) on labelling

Symptoms	**Grain** - Vomiting - Lack of appetite - Bloating - Flatulence - Abdominal pain - Diarrhoea - Constipation	**Soy lecithin** - abdominal pain and diarrhea, vomiting, breathing - cough - difficulty breathing and oral syndrome and skin urticaria - eczema
Gravity	**3**	

Source: *Own study.*

Once allergens have been identified, it is important to put in place prevention and control measures to avoid cross-contamination with foods that should not contain these allergens, and thus ensure the safety of allergic consumers. These measures may include the physical separation of ingredients and production areas, the proper labeling of foods containing allergens, the training of staff and the cleaning and disinfection of production equipment as well as informing the consumer of the allergens that the product consists of through labeling.

6.3 Hazard Analyses

In this step, the manufacturing process is broken down into stages and an inventory is drawn up of the biological, physical, chemical, microbiological or allergenic hazards on the PALMITO biscuit, which are likely to contaminate the product during its production process and make it unsanitary. After dissecting the production circuit, we identified the hazards (microbiological, chemical and physical) related to each step of the production process, then using the scoring method we evaluated the criticality of these hazards and thus illustrate them.

To determine the potential risks in the PALMITO biscuit production process, it is important to divide the process into different steps. Each of these steps should be examined to identify potential hazards such as biological, physical, chemical, microbiological, or allergenic hazards.

The assessment of each hazard throughout the chocolate filled biscuit manufacturing chain follows the methodology described below:

During the hazard analysis, hazards are separated into microbiological (M), chemical (C), and physical (P) hazards.

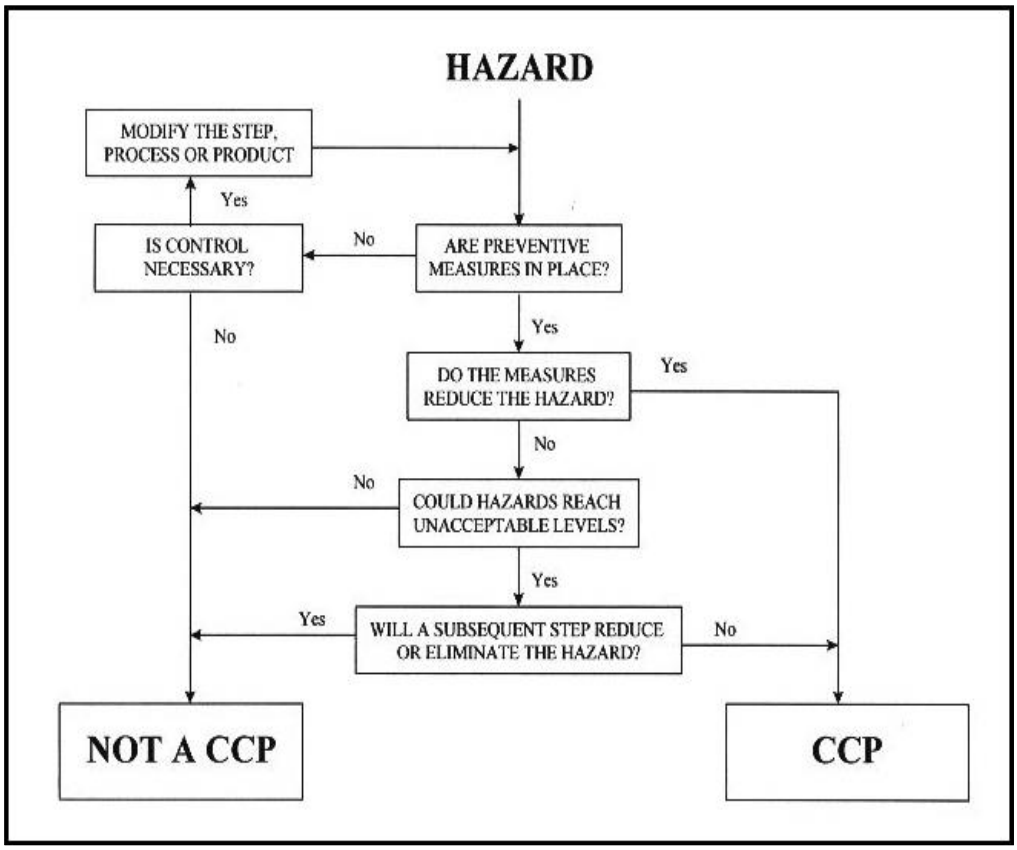
In hazard analysis, the 5M Rule is used to determine the origin or cause of the hazard (Material (PM), Medium (ML), Material (MT), Method (MD) and Labour (MO)).

- Step 6: Principle 2: Identification of critical control points

Following the identification and hazard assessment carried out in the previous step, we resorted to the determination of CCPs within the KAMELO FOOD ZAOUIA-BLIDA biscuit production line. The determination of CCPs can be confirmed by the use of a decision tree that should be used flexibly and common-sense.

The decision tree can be applied to all existing and potential hazards with significant associated hazards. At each step, it is a matter of answering the question correctly so that you can decide to move on to the next question. For the determination of critical points, the decision tree mentioned in Figure 4 was used:

Figure 4. *Decision Tree*



Source: *Codex Alimentarus.*

A decision tree, shown in Figure 4, will be applied to these hazards, in order to highlight the CCPs and OPPs. The respondents are as follows:

- Question 1: Are there one or more preventive control measures?
- Question 2: Is the step specifically designed to eliminate the likelihood of a hazard occurring or to reduce it to an acceptable level?

- Question 3: Is it possible that contamination by the identified hazards could occur at a level exceeding acceptable limits or could these hazards reach unacceptable levels?
- Question 4: Will a subsequent step eliminate the identified hazard(s) or reduce their likelihood of occurrence to an acceptable level?

6.4 HACCP Plan

Verification and Validation Procedure :

The verification only takes place when the plan is implemented, but before that, it must be validated that the HACCP plan is indeed adapted to control the specific hazards of the product throughout its life cycle. This means that it must be determined whether:

- ✓ The HACCP method, CCPs and critical values are capable of eliminating or reducing the hazards present to an acceptable level.
- ✓ The proposed corrective actions are having the desired effect.

Effective Verification :

The proper functioning of the HACCP method should be checked regularly at predetermined times, taking place at least once a year, or when there is a change in the process or composition of the product, this includes the elaboration:

- Revisions to the hazard analysis and testing and simulation of PPCs and/or OFPPs;
- Verification and/or validation of changes that may be made to OFPPs or CCP critical limits;
- Audits (internal and external) of HACCP.

However, it is always necessary to verify that the method is effective, that it is actually applied as described in the plan and that it is always up to date, by:

- Reviews of the system's documentation;
- Targeted sampling and analysis to confirm that the product complies with the required specifications;
- Calibration of measuring equipment to ensure the accuracy of equipment and instruments;
- Servicing and maintenance of equipment.

7. Discussion of Results

The data gathered during the assessment of the PRP status holds utmost significance for the progression of our project. These data are processed to form the foundation upon which the implementation of the HACCP method is built.

Furthermore, these data will enable the examination of results obtained and the analysis of PRPs, facilitating the identification of areas for improvement. Through a collaborative effort within a working group comprising all trades involved in the treatment process, all employees gained a visual understanding of hazards and actively contributed to defining the relevant control measures. Consequently, professionals have taken ownership of the documentation system by emphasizing key points and critical aspects.

The hazard analysis was initiated only after the creation and validation of the fabrication flow diagram. The process unfolded systematically, covering each step from the receipt of raw materials to the shipment of finished products. The initial step involved identifying hazards categorized into four general types: biological (pathogens), chemical (toxic substances), physical (foreign bodies), and allergens, as outlined in the research conducted by Amores *et al.* (2011).

The fundamental objective of the hazard analysis is to identify Critical Control Points (CCPs) and Operational Prerequisite Operating Programs (OFFPs). This aims to concentrate inspections at these specific points, facilitating process enhancements through a methodology described in the second section. The approach draws inspiration from the Failure Modes and Effects Analysis (FMEA) method to formulate a comprehensive HACCP plan.

The efficacy of the HACCP plan is contingent upon several critical factors. Foremost, conducting a comprehensive analysis of potential hazards associated with raw materials, production processes, and storage conditions is essential. This analysis aids in pinpointing critical points where control measures must be implemented to prevent, eliminate, or reduce hazards to acceptable levels.

It is crucial to underscore that the successful implementation of an effective HACCP plan hinges on the active involvement and commitment of management, coupled with the adequate training of staff. Internal communication and fostering awareness about the significance of food safety also stand out as pivotal factors influencing the success of the HACCP plan, as confirmed by Fahad *et al.* (2022).

Throughout our project, we faced challenges primarily related to human resources, finances, and time constraints. The implementation of a HACCP approach typically demands managerial and financial investments, active staff participation, and a considerable amount of time for project success.

Additionally, investing in the effective application of prerequisite programs is crucial. Notably, organizational commitment and the discipline of workers in managing the HACCP plan emerged as key factors for project success, as corroborated by research findings (Maryland *et al.,* 2019; Suvasish *et al.,* 2018).

8. Conclusion

The current study, conducted within the premises of KAMELO Company, affirms that the implementation of the HACCP approach effectively ensures the sanitary quality of biscuits. Initially, a diagnostic assessment of the prerequisite programs was undertaken to assess the current state of the business environment.

Subsequently, hazard analysis was performed following the development and verification of the on-site fabrication flowchart. From this analysis, a singular critical point, particularly in the filling and creaming stage, was identified, specifically addressing the presence of physical hazards (metal, glass). To manage and control the quality and safety of biscuits, a monitoring plan and verification plan were developed.

The outcomes of this study shed light on the significant impact of adhering to regulations and requirements, including the implemented corrective actions, hazard analysis, and monitoring/verification plans. This influence is evident in the production of biscuits, both in terms of quantity, preventing the return of non-compliant products, and in terms of quality, directly contributing to consumer satisfaction and fostering loyalty to KAMELO Biscuits.

Upon concluding this investigation, it becomes evident that establishing an approach for food safety management within any food industry is a sustained, long-term undertaking. This process necessitates the incremental assimilation of principles and methods related to food safety management by all staff members within the organization, coupled with ongoing enhancements in implementation across all levels of the structure.

For KAMELO company, ensuring the successful adoption of the HACCP method with the aim of certification in the forthcoming years necessitates a heightened emphasis on the following aspects:

- Demonstrate moral and financial commitment from KAMELO's management.
- Facilitate comprehensive staff training in hygiene.
- Sustain ongoing enhancements to various prerequisite programs.
- Regularly update the established system.
- Adhere to the principle of forward movement, especially when constructing a new production site.

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Appendix 1: Carrying out an internal diagnosis

In this section, we will carry out an internal diagnosis in the company using a checklist for the evaluation of pre-requisite programs.

1) Preparation of the checklist

The elaboration of the checklist is a reference to the statutory instrument (JORA ,Decret exècutif n° 17-140, 2017) For prerequisite programs which contains 10 chapters :

1 Facility and Equipment:
- 10.1 Establishment of establishments.
- 10.2 Facility design and layout.
- 10.3 Equipment, materials and utensils.

2 Water supply.
3 Lighting and ventilation.
4 Waste disposal.
5 Maintenance, cleaning, disinfection.
6 Packaging and packaging of foodstuffs.
7 Taxation of foodstuffs.
8 Charges applicable to personnel and staff training.
9 Product Recall Procedures.
10 Transport.

Appendix 2 : The product

Category: Biscuit
Brand: Palmary
Description:Dry biscuit filled with chocolate flavour cream
List of ingredients:
Paste: wheat flour, sugar, vegetable fat (non-hydrogenated palm oil), water, whey powder
Food additives: leavening agent: (disodium diphosphate E450(i), ammonium acid carbonate E503(ii), sodium acid carbonate E500(ii)), salt, preservative (sodium metabisulfite E223), emulsifier (soy lecithin E322), artificial flavouring.
Cream of Filling: sugar, vegetable fat (palm), cocoa powder, corn starch, whey powder, food additives: emulsifier (soy lecithin E322), artificial flavour Hazelnut.

Nutritional data	Energy per 100g Kcal/kj 469,26/1961,50
	Target (g)
Lipids	17,14
Saturated Fatty Acids	8,96
Carbohydrates	72,65
Sugar	36,17
Protein	6,1
Salt	0,516

Physico-chemical characteristics:
Acceptable level
Humidity 2%
Net weight 48g ± 9%

Microbiological characteristics:

Metabilites microorganisms	Simpling plan		Microbiologic limits	
	N	C	m	M
Aerobic germes at 30°	5	2	10^3	10^2
E-coli	5	2	3	30
Moisissure	5	2	10^2	10^3
Coagulate staphylococus	5	2	10^2	10^3
Salmonella	5	0	Absence in 25 g	

Shelf life:18 Months
Storage conditions: Store in a cool, dry place
Primary Packaging: Contains 6 pieces of biscuits
Secondary Packaging: Cardboard Box (48 Pcs)
Concept of allergens
This product contains allergens such as gluten, milk, and may contain traces of tree nuts.
food Safety Labelling:
1. The name of the sales
2. List of Ingredients
3. Net quantity
4. use-by date
5. Storage conditions
6. Name/company name
7. The original paid
8. Batch identification
9. Allergens
10. Nutrition labelling
Distribution Method: In Covered Trucks
Intended use: Direct consumption, product intended for the entire population
Regulatory Reference

- Executive Decree No. 13-378 of 09/11/2013 laying down the conditions and procedures relating to consumer information
- The Interministerial Order of 2 Moharram 1438 corresponding to 4 October 2016 setting the microbiological criteria for foodstuffs.