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Assessment of HACCP implementation in a retail catering service: From Theory To Practice

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I dedicate this work to my mom **AMEL**, who has always placed my well-being and success above her own comfort, offering me a life filled with care, encouragement, and emotional security .Thank you for your infinite patience and quite strength .You will forever be my Idol.

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Abstract

This study evaluates the implementation of the Hazard Analysis and Critical Control Points (HACCP) system in a retail catering service through a dual approach combining on-site audits and microbiological analysis. The results show an overall satisfaction rate of 87% regarding HACCP compliance ,while 13% expressed dissatisfaction highlighting room for improvement .Although basic regulatory components such as infrastructure, staff training, and raw material control are generally present, findings reveal a lack of operational discipline and insufficient enforcement of hygiene procedures, especially in high-level operational methods. The detection of *Listeria* spp. on food-contact surfaces and ready to eat products highlights significant deficiencies in hygiene management and contamination control, confirming the gap between documented procedures and real-world application. The establishment appears to be in a transitional phase, moving from a reactive hygiene model to proactive, risk based system. The study emphasizes the critical role of staff behaviour and work place culture in achieving effective food safety, advocating for routine integration of hygiene practices, continuous training, and reinforced verification measures at Critical Control Points CCPs .These findings underscore the need for a stronger, people-centred approach to HACCP implementation in collective catering environments.

Key words : HACCP, Security , catering ,GHP , *L*isteria , Food

Résumé

Cette étude évalue la mise en œuvre du système d'analyse des dangers et de maitrise des points critiques (HACCP) dans un contexte de restauration collective, en combinant une approche par audit sur site et une analyse microbiologique. Les résultats révèlent un taux de satisfaction global de 87% concernant la conformité au system HACCP , tandis que 13% des cas témoignent d'une insarisfaction, soulignant des marges d'amélioration. Bien que les composants réglementaires de base tels que l'infrastructure, la formation du personnel et le contrôle des matières premières soient globalement en place, les résultats révèlent un manque de discipline opérationnelle et une application insuffisante des procédures d'hygiène, notamment dans les méthodes opérationnelles avancées. La détection de *Listeria* spp. dans les surfaces en contact avec les aliments et dans des produits prêts à consommer met en évidence d'importantes lacunes dans la gestion de l'hygiène et le contrôle de la contamination, confirmant l'écart entre les procédures formalisées et leur application réelle.

L'établissement semble en phase de transition, passant d'un modèle d'hygiène réactif à un système proactif basé sur l'analyse des risques. L'étude souligne le rôle essentiel du personnel et de la culture de travail dans l'efficacité des dispositifs de sécurité sanitaire, en insistant sur la nécessité d'intégrer les bonnes pratiques d'hygiène dans la routine, de renforcer la formation continue et d'améliorer les procédures de vérification au niveau des points critiques (CCP). Ces résultats appellent à une approche plus humaine et plus ancrée dans la réalité pour assurer une mise en œuvre durable du système HACCP en restauration collective.

Mots – Clés : HACCP ,Sécurité ,restauration , BPH , *L*isteria , Aliments

الملخص

تهدف هده الدراسة الى تقييم مدى تطبيق نظام تحليل المخاطر و نقاط التحكم الحرجة في قطاع التموين الجماعي ؛من خلال مقاربة مزدوجة تجمع بين التدقيق الميداني و التحليل الميكروبيولوجي, اظهرت النتائج معدل رضا عام بلغ 87% فيما يتعلق بالامتثال لنظام **HACCP** في

حين عبر 13% من الحالات عن عدم الرضا مما يبرز الحاجة الى التحسين . رغم توفر العناصر التنظيمية الأساسية مثل البنية التحتية، وتدريب العاملين، ومراقبة المواد الأولية متوفرة بشكل عام، إلا أن هناك قصوراً واضحاً في الانضباط التشغيلي وتطبيق الإجراءات الصحية، خاصة في ما يتعلق بالأساليب التشغيلية المتقدمة والممارسات المنهجية للنظافة

تشير المعطيات إلى أن المنشأة لا تزال في مرحلة انتقالية، من نموذج نظافة تفاعلي نحو نظام استباقي قائم على تحليل المخاطر. وفي هذا السياق، يظهر الدور الحاسم للعامل البشري، إذ إن فعالية أي نظام للسلامة الغذائية لا تعتمد فقط على البنية التحتية أو الوثائق، بل على مدى وعي العاملين بأهمية معايير النظافة ودمجها في سلوكهم اليومي حتى تصبح روتينية وليست مجرد التزامات خارجية.

كما كشفت التحاليل الميكروبيولوجية عن وجود بكتيريا *Listeria* spp. على الأسطح الملامسة للأغذية وفي منتجات جاهزة للأكل، ما يدل على وجود خلل كبير في إدارة النظافة والسيطرة على التلوث داخل بيئة التحضير. وبالتالي، تبرز الحاجة العاجلة إلى اتخاذ إجراءات تصحيحية فعّالة على مستوى نقاط التحكم الحرجة (CCPs)، بما في ذلك تعزيز بروتوكولات التنظيف، تدريب الموظفين، وتكثيف عمليات التحقق.

تؤكد هذه النتائج أن تحقيق السلامة الغذائية الحقيقية يتطلب أكثر من مجرد أنظمة مكتوبة، بل يستوجب ترسيخ ثقافة مهنية يكون فيها جميع العاملين جزءاً فاعلاً من منظومة الوقاية والالتزام طويل المدى.

الكلمات المفتاحية: اغدية ,*Listeria*, BPH, تموين ,امن ,HACCP

LIST OF ABREVIATIONS

- **C**

CAC: Codex Alimentarius Commision

CCP: Critical Control Point

CXC: Codex Alimentarius Code

- **E**

EU: European Union

- **F**

FAO: Food and Agriculture Organization

FBO: Food Buisness Operatures

FDA: Food and Drug Administration

- **G**

GHPs: Good Hygiene Practices

- **I**

ICMSF: International Commission on Microbiological Specifications for Food

ISO: International Organization for Standarization

- **N**

NAS : National Academy of sciences

NASA : National Aeronautics and Space Administration

- **P**

PRP: Prerequisite Program

- **S**

SOPs : standard operating procedures

- **T**

TQM: Total Quality Management

- **U**

US : United States

- **W**

WHO: World Health Organization

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Glossary

- **Acceptable Level** : a level of hazard in a food at or below which the food is considered to be safe according to its intended use **(CXC 1-1969).**
- **Audit** : a systematic and functionally independent examination to determine whether activities and related results comply with planned objectives **(CAC/GL 26-1997).**
- **Catering**: the preparation, storage and, where appropriate, delivery of food for consumption by the consumer at the place of preparation or at a satellite unit **(CXC 39, 1993).**
- **CCP: Critical Control Point:** a specific step at which the hazard must be controlled to prevent or reduce food safety hazard to an acceptable level **(CXC 1-1969).**
- **Cleaning:** The removal of soil, food residues, dirt, grease, or other objectionable matter .The cleaning should remove food residues and dirt, which can be a source of contamination, whether by manual or automated procedures **(CAC/RCP 1-1969).**
- **Codex Alimentarius commission** : joint commission of experts from the WHO (World Health Organization) and the FAO (Food and Agriculture organization) **(Blanc,2017).**
- **Cold Chain:** is an integrated temperature-controlled food distribution system that helps to ensure the quality, nutritional value and safety of perishable produce and/or temperature-sensitive products **(FAO,2022) .**
- **Contaminant:** Any biological, chemical or physical agent, foreign matter or other substances not intentionally added to food that may compromise food safety or suitability. **(CXC 1-1969).**
- **Contamination:** The introduction or occurrence of a contaminant in the food or food environment **(CXC 1-1969).**
- **Corrective Actions:** systematic steps taken when monitoring indicates a deviation in a particular CCP.
- **Critical limits:** regulatory limits, a maximum and or minimum value to which a biological, chemical or physical parameter (T°, time, and pH) must be controlled at a CCP level to minimize to an acceptable level the occurrence of a food safety hazard **(FDA, 2020).**
- **Cross contamination**: is the unintentional passing /transferring of bacteria and viruses from a contaminated food or surface such as a chopping board and utensils to other food **(CAC/RCP 1-1969).**
- **Decision tree :** A series of questions linked diagrammatically to be answered with Yes or No. The answers determine which path is followed and which decision this leads to. **(CAC/RCP-1 1969).**
- **Deviation**: Failure to meet a critical limit or to follow a GHP procedure (**CXC 1-1969).**
- **Disinfection:** An operation that reduce the number of microorganisms to a safe level except spores, through chemical agents or physical methods that is food-safe **(CXC 1-1969).**

- **First in first out :** stock rotation based on the principle of despatching earliest received products first (**ISO22000 ,2009).**
- **Flow diagram:** A systematic representation of the sequence of steps used in the production or manufacture of food (**CAC/RCP-1 (1969).**
- **Food Business Operators (FBO):** the entity responsible for operating a buisness at any step in the food chain **(CXC 1-1969).**
- **Food chain :** sequence of steps and operations involved in the production , transformation , distribution , storage and handling of a food product and its ingredients, from primary production to consumption (**Blanc, 2017).**
- **Food hygiene:** includes the conditions and measures necessary for the production, preparation, storage, and distribution of food products in order to obtain products that are in good condition, safe, harmless, and fit for human consumption (**FAO/OMS, 2003).**
- **Food safety:** Assurance that food will not cause adverse health effects to the consumer when it is prepared and/or eaten according to its intended use **(CAC/RCP 1-1969).**
- **Food security :** the physical, social, and economic access of everyone, at all time ,to sufficient, safe, and nutritious food that satisfies their dietary needs and food preferences supporting an active and healthy life **(FAO, 1983)**.
- **Foodborne diseases :** are illnesses associated with the ingestion of food contaminated by bacteria, viruses, parasites and chemicals as well as bio-toxins**.(FAO,2019).**
- **Forward Flow (Unidirectional flow):** refers to the organizational layout of a food preparation area designed to prevent cross-contamination by ensuring that the clean circuit does not intersect with the dirty circuit. This is achieved by structuring the workflow logically, from the receipt of raw materials to the final service to the customer**.(Anonymous 1 ,2022).**
- **Good hygiene practices (GHP):** Fundamental measures and conditions applied at any step within the food chain to provide safe and suitable food **(CXC 1-1969).**
- **HACCP plan:** A document prepared in accordance with HACCP principles and which delineates the procedures to be followed **(FAD,1997).**
- **Hazard**: a microbiological, chemical or physical agent, or condition of food that might be a source of harm to the public health (**CXC 1-1969).**
- **Hazards Analysis**: the evaluation of data and conditions to identify which of these may pose risks to human health, in order to plan an appropriate response measures when necessary **(CXC 1-1969).**
- **ISO (International Organization for Standardization) :** is a worldwide federation of national standards bodies responsible of creating international standards to improve products and processes and ensure their safety and quality (**ISO, 2018).**
- **Operational PRP:** identified by the hazard analysis as essential to control the possibility of appearance of food hazards, related to food security **(Blanc, 2017).**
- **Prerequisite programs (PRP)**: Procedures, including Good Manufacturing Practices that address operational conditions providing the foundation for the HACCP system (**FDA,2020).**

- **Product Recall :**removal of a non-conforming product from the market, trade and warehouses, distribution centres and/or customer warehouses because it does not meet specified standards **(ISO22000,2009).**
- **Risk characterisation** :is 'The qualitative and, wherever possible, quantitative determination, including attendant uncertainties and variability of data and/or populations being evaluated, of the probability of occurrence of known and potential adverse effects of an agent in a given organism, system or (sub)population, under defined exposure conditions**(Global Food Safety Initiative, 2019).**
- **To Monitor:** To conduct a planned sequence of observations or measurements to assess whether a CCP is under control and to produce an accurate record for future use in verification **(FAD, 1997).**
- **Traceability:** the ability to follow the movement of a food through specified stage(s) of production, processing, and distribution. **(FAO and WHO, 2023).**
- **WHO (World Health Organization):** is a specialized agency of the United Nations established in 1948. its primary goal is to ensure that all people attain the highest possible level of health, defined as a complete state of physical, mental, and social well-being, and not merely the absence of disease **(WHO,2025).**

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INTRODUCTION

Food Safety is a shared responsibility, primarily ensured through the combined efforts of all stakeholder involved in the food chain -from farm to fork- **(Boutou, 2006).** Therefore, an effective risk management grounded in sound science and objective information is required **(Motarjemi *et al.*,2014).**Since 1960s , the HACCP system has become the internationally recognized and accepted method for ensuring food safety **(WHO ,1997).**

As food consumption increasingly shifts to out-of-home settings, particularly in urban environments, collective catering services have taken on a crucial role in providing food to a significant portion of the population. As a result, they are required to operate under strict food hygiene and safety standards **(Motarjemi *et al.*, 2014).**

However, from the reception of the raw material to food preparation, handling, storage and service, any lapse in hygiene can result in microbiological, chemical, or physical contamination. Among the pathogens of concern, *Listeria monocytogens* is particularly relevant in ready to eat food, given its persistence in the environment and potential severity in vulnerable population **(ICMSC, 2002).**

In response to these challenges, food business operators (FBOs) are expected to not only follow Good hygiene practices (GHPs) and good manufacturing practices (GMPs), but also implement structured food safety systems such as HACCP. This approach, if correctly implemented, should give FBOs and retailers confidence that their provided food is safe, and reduce the possibilities of the appearance of risks **(Mortimore and wallace, 2013).**

To explore the gap between theory and implementation, this study conducts a multifaceted evaluation in a collective catering unit integrated into a retail store located in Algiers.
The central research question is: What non-satisfactory that can lead to a lack of control over the quality of served food and hygiene in this catering service ,and what corrective measures that should be put in place to ensure the successful implementation of the HACCP system ?

To address this problem, the study is structured as follows:

A bibliographic section: composed of two chapters: Food safety and food security management in catering services, and HACCP system.

A practical section, aimed at evaluating the existing hygiene conditions and organizational practices through a field audit, which was conducted using the 5M method–a cause-and-effect framework derived from the ISHIKAWA diagram. An experimental step was also conducted with a microbiological analysis for the detection of *Listeria* spp. on surface and food samples to provide an empirical basis for the audit.

BIBLIOGRAPHIC SYNTHESIS

CHAPTER I: FOOD SAFETY AND FOOD SECURITY MANAGEMENT IN CATERING SERVICES

I.1. Definition of catering services

Catering service is a food business based on the specific needs and desires of clients whether it is for events or corporate functions. It includes :Menus designing/ planning, food preparation and on-site service .The main function of the catering services is to provide food ,drinks and accommodations at any time of the day for people of different ages , races , creeds and all walks of life **(Cesarani *at al.*,1992).**

The regulatory definition of catering is: the preparation, storage and, where appropriate, delivery of foodstuffs for consumption by the consumer at the place of preparation or in a satellite unit **(CAC/RCP 39-1993)**

Definition of Commercial food services in retail stores: food services offered by retail or grocery stores, in the private or public sector, to make a profit or maximize revenue. These services are aimed at both in-store customers and those wishing to take their meal away.

I.2. Importance of hygiene in catering services:

Hygiene in collective catering plays a fundamental role, not only in ensuring food safety but also in preventing the spread of foodborne diseases. However, to achieve these objectives, it relies on strict and essential prerequisites that ensure a safe environment where food preparation, handling, and distribution comply with rigorous hygiene and sanitary standards **(Tondusson and Bergus, 2001).**

I.3. Pre-requisite programs:

I.3.1. Definition: The World Health Organization **(WHO, 1999)** defines prerequisite programs (PrP) as "those practices and conditions necessary before and during the implementation of a risk management system such as HACCP [Hazard Analysis Critical Control Point], and which are essential for food safety (figure 1).

Prerequisite programs consist of standard operating procedures (SOPs) and environmental conditions that enable food operators to maintain a safe food production and reduce the number of critical control points (CCPs), and are therefore essential to guarantee food safety **(Global Food Safety Initiative, 2019).**

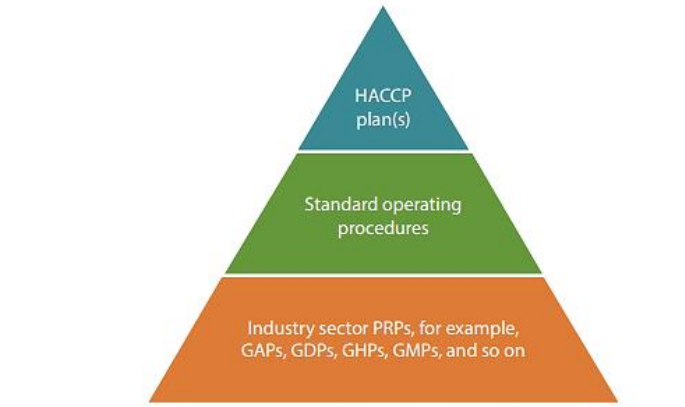


Figure 1:Position Of PRPs in a HACCP system (WBG,2020)

I.3.2. Main prerequisites:

PRPs must be adapted to the organization's specific food safety requirements, taking into account the size and type of operation, as well as the nature of the products manufactured or handled. They must be either implemented at all levels of the production system, as generally applicable programs, or as programs designed for specific products or production lines. In addition, they must be validated as part of the food safety system **(Blanc, 2017).**

These prerequisites are:

A. Facility design and maintenance :

Compliance with Good hygiene practices (GHPs) in the design and construction of buildings. The choice of a suitable location and the provision of adequate facilities are necessary to guarantee effective control of hazards. In order to avoid or minimize the occurrence of food hazards, establishments should be located away from areas of environmental pollution or industrial activities likely to contaminate food, areas subject to flood hazards, areas subject to pest infestations or areas where it is not possible to effectively dispose of solid or liquid waste (CXC 1-1969). In addition, plant layout should include the separation of areas with different levels of hygiene, in order to facilitate the unidirectional flow of material, personal, and processes .This design ensures the progress of operations from areas of lower contamination risk to higher hygiene standards without backtracking. e g. raw material vs finished product areas, thereby minimizing the risk of cross-contamination and strengthening the control of critical points throughout the production chain**(Anonymous 2, 2025).**

Surfaces (ceilings, walls, floors) are made of non-porous, non-contaminating, impact-resistant materials. Surfaces are smooth and washable to prevent dirt build-up (**CXC 1-1969).**

B. Reception and storage of raw material :

Raw materials and ingredients are generally sourced through trusted distributors to ensure product quality, consistent supply, traceability and favourable pricing. The premises and surrounding areas of purchasing sites must be kept clean. This means daily sweeping, dusting, waste collection and disposal **(Tondusson and Bergus, 2001)**

During purchasing, the selection of raw materials should consider not only their quality, freshness, and price but also the seller's hygiene and environment, which are indicators of their commitment to sanitary standards. Additionally, the condition of the transport truck, including its appearance, smell, and absence of contaminants, should not be overlooked **(Tondusson and Bergus, 2001).**

The storage must be carried out in the respect of the temperature for each product, to ensure the safety of the raw material and avoid the proliferation of germs**.** Therefore, suitable, large and separate facilities should be provided for the safe and hygienic storage of food products, food ingredients, packaging materials, and non-food chemicals (including cleaning agents, lubricants, and fuels)**.**

Food storage facilities should be designed and constructed to: facilitate adequate maintenance and cleaning, avoid pest access and harbourage, enable food to be effectively protected from contamination, including allergen cross-contact, during Storage, with daily temperature and humidity control to certain products such as meat , fruits and vegetables **(CXC 1-1969).**

The principal of Food traceability which is a recordkeeping tool to follow all food production processes **(WBG, 2020**),as well as The "first in, first out" principle should be followed to ensure that older stock is used before newer stock. This helps avoid spoilage and waste, ensuring that products remain safe for consumption **(FAO, 2013).**

C. Products tractability and recall: Traceability is a tool used in food control systems to manage hazards, ensure product authenticity, and provide accurate product information, which allow rapid identification, tracking and recall of food lots when safety issues arise **(FAO, 2025).** The withdrawal or recall of unsafe food is one of the core responsibilities of Food Business Operators (FBO's) aiming to protect customers from unsafe food. In cases of withdrawal or recall, FBOs are also responsible for cooperating with the relevant regulatory authorities (WBG, 2020).

D. Forward flow: this principal ensures a one-way progression of products through successive operations, including the movements of personnel and material within the buildings, from the reception of the raw material, to the presentation of the final product .In order to prevent or minimize cross-contamination. It is achieved by a physical separation in time or space **(DILA, 2011).**

E. Personal:

The personnel handling the products can be a significant source of contamination, either due to poor health or because of failure to adhere to basic hygiene rules **(DILA, 2011).**

Therefore, the staff must respect strict body, clothing and behavioural hygiene and have the necessary skills and knowledge in food safety and hygiene to ensure safe food handling **(Bergus and Tondusson, 2001)** . The establishment managers should organize ongoing training and information for all individuals responsible for food handling, focusing on hygienic food handling methods and personal hygiene. Every employee should take responsibility for the quality and safety of the products they produce. Signs and pictograms should be posted to remind staff to wash their hands, and regular checks should be carried out to ensure compliance.

All personnel working in food handling areas should wash their hands (as well as their arms and nails) frequently and thoroughly when taking the post, when leaving the toilet, after each manipulation, after breaks, when moving between different production areas, and whenever necessary. In addition, individuals who handle food as part of their work should undergo a medical examination before being hired (CX 4/20.2 1997).

By the end of the training Staff should have an understanding of:

1. What hazards are and their importance in food safety
2. CCPs and their role in the assurance of product safety
3. Critical limits, which should be met
4. Corrective actions and responsibilities
5. Record-keeping requirements
6. The objective of verification procedure **(Arvanitoyannis, 2019).**

F. Preparation and processing:

The preparation and processing steps, during which raw material is transformed into the finished product, represents the highest risk for contamination. Therefore, Critical Control Point (CCP), in each process must be identified and controlled **(CXC 1-1969).**

G. Pest control:

Pest infestations can occur in areas where breeding sites and a food source are present. Good Hygiene Practices (GHPs) should be implemented to prevent the creation of conditions conducive to pest activity **(CXC 1-1969)**

Prevention can be by Ensuring the good condition and hygiene of the facilities, Keeping outdoors areas clean and free from weeds, to prevent contamination risks from pests .Also, regular inspection of the premises for any signs of pests using detectors and traps (e.g. insect light traps, bait stations), hiring a pest control contractor might also be needed. In addition to deliveries check-ups for signs of pests, such as gnawed packaging or insects (e.g., beetles), and refuse any delivery showing such signs **(FSA, 2024).**

Even if monitoring is outsourced, FBOs should review reports and take corrective actions, such as pest eradication and eliminating harbourage sites.

H. Maintenance, cleaning and disinfection:

Cleaning should effectively eliminate food residues and dirt that could serve as a source of contamination, including allergens. The cleaning techniques and materials required will vary based on the type of food business, the food being handled, and the surfaces being cleaned. Therefore, it can be by the separate or the combined use of physical methods, such as heat, scrubbing, turbulent flow, and vacuum cleaning, chemical (detergents, alkalis, or acids) or other dry methods where water might increases the likelihood of microbiological contamination.

In addition, cleaning equipment and utensils must be suitably designated and separated for different hygiene zones (e.g. food and non-food contact surfaces) **(CXC 1-1969).**

All the Equipment, tools, utensils, and other items that encounter food must be cleaned and, when necessary, disinfected. These items may need to be disassembled regularly throughout the day—at least after each break and when transitioning from one food product to another **(CXC 1-1969).**

The implementation of cleaning and disinfection procedures should be regularly monitored to assess their effectiveness, with periodic verification through methods like visual inspections and audits. This ensures proper application of the procedures.

CHAPTER II: HACCP SYSTEM

II.1. -Definition of The HACCP system:

The HACCP stands for « **H**azard **A**nalysis **C**ritical **C**ontrol **P**oint »: which is an international recognised preventative system that provides a framework for monitoring the total food chain from the raw material production to the consumption, in order to prevent and reduce the food-borne diseases to acceptable levels **(ANONYME 2 ,2023).** The HACCP system is based on scientific and consistent foundations, it defines specific hazards and outlines the measures to be taken to control them, and ensure the safety of the food **(CAC/RCP 1-1969)**. According to Codex Alimentarus : all stakeholders -including primary producers, importers, manufacturers and processors, food business operators, food handlers, retailers, and consumers- are responsible of ensuring that food is safe and suitable for consumption.

The HACCP system provides a flexible approach that can be adapted to the circumstances and capabilities of the food business operation. It can also be updated or developed in response to changes in equipment, modifications in processing parameters and steps, updates in manufacturing technology, variations in end-product characteristics, shifts in distribution methods, and changes in intended use or good hygiene practices (GHPs). This adaptability ensures that the HACCP system remains relevant and effective in addressing evolving processing procedures and technological developments **(CXC 1-1969).** However, the production of safe food products requires that the HACCP system be built upon a solid foundation of prerequisite programs, "in accordance with the General Principles of Food Hygiene of the Codex, the corresponding Codex Codes of Practice, and the appropriate food safety requirements" **(CAC/RCP 1-1969).**

II.2. Background of The HACCP system:

The HACCP system originated from two major concepts. The first was the integration of Deming's theories, which were later developed into Total Quality Management (TQM) systems. These systems implement an approach to enhance quality during production while reducing costs. The second concept was the development of the HACCP system by the American space agency NASA, the private company Pillsbury, and the US Army between 1959 and 1960. This collaboration aimed to guarantee the safety and hygiene of astronauts' food **(FAO, 2001).** The team implemented precise and strict biological controls during the preparation of meals provided to astronauts throughout their flights and missions **(Anonymous 4, 2017).**

However, the initial version of HACCP was first presented to the public in 1971, based on three principles:

- Conduct a hazard analysis
- Determine critical control points
- Establish monitoring procedures

Later, in 1975, the Pillsbury Company adopted two additional principles:

- Establish critical limits
- Establish corrective actions

In 1985, the National Academy of Science (NAS) and the International Commission on Microbiological Specifications for Food (ICMSF) advocated for HACCP to address the need for an effective food safety assurance method following an increase in foodborne disease incidents. In 1990, France experienced significant growth in the use of the method within a regulatory framework **(Genestier, 2002).**

In 1993, the Codex Alimentarius Commission (CAC) produced the first official version of the HACCP system, titled "Risk Analysis System – Critical Control Points," in the form of an appendix to the document CAC/RCP-1-1969.

In 2005, ISO 22000 introduced an auditable standard for food safety management systems, including the concept of Operational Prerequisite Programmes **(Blanc, 2017).** Finally, since 2006, all seven Codex HACCP principles have become a legal requirement for most food businesses in the European Union.

The principles are as follows:

1. Conduct a hazard analysis and identify control measures.
2. Determine the critical control points (CCPs).
3. Establish validated critical limits.
4. Establish a system to monitor the control of CCPs.
5. Establish corrective actions to be taken when monitoring indicates a deviation from a critical limit at a CCP.
6. Validate the HACCP plan and establish procedures for verification to confirm that the HACCP system is functioning as intended.

7. Establish documentation for all procedures and records appropriate to these principles and their application.

In Algeria:

The adoption of food safety systems based on HACCP principales has been progressively implemented through several key decrees.

Executive Decree No. 10-90 of 24 Rabie El Aouel 1431 (March 10, 2010) complements Executive Decree No. 04-82 of 26 Moharram 1425 (March 18, 2004). These decrees establish the conditions and procedures for the sanitary approval of establishments involved in activities related to animals, animal products, products of animal origin, and their transportation.

- **Art. 3**: The Hazard Analysis Critical Control Point (HACCP) system is defined as a set of actions and written procedures to be implemented in establishments whose activities involve animal products and products of animal origin. Its purpose is to evaluate hazards and identify critical points that pose a threat to food safety, with the goal of controlling these risks. All businesses involved in the production, handling, or processing of animal products and products of animal origin are required to implement the HACCP system.
- **Article 8**: The content, requirements, and methods for implementing HACCP are determined by an order from the minister responsible for veterinary authority or, where applicable, by a joint order from the minister responsible for veterinary authority and the relevant sectoral minister.

In **2017**, Executive Decree No. 17-140 of April 11, 2017, established the hygiene and safety conditions for producing food products suitable for human. This decree requires operators to implement HACCP principles.

- **Article 5** — Except for activities at the primary production stage, establishments (defined as any unit or area where food products are handled, along with their surroundings under the same operator) must establish procedures to ensure the safety and security of food products based on the principles of the HACCP system.

II.3. Importance of The HACCP system:

Continuous improvement in food safety requires the implementation of the HACCP system, which can bring a number of significant benefits.

The system, when properly applied, can be integrated into every stage of the food system, from harvesting and cultivation to processing, manufacturing, distribution and marketing, ultimately ensuring that food is safe for consumption (Figure 2). Each stage requires specific adaptation of the system to meet national and international food safety standards **(Pearson and Duston, 1999).** Furthermore, the application of the HACCP system can assist regulatory authorities in their inspection tasks and promote international trade by strengthening confidence in food safety **(CAC/RCP 1-1969).**

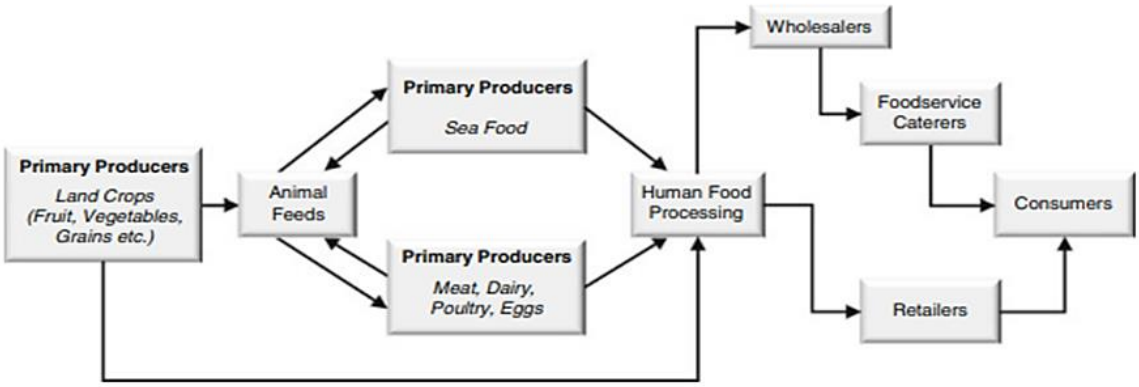


Figure 2: Sectors of application of the HACCP (Mortimore and Wallace ,2013).

Although HACCP is not an inspection system, it can make inspection more effective by enabling inspectors to see how the establishment has operated over time, to determine whether problems have occurred and, if so, how they have been resolved **(Pearson and Duston, 1999).**

II.4. Implementation of the HACCP system:

The application of HACCP principles involves carrying out the following tasks as they are described in the logical sequence of the HACCP system's implementation (figure 3) **(CAC/RCP 1-1969).**

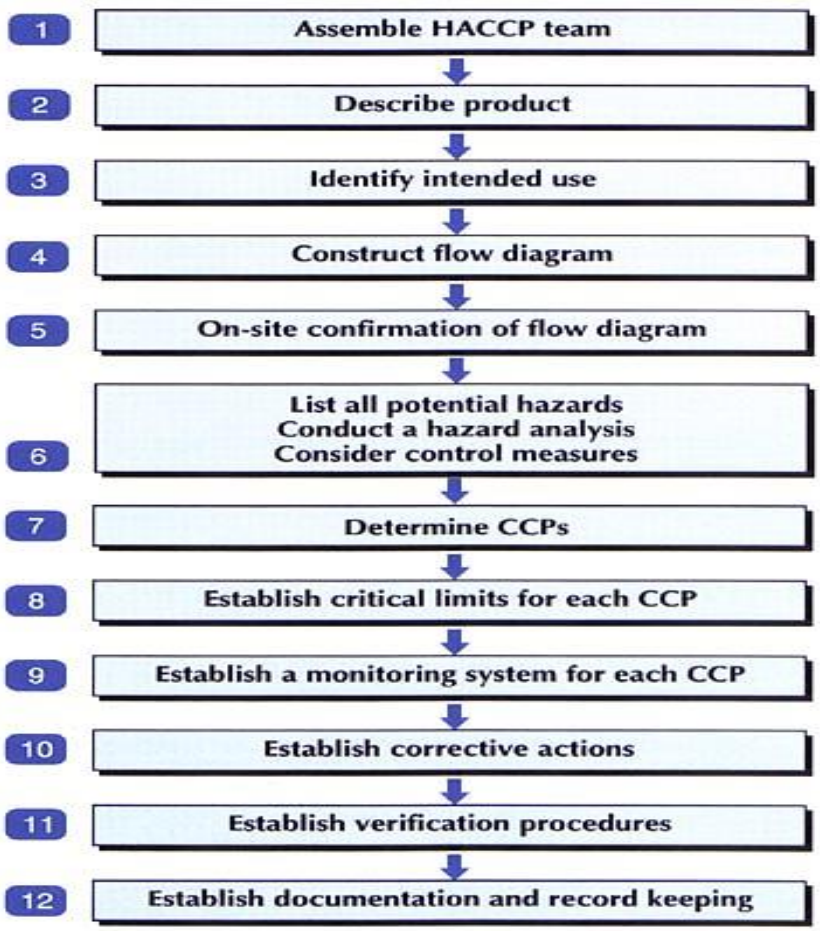


Figure 3: The twelve steps to implementing the HACCP system (FAO, 1998)

The twelve steps for implementing the HACCP system are described as follows:

II.4.1. Assembling the HACCP team: Creating an operational team is the main step to an effective HACCP plan, since they are considered the leaders of the system and the main authority responsible for the management of the system. The members are chosen based on their experience, responsibility and their knowledge of the products, procedures and the possible risks.

Their tasks involve identifying hazards, assessing and prioritising risks, proposing and monitoring control measures, defining the necessary corrective actions and carrying out an overall assessment of the HACCP system.

II.4.2.Description of the product:

An FBO that is producing, storing, or otherwise handling food should have a description of the food Products including: relevant safety information such as composition (i.e. ingredients), physical/chemical characteristics (e.g. aw , pH, preservatives, allergens), processing

methods/technologies (e.g. heat- treatment, freezing, drying, brining, smoking, etc.), packaging, durability/shelf life, storage conditions and method of distribution **(CXC 1-1969 (2023).**

In catering services, this step is harder due to the production of multiple aliments. Therefore it is easier to define the grand sectors such as : cold storage, hot preparations , transport …

II.4.3. Identify intended use and users

The ISO 22000 requires describing the use intended by the FBO and the expected handling of the finished product by the next FBO in the food chain or the consumer. In addition, any misuse or improper use must be considered and documented as necessary for conducting the hazard analysis. It is also essential to Study the different types/ groups of consumers of the product with particular emphasis on vulnerable populations, such as the elderly and individuals at increased health risk (diabetic, food allergic and pregnant women...etc **(Blanc, 2017).**

II.4.4. Construct flow diagram

The ISO 22000 requires the construction of a flow diagram that describes all manufacturing processes, organizing them by product line or sector of activity (e.g., manufacturing diagram). For each step, a maximum of information must be collected regarding the premises, the ingredients, temperatures, the nature and function of operations, the materials used the various flows (air, water, personnel, waste, and storage). it must including any applicable rework **(Bergues and Tondusson, 2001).**

The diagram must be dated and should clearly identify each Critical Control Point (CCP),

to evaluate the possible occurrence, increase, decrease or introduction of hazards .during the on-site confirmation **(Blanc, 2017)**.

II.4.5. On-site confirmation of flow diagram

It is important to verify on the ground the reliability of the developed diagram and the completeness of the information gathered **(Bergues and Tondusson, 2001).**

II.4.6. Hazards Analysis (Principle one):

The HACCP team should list all potential hazards that are likely to occur and associated with each step, conduct a hazard analysis to identify the significant hazards, and consider any measures to control identified hazards.

The HACCP team should next evaluate the hazards to identify which of these hazards are such that their prevention, elimination, or reduction to acceptable levels is essential to the production of safe food (i.e. determine the significant hazards that have to be addressed in the HACCP plan) **(CXC 1-1969 (2023).**

II.4.7. Determine the critical control point (CCP) (principle Two):

The FBO should consider which among the available control measures listed during Step 6; (Principle 1) should be applied at a CCP. CCPs are to be determined only for hazards identified as significant as the result of a hazard analysis. CCPs are established at steps where control is essential and where a deviation could result in the production of a potentially unsafe food. The control measures at CCPs should result in an acceptable level of the hazard being controlled.

Determining whether the step at which a control measure is applied is a CCP in the HACCP system can be helped by using a decision tree or a CCP determination worksheet (figure 4) **(CXC 1-1969 (2023).**

II.4.8. Establish Critical Limits (principle three) : Critical limits establish whether a CCP is in control, and in doing so they can be used to separate acceptable products from unacceptable ones. These critical limits should be measurable or observable. Critical limits for control measures at each CCP should be specified and scientifically validated to obtain evidence that they are capable of controlling hazards to an acceptable level if properly implemented. Validation of critical limits may include conducting studies (i.e. microbiological inactivation studies) **(CXC 1-1969 (2023).**

II.4.9. Establish Monitoring Procedures (principle Four):

Monitoring procedures are a planned sequence of observation or measurements to assess whether a CCP is adequate and the critical limits are being met, or if there is a loss of control, in which case corrective actions will be needed.

The monitoring procedures are assigned to selected employees by the HACCP operators who are responsible and adequately trained to acknowledge and report any unusual occurrences and should be familiar with all the processes the purpose of monitoring. All the procedures should be documented to be up to date with any deviation in the CCP throughout the production process at any given time .including all the corrective actions for future use and verification **(CXC 1-1969 (2023).**

II.4.10. Establish the corrective actions (principle Five):

Correction is to take action to correct an immediate problem like fixing a machine .However, the corrective actions are systematic steps taken when monitoring indicates a deviation in a particular CCP from the critical limit to study and correct the cause of the hazard, and to prevent its potential occurrence in foods **(FDA, 1997).**

The corrective actions taken when a deviation occurs should ensure that the CCP has been brought under control and food that is potentially unsafe is handled appropriately and does not reach consumers. Details of the corrective actions, including the cause of the deviation and product disposition procedures, should be documented in the HACCP records **(CXC 1-1969 (2023).**

II.4.11. Validation of the HACCP plan and verification procedure (principle Six):

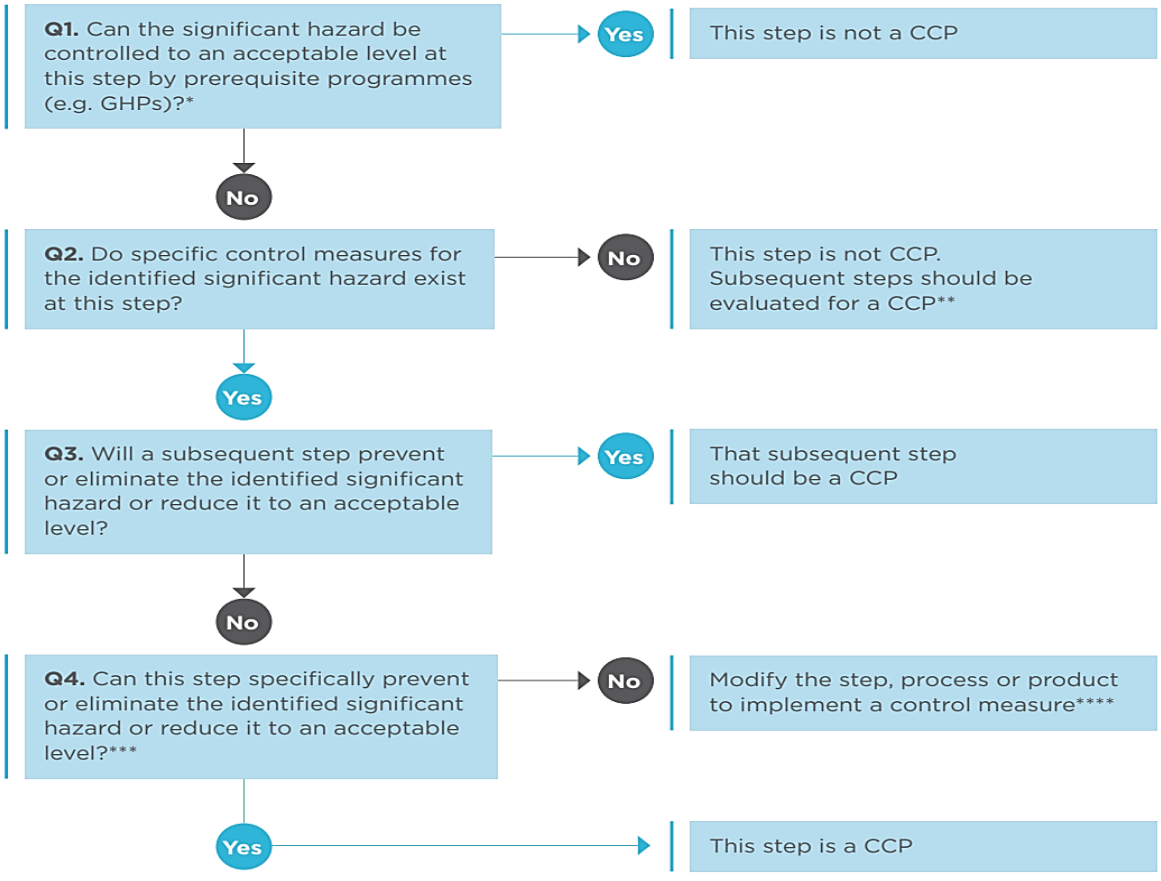
By applying specific process to verify and follow the scientific and technical effectiveness of the previous/ current procedures systematically such as the application of methods, procedures analyses and other evaluation in addition to monitor and to determine compliance with the HACCP plan **(Schmidt and Newslow, 2019).**

II.4.12. Establish Record Keeping and Documentation (principle Seven):

Efficient and accurate record keeping is essential to the application of a HACCP system. HACCP procedures should be documented. Documentation and record keeping should be appropriate to the nature and size of the operation and sufficient to assist the business to verify that the HACCP controls are in place and being maintained. Expertly developed HACCP guidance materials (e.g. sector-specific HACCP guides) may be utilized as part of the documentation, if those materials reflect the specific food operations of the business.

II.4.13. Training

Training of personnel in food businesses, government and academia in HACCP principles and applications is an essential element for the effective implementation of HACCP. As an aid in developing specific training to support a HACCP plan, working instructions and procedures should be developed which define the tasks of the operating personnel in charge of each CCP. Training programmes should be designed to address the concepts at a level appropriate for the knowledge and skill level of the personnel being trained **(CXC 1-1969 (2023).**



* Consider the significance of the hazard (i.e. the likelihood of occurrence in the absence of control and the severity of impact of the hazard) and whether it could be sufficiently controlled by prerequisite programmes such as GHPs. GHPs could be routine GHPs or GHPs that require greater attention to control the hazard (e.g. monitoring and recording).

** If a CCP is not identified at questions 2–4, the process or product should be modified to implement a control measure and a new hazard analysis should be conducted.

*** Consider whether the control measure at this step works in combination with a control measure at another step to control the same hazard, in which case both steps should be considered as CCPs.

**** Return to the beginning of the decision tree after a new hazard analysis.

Figure 4: Example of a decision tree-apply to each step where a specified significant hazard is identified (CXC 1-1969 (2023).

PRACTICAL AND EXPERIMENTAL PART

OBJECTIVES:

Since 2010, the Algerian authorities have required the implementation of the HACCP system across various establishments. In order to improve the control and management of food-related health risks and to ensure national food safety throughout the entire food production chain.

The aim of this study is to assess the level of HACCP implementation and to evaluate the hygienic conditions and practices within a collective catering service. This evaluation was conducted through a structured audit based on the PRPs and the 5M method.

To validate and support the audit findings, Microbiological analyses were also conducted, including the surfaces in contact with food, and ready to eat products specifically cold sandwiches, To detect the presence of *Listeria* spp. particularly *Listeria monocytogenes* , as a critical food safety hazard.

I.HACCP audit

I.1.Materials

I.1.1.Presentation of the unit:

This study was conducted within a catering service in a large retail hypermarket located in Algiers, Algeria. This service is responsible for the preparation and distribution of a wide range of ready-to-eat products including: cold and hot traditional dishes, salads and sandwiches, intended for immediate consumption or takeaway.

The service includes dedicated work areas for food preparation zones, storage (cold and dry), packaging and distribution counters, as well as annexes such as two refrigeration units and staff hygiene and consumption facilities (figure 5). The staff is composed of 8 employees, work by shifts (morning and evening teams).

This location provided a practical and representative setting for the implementation and evaluation of the HACCP system as part of this study, particularly due to the diversity of food items served.

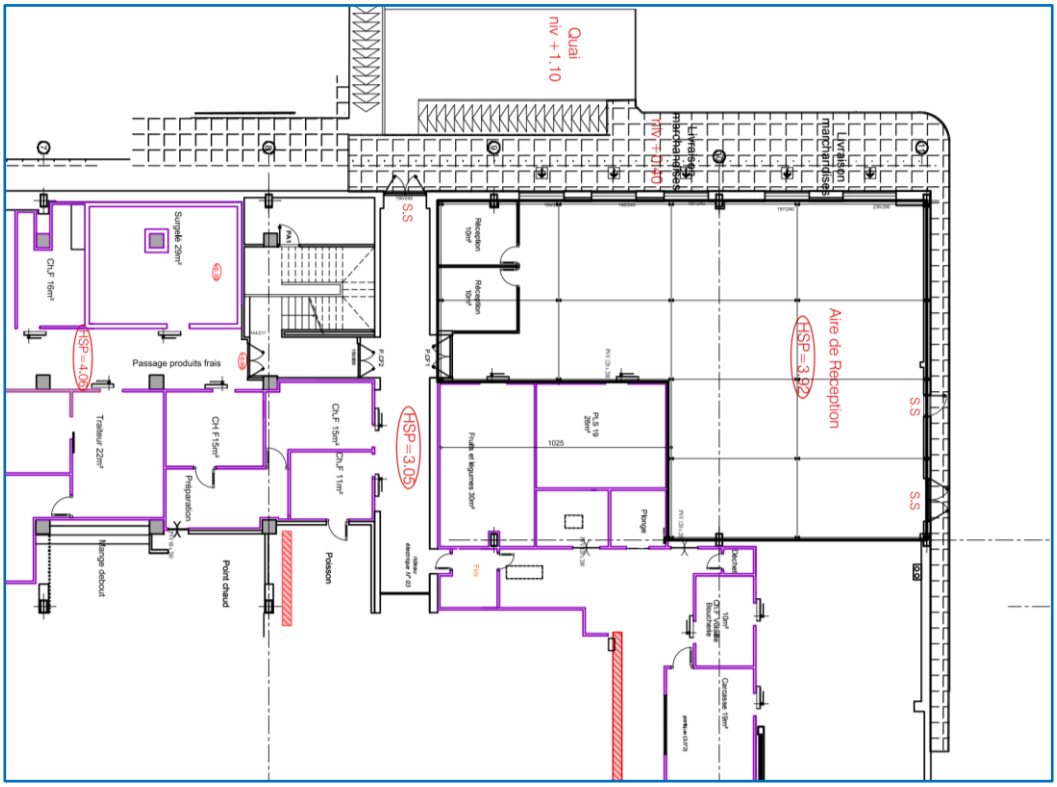


Figure 5: Ground plan of the catering facility (facility records, 2025)

I.1.2.Period of study:

The study was carried out over a two-week period, from February 12 to February 26, 2025, during which an on-site HACCP-based audit and microbiological sampling were performed to assess hygiene practices and food safety compliance.

I.1.3. Checklist:

The requirements were checked and evaluated using an audit checklist specific to the section, which was inspired by two manuals: Algerian food safety decree 17-140(2017) and the Codex Alimentarius (2003).

The checklist was structured around five key food safety requirement (5M) based on the ISHIKAWA diagram (figure 06):

1. Management of the environment (environment and premises)
2. Machinery (equipment and tools)
3. Methods (processes and procedures)
4. Manpower (personnel and training)
5. Raw material

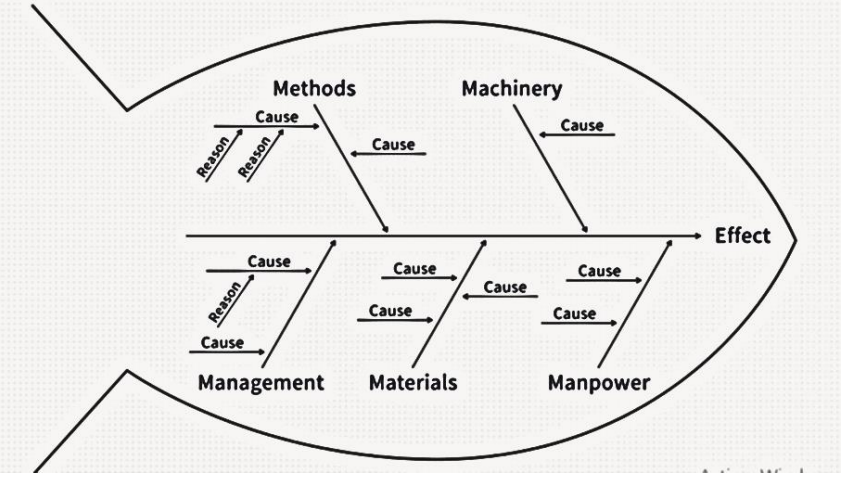


Figure 6: Ishikawa Diagram (bang, 2020)

I.2. Methods:

I.2.1.Audit:

Each item in the checklist was broken down into several sub-items, which were assessed using the following scoring system:

- S (Satisfactory) :a score of 1 was assigned if the requirement is fully respected and implemented in compliance with the Algerian regulation and/or codex standards
- AA (To be improved): a score of 0.5 was assigned if the requirement is partially met .Actions are in place but not fully compliant or need improvements.
- NA (Not Applied) : a score of 0 was assigned the requirement is not met at all or absent ,no evidence of compliance

I.2.2.Calculation of the satisfaction percentage:

The percentage of compliance (satisfaction) for each item was calculated using the following formula:

$$\text{Satisfaction \%} = \frac{(NPS \times 1)+(NPAA \times 0{,}5)+(NPN \times 0)}{NPS+NPAA+NPNA}$$

Where

- NPS = number of "satisfactory" responses
- NPAA= number of "To be improved" responses
- NPNA = number of "Not applied" responses

I.3. AUDIT REPORT:

The results of the audit are presented in the table below:

I.3.1.MANAGEMENT OF THE ENVIRONMENT

The results of the management of the environment assessment are reported in the table 01

Table 1: Results of the assessment of management of the environment

Element to evaluate	Requirements	Current condition	status	Scoring
Setting of the facility				
	Away from polluted areas or the ones that involve industrial activities with potential source of contamination.	The establishment is located in a clean, safe area away from pollution, industrial contamination, and waste storage and flood risks.	**S**	**1**
	Away from Flood-prone areas ,unless adequate safety measures are implemented		**S**	**1**
	Adequate protection must be provided against pests, insects , rodents , other animals and external pollution	pest control measures are in place ;however , the occasional presence of pests have been observed.	**AA**	**0.5**
Design and layout of the facility				
The permises and their annexes	Must be of sufficient dimensions depending on their intended use ,the required personnel , and equipment and materials employed	Requirement fulfilled.	**S**	**1**
	Areas where foodstuffs are handled Must be Separated and do not have direct communication with the lockers rooms ,toilets or washroom	Requirement fulfilled	**S**	**1**
	Areas of reception and storage of raw materials and those for the preparation packaging of the finished products must be separated	Requirement fulfilled	**S**	**1**
	Hot food and cold food area must be separated	Hot and cold food area are separated by partition walls	**S**	**1**
	Must be designed in a way that the one way flow of product is respected (codex)	Requirement fulfilled : the separation is done by time	**S**	**1**
Floor	Floor coverings must be smooth , clear washable , and made of resistant waterproof ,light colored ,non-slip , and nontoxic materials	Requirement fulfilled	**S**	**1**
	Must be designed to allow liquid waste to drain away	Requirement fulfilled	**S**	**1**
Drainage system	Establishments must have and keep in good working order an effective system for removing effluent and waste	The drainage system setup is in place with a proper pipes installation, and ventilation, which ensures wastewater removal.	**S**	**1**

	Drain pipes must direct wastewater into drains(not below a production area)	Requirement fulfilled	**S**	**1**
	Drainage system must be equipped with siphons and airing devices and prevent the entry of odors ,vermin ,waste or back flow contaminated water	Requirement fulfilled	**S**	**1**
	The drainpipes must be well maintained and do not have any leaks	Requirement fulfilled	**S**	**1**
Walls	Wall coverings must be smooth, clear, washable, waterproof, resistant painted with food paint ,and made of stainless steel at the corners and bottom.	Requirement partially fulfilled :Presence of damaged tiling	**AA**	**0.5**
	Made up to an appropriate height	Requirement fulfilled	**S**	**1**
	Angles of Wall and floor joints must be rounded	Requirement fulfilled	**S**	**1**
Ceilings	Ceilings and suspended equipment are cleanable, prevents mold, condensation and the release of particles onto food or contact surfaces.	Requirement fulfilled	**S**	**1**
Doors	Doors are made of smooth, non-absorbent materials that are easy to clean and, when necessary , disinfect	Requirement fulfilled	**S**	**1**
	Doors are kept in a constant state of cleanliness	Requirement partially fulfilled	**AA**	**0.5**
Lighting	Adequate lighting in all areas promoting inspection and production activities, without altering the color of food.	Requirement fulfilled	**S**	**1**
	Hanging lamps are covered to prevent contamination or physical hazards if broken.	Requirement partially fulfilled Presence of uncovered lights (lack of protection).	**AA**	**0.5**
Ventilation	Adequate natural or mechanical ventilation is installed ,with easy to access for cleaning ,control or replacement Prevent airflow from a contaminated area toward a clean area , especially in zones where foodstuffs are handled	Requirement not fulfilled: The air extraction system in the cooking area has Insufficient capacity .The hoods are out of service, leading to the accumulation of steam.	**NA**	**0**
Locker rooms and sanitary facilities				
	sufficient sanitary facilities are provided for the staff, including sinks, changing rooms, and toilets ,always maintained in good hygienic conditions	Requirement fulfilled	**S**	**1**
	The sanitary facilities, changing rooms and refectories are separated from production areas.	Requirement fulfilled	**S**	**1**
	Changing rooms are clean, lighted ,ventilated and separated from toilets	Requirement fulfilled	**S**	**1**

	There are sufficient non-manual handwashing and drying stations (with hot/cold water) near the restrooms.	Requirement fulfilled	**S**	**1**
	The recommendation « washing hands is mandatory after using the toilet » in pictograms forms is displayed in the restrooms.	Requirement fulfilled	**S**	**1**

I.3.2.MACHINARY

The results of the material assessment are reported in the table 02

Table 2: Results of the assessment of the machinary

Element to evaluate	**Requirements**	**Current condition**	**status**	**Scoring**
Equipment , material and utensils in contact with food	Present an appropriate appearance and shape, and be installed in a way that facilitates maintenance, cleaning, and disinfection	Requirement fulfilled	**S**	**1**
	Have surfaces in contact with food that are perfectly smooth, non-toxic, non-corrosive, and resistant to repeated maintenance and cleaning operations	Requirement not fulfilled: the Cutting boards are heavily worn, with deeps grooves ,and numerous cuts .their current condition poses risk of cross-contamination	**AA**	**0.5**
	The color code is correctly followed in the equipment (cutting boards , knives)	Requirement not fulfilled :The color code is applied on the material but not followed during the use, the same cutting board is used for white meat and vegetables , but the cleaning is properly managed	**AA**	**0.5**
	Be constructed from materials that have no toxic effect on the food, in accordance with applicable regulations	Requirement fulfilled	**S**	**1**
Refrigerating equipment and materials	made from impermeable, rot-resistant, shock-resistant , washable, and disinfect able materials that do not alter the food in contact and are easy to clean and disinfect	Requirement fulfilled	**S**	**1**
	equipped with a temperature recording system placed in such a way that it can be easily consulted	Requirement fulfilled	**S**	**1**

	Arranged to facilitate a rational storage of foodstuffs, allowing for internal air circulation and an even distribution of the ambient temperature among all the different components of the stored foodstuffs	Requirement fulfilled	**S**	**1**
	Maintained In good hygienic condition: Absence of mold, grease, condensation, and peeling paint (absence of contamination sources).	Requirement partially fulfilled: low hygiene maintenance and Presence of peeling paint	**AA**	**0.5**
	The refrigerating equipment and material must be made from materials designed for easy cleaning and disinfection.	Requirement fulfilled	**S**	**1**
	Must be equipped with a temperature recording system	Requirement fulfilled	**S**	**1**
	Absence of both packaged food (cardboard boxes) and vacuum-sealed items(plastic wrapped meat)	Requirement partially fulfilled :Presence of cardboard boxes in the cold chamber	**AA**	**0.5**

I.3.3.RAW MATERIAL

The results of the raw material assessment are reported in the table 03

Table 3: Results of the assessment of the material

Element to evaluate	**Requirements**	**Current condition**	**status**	**Scoring**
Transportation and reception of raw materials	This equipment or means of transport must be equipped with the necessary modifications and equipment to ensure the required storage conditions, depending on whether they are frozen, deep-frozen, or refrigerated in their fresh state.	Requirement fulfilled : selected employees are responsible of the verification of the transportation equipment	**S**	**1**
	Different foodstuffs must be effectively separated to prevent any cross-contamination.	Requirement fulfilled	**S**	**1**
	There is a specific area for the receipt of food products.	Requirement fulfilled:Pesence of food safety certificate for each batch delivered All checked by specific employees	**S**	**1**

	All products received, including packaging materials and labels must be verified in order to check their compliance with the specifications and	Requirement fulfilled : selected employees are responsible of the verifications of all the delivered materials at the reception area	**S**	**1**
Storage	Raw materials and ingredients must be stored and preserved under adequate conditions that prevent their deterioration and protect them from contamination	Requirement fulfilled	**S**	**1**
	The cold chain must not be interrupted for all raw materials and products.	Requirement fulfilled	**S**	**1**
	All products are clearly identified and separated	Requirement fulfilled	**S**	**1**
	Absence of food items with incompatible sanitary levels (fruits, vegetables, meat...)	Requirement fulfilled	**S**	**1**
	Detoriable foodstuffs that are refrigerated, frozen or deep-frozen must be stored in cold rooms (art 48)	Requirement fulfilled	**S**	**1**
	The equipment and tools of the storage room are kept in good hygienic condition.	Requirement partially fulfilled The floors are not cleaned on regular basis	**AA**	**0.5**
	Temperature, humidity, and ventilation conditions are satisfactory.	Requirement fulfilled	**S**	**1**
	Temperature monitoring devices are present in all premises and storage equipment.	Requirement fulfilled	**S**	**1**
	The use of the products must be carried out in accordance with the principles of FIFO and FEFO (first expired first out)	Requirement fulfilled	**S**	**1**

I.3.4.MANPOWER

The results of the manpower assessment are reported in the table 04

Table 4: Results of the assessment of the manpower

Element to evaluate	Requirements	Current condition	status	Scoring
Staff hygiene	The staff in touch with food is wearing the complete and correctly worn required uniform.	Requirement fulfilled	**S**	**1**
	The staff has a sufficient number of work uniforms.	Requirement fulfilled	**S**	**1**
	The personal hygiene of the staff is satisfactory	Requirement fulfilled	**S**	**1**
	Lockers/wardrobes are properly maintained and free of unnecessary items.	Requirement fulfilled	**S**	**1**
	The wearing of rings, nail polish, personal items (vests…) is in compliance.	Requirement fulfilled	**S**	**1**
	Must wear gloves that are clean and suitable for food contact	Requirement not fully fulfilled	**AA**	**0,5**
	personnel avoid any behavior that could lead to contamination of foodstuffs, such as eating, chewing, consuming tobacco products, spitting, or any other unhygienic practices in food handling areas	Requirement fulfilled	**S**	**1**
	Staff has a specific area for consumption.	Requirement fulfilled	**S**	**1**
	Frequent use of handwashing stations is observed	Requirement not fulfilled	**AA**	**0.5**
	signs, notices, and recommendations of hand washing to the staff are posted in appropriate areas	Requirement fulfilled	**S**	**1**
	There are no individuals with non-waterproof bandages or open wounds on their hands.	Requirement fulfilled	**S**	**1**
	Sick individuals (colds, sore throats, diarrhea, and paronychia) are excluded from sensitive work positions.	Requirements fulfilled	**S**	**1**
	Staff received periodic medical visits and additional examinations at least every six (6) months, and received vaccinations required by applicable legislation and regulations (art 55)	Requirements fulfilled	**S**	**1**
Staff Training	The staff has received recent training regarding the application of HACCP	Requirements fulfilled	**S**	**1**

	principles and hygiene rules food hygiene.			
	Food handlers are continuously informed of the necessary procedure updates and comply with them to maintain the safety and hygiene of foodstuffs.	Requirements fulfilled	**S**	**1**
	Staff responsible for cleaning and disinfecting the premises have received training in hygiene and cleaning/disinfection techniques.	Requirements fulfilled	**S**	**1**

I.3.5.METHODS

The results of the methods assessment are reported in the table 05

Table 5: Results of the assessment of the methods

Element to evaluate	Requirements	Current condition	status	Scoring
Cold preparation area	There is a sufficiently spacious area for preparing cold dishes to minimize the risk of contamination during preparation.	Requirement fulfilled	**S**	**1**
	Cold preparation is done at specific times to ensure temperatures and conditions that limit microbial contamination.	Requirement fulfilled	**S**	**1**
	The operations are carried out continuously to minimize waiting times that could promote the development of pathogens or toxin formation.	Requirement fulfilled	**S**	**1**
	Environment: hygiene of the area/room.	Requirement not fulfilled During the operations , the production area becomes visibly soiled and not cleaned till the end of service	**AA**	**0.5**
	Equipment: hygiene of the equipment and containers.	Requirement partially fulfilled : the equipment are not washed after every use which raises the risk of cross contamination	**AA**	**0.5**
	Workforce: hygiene of the staff.	Requirement not fulfilled :the staff do not systematically wash their hands	**AA**	**0.5**
	Method: compliance with the procedures and steps for handling and processing raw materials	Requirement fulfilled	**S**	**1**

Vegetable preparation area	There is a designated area for the preparation of raw plant products.	Requirement not fulfilled: area also used for meat chopping	**NA**	**0**
	Fruits and vegetables are properly cleaned and dried before use	Requirement fulfilled	**S**	**1**
	Waste disposal from the vegetable preparation area is done without the risk of contaminating other products.	Requirement fulfilled	**S**	**1**
Hot temperature area	The kitchen is designed and sufficiently spacious to avoid any sanitary risks	Requirement fulfilled	**S**	**1**
	There is an extraction system for steam (hood, extractor).	Requirement not fulfilled :The system exist but is not in proper working order	**NA**	**0**
	There are temperature control devices in this area.	Requirement fulfilled	**S**	**1**
	The operations are carried out continuously to minimize waiting times that could fasten the growth of pathogens or toxin formation.	Requirement fulfilled	**S**	**1**
	compliance with the procedures and steps for handling and processing raw materials	Requirement not fully fulfilled: operation such as cutting of meat and other ingredients is done with the same material (risk of cross contamination)	**AA**	**0,5**
	Good hygiene practices are followed.	Requirements not fulfilled	**AA**	**0.5**
	Environment: hygiene of the area/room.	Requirements not fulfilled : During the operations , the production area becomes visibly soiled and not cleaned till the end of service	**AA**	**0.5**
	There is a rapid cooling unit with sufficient capacity to meet production needs.	Requirement not fulfilled : the device exists but is not in proper working order	**NA**	**0**
	For operations requiring initial treatments (browning, roasting, blanching, partial cooking), these are done as early as the day before consumption, followed by rapid cooling.	Requirement fulfilled	**S**	**1**
	Reheating of prepared dishes to be served hot is done to ensure products stay within the temperature range of 10°C to 63°C for no more than 1 hour. These products are consumed the same day	Requirement fulfilled	**S**	**1**

	Operators in this area have non-manual handwashing stations equipped with bactericidal soap, disposable hand towels, and covered trash bins.	Requirement fulfilled	**S**	**1**
Packaging and Wrapping of Foodstuffs	The materials used for packaging foodstuffs must not be a source of contamination	Requirements fulfilled	**S**	**1**
	Packaging and wrapping operations must be carried out in a manner that avoids any contamination of foodstuffs	Requirements fulfilled	**S**	**1**
	Packaging materials must be stored in such a way that they are not exposed to any risk of contamination or deterioration	Requirements fulfilled	**S**	**1**
Cleaning and Disinfection				
Cleaning schedule	The programs are established to properly maintain the premises and their annexes, as well as their equipment	Requirement fulfilled :a Cleaning and disinfection plan specific to the company with posters at all sites explaining the frequency of use , products used ,methods and responsible person	**S**	**1**
	Cleaning and disinfection programs must be properly implemented by qualified personnel, documented and monitored.	Requirement not fully fulfilled There is a lack of compliance with the programs	**AA**	**0.5**
	The disinfection of premises and their annexes(especially with aerosols) must only be done when all food production activities have stopped	Requirements fulfilled	**S**	**1**
	The cleaning and disinfecting of the premises and their annexes must be carried out frequently enough to prevent any risk of contamination	Requirements not fully fulfilled: the cleaning and disinfection of the premises is only fully done after the end of service.	**AA**	**0,5**
	Dry sweeping and the use of sawdust on the floors of the premises is prohibited	Requirements fulfilled	**S**	**1**
	The effectiveness of cleaning and disinfection measures must be verified and justified by risk assessment	Requirement fulfilled :Regular visual inspection and sample analysis	**S**	**1**
Cleaning and maintenance products	cleaning and disinfection products and tools must be clearly identified and used with all necessary precaution to avoid contamination	Requirement not fulfilled :Cleaning products are well protected and labeled with the avaibility of safety use sheets for each product .however their	**AA**	**0.5**

		use are not well organized nor maintained		
	Must not be stored where foodstuffs are handled	Requirement fulfilled	**S**	**1**
	absence of materials hung or placed on the walls	Requirement fulfilled	**S**	**1**
	Cleaning and maintenance products used on equipment or utensils that come into contact with foodstuffs must comply with regulations	Requirement fulfilled	**S**	**1**
Dishwashing	There is a specific space for dishwashing	Requirement fulfilled	**S**	**1**
	The condition of dishwashing equipment (machine/tunnel) is satisfactory in terms of maintenance and operation.	Requirement not fully fulfilled: the dishwashing is done manually by the staff , the equipment requires replacement and there are noticeable operational deficiencies	**AA**	**0.5**
	There is a distinct circuit for dirty and clean items.	Requirement fulfilled : dirty items are placed in a designated area (sink) then transferred after it is washed for storage	**S**	**1**
	Clean dish storage is done in satisfactory conditions to prevent recontamination after washing.	Requirement not fulfilled: dish storage is not well maintained nor cleaned	**AA**	**0.5**
Waste management				
	A waste management procedure must be put in place to avoid contamination	Requirement fulfilled	**S**	**1**
	The waste collection area is located at a sufficient distance from the production area	Requirement fulfilled	**S**	**1**
	All bins are made of impenetrable material and are equipped with a pedal	Requirement fulfilled	**S**	**1**
	All local regulation provisions concerning the disposal of waste must be respected	Requirement fulfilled	**S**	**1**
	Food waste and other waste should be removed daily as quickly as possible from areas where food is handled , the accumulation of waste must be avoided	Requirement fulfilled: waste disposal is done on daily basis and As soon as the bins are full , they are taken outside to the container .	**S**	**1**
	Records of disposal must be kept by the company	Requirement fulfilled	**S**	**1**

I.4. Results and discussion

I.4.1. Global satisfaction rate

By applying the formula: Satisfaction % = $\frac{(NPS\times1)+(NPAA\times0,5)+(NPN\times0)}{NPS+NPAA+NPNA}$, The overall satisfaction score is 87% (figure 7) which indicates a strong adherence to HACCP principals within the evaluated facility. This high rate of satisfaction suggests that most of the monitored GHPs and PRPs related to the five M are being applied effectively .The 13% Non-satisfaction might reflect minor deviations that may benefit from targeted improvements, but do not affect overall safety or compliance of operations .

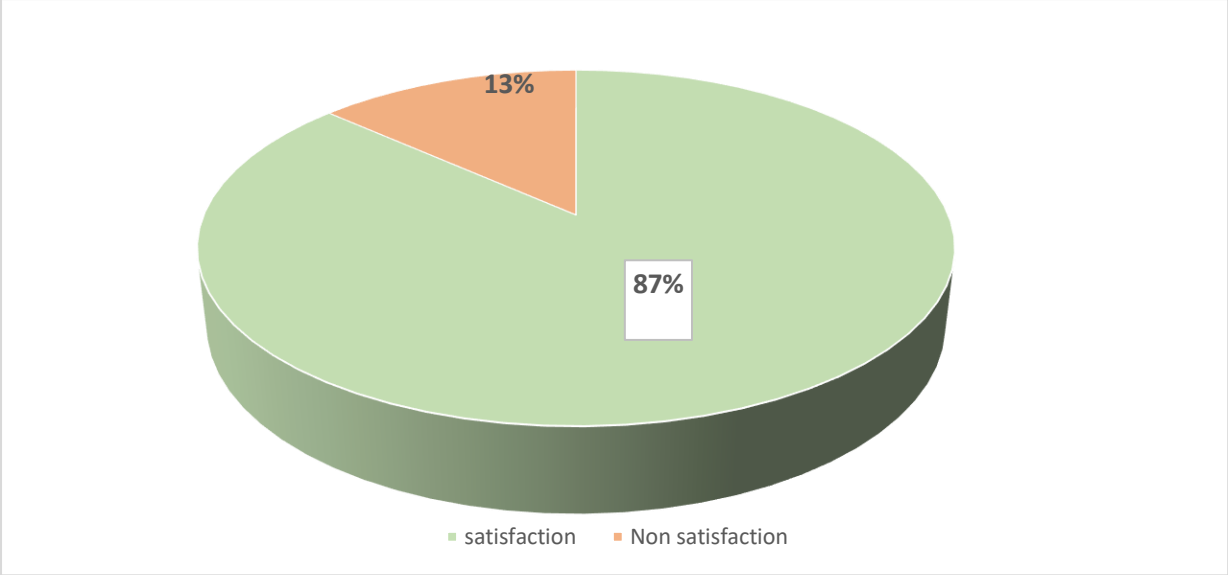


Figure 7: Global Satisfaction rate

I.4.2. Rate of satisfaction per item:

The evaluation of hygiene and operational conditions of the studied facility was structured using the 5M method, based on the ISHIKAWA diagram (figure 5) .The findings of this evaluation are presented in table 06 and figure 08.

Table 06: Overall evaluation results

Items		S	NS	
			AA	NA
1	Management of the environment	82,14%	14,28%	3,57%
2	machinery	63,63%	36,36%	0%
3	Raw material	92,30%	7,69%	0%
4	Manpower	87,5%	12,5	0
5	Methods	68,18%	25%	6,81%

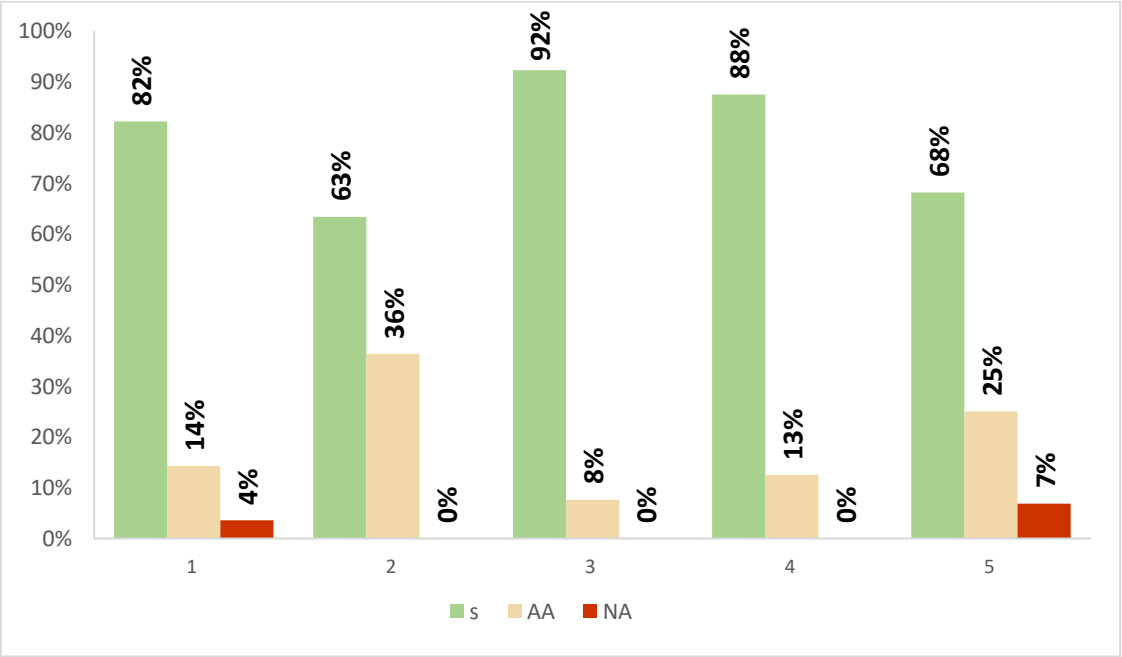


Figure 8: Satisfaction percentage per item

The audit results (figure 08) highlight varying levels of compliance across the 5 items. Overall ,the highest satisfaction rate(92%) was found in the evaluation of the raw material (item 3) followed by Manpower (item 4) with 88% satisfaction, suggesting strong adherence to hygiene

and safety protocols in ingredient sourcing and personnel hygiene .with a low rate of "AA" in areas that requires improvements.

In contrast, the lowest satisfaction rate were recorded for machinery (63%) with 36% of items needing improvement. This indicates notable hygiene or maintenance issues related to equipment. Method (item 5) had a moderate satisfaction level (68%), but with the highest percentage of "NA" (7 %). This suggests inconsistencies or incomplete application of food safety protocols. The relatively high AA value (23%) reinforce the need for strengthening procedural compliance and employee training on standard operating procedures.

I.4.3. Rate of satisfaction per Sub- item:

1.Evaluation of Environmental management:

The environment and infrastructure of the establishment is crucial for preventing cross-contamination and ensuring hygienic conditions in food production. Building and installation should be designed to facilitate hygienic conditions of operations from arrival of raw material to the final product. The findings of the evaluation of this item are presented in table 07 and figure 09.

Table 6: Percentage of satisfactory and non-satisfactory rating from item 1(environmental management)

Items	sub- items	S	NS	
			AA	NA
Management of the environment	location	66,66%	33,33%	0
	Design and layout of the facility	80%	15%	5%
	Locker rooms and sanitary facilities	100%	0	0

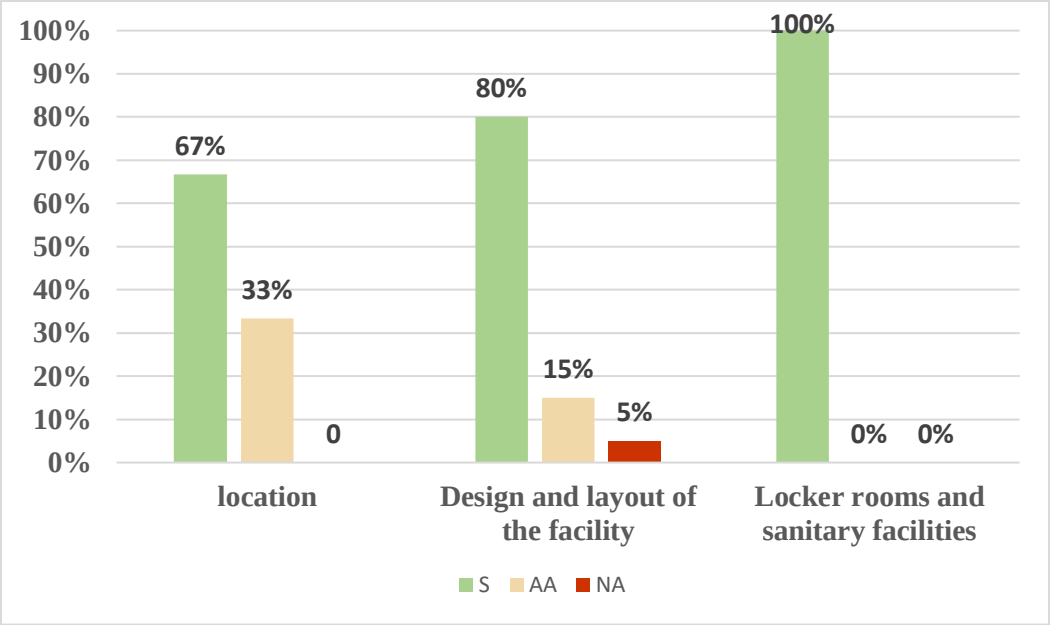


Figure 9: Distribution of satisfaction scores for environmental management

The assessment of item 1 " environmental management" focused on three critical sub-items :the location of the establishment, building design and layout ,and sanitary areas (Locker rooms and restrooms) .Overall ,The results show a good level of hygiene and structural compliance , though some inadequate elements that are AA and NA rated may require corrective action.

The sub-item Locker rooms and sanitary facilities scored 100% satisfaction, indicating a clean and well-managed internal environment that supports staff hygiene.

The design and layout of the facility achieved 80% satisfaction, suggesting a structure that supports hygienic practices .Nonetheless ,15% of the criteria were rated as Needing improvement "AA", due to issues such as: pest control short-comings , damaged wall tiling ,and uncovered lights . Additionally, one criterion (5%) was rated as Not Applied "NA", specifically the absence of a ventilation system in the cooking area, a critical CCP, where it increases risk of microbial growth and airborne contamination.

The location of the facility was rated as 66% satisfactory with 33% requiring improvement, particularly regarding the challenges related to rodent and pests.

2.Evaluation of Machinery:

HACCP implementation relies heavily on the avaibility and condition of equipment which must be hygienically designed (easy to clean), maintained in good condition and calibrated regularly. The findings of this evaluation are presented in table 08 and figure 10.

Table 7: Percentage of satisfactory and non satisfactory ratings for item 2 (machinary)

Items	sub- items	S	NS	
			AA	NA
machinery	Equipment , and utensils in contact with food	50%	50%	0
	The refrigerating equipment and materials	71,42	28,57%	0

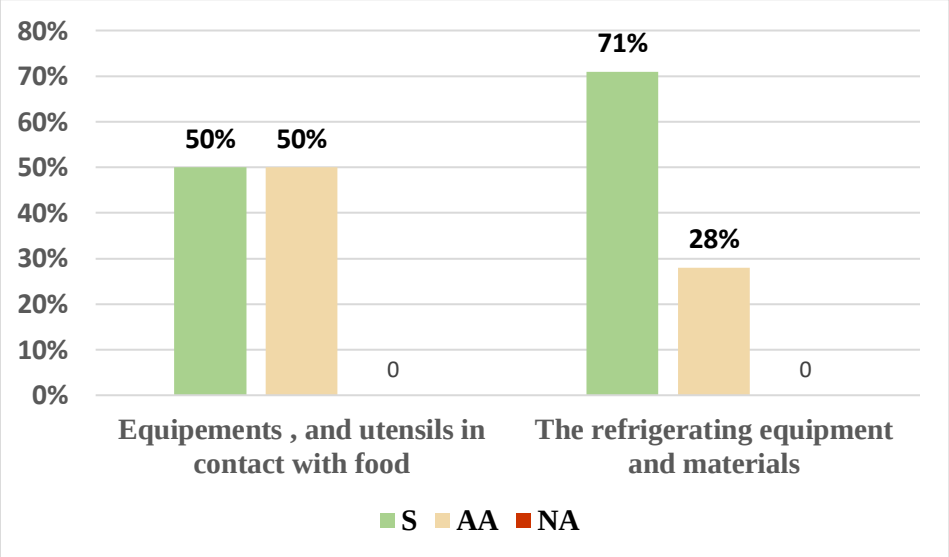


Figure 10: Distribution of satisfaction scores for machinary sub-items

The evaluation of machinery focused on two critical sub-items:

- The equipment in contact with food: which received a 50% satisfaction rate while the remaining 50% required improvement (AA) .

These deficiencies are primarily related to the heavily worn cutting boards, and non-compliance with color-coding. , which represents a microbiological and physical contamination risk that is confirmed in the microbiological analysis.

- The refrigerating equipment performed more favorably, with 71% satisfaction primarily attributed to the effective temperature control in the refrigeration equipment. However, more than one third of the items (28%) were classified as AA indicating concerns or inefficiencies that are manageable such as insufficient cleaning of interior compartment and the presence of peeling paint and cardboard boxes during the inspection period.

3.Evaluation of Raw material:

The management of raw materials is a cornerstone of HACCP principle 1 (hazard identification), as many hazards originate at the reception and storage stages. The findings of the evaluation of this item are presented in table N09 and figure 11.

Table 8: Percentage of satisfactory and non-satisfactory ratings for item 3 (Raw material)

Items	sub- items	S	NS	
			AA	NA
Raw material	Transportation and reception of raw materials	100%	0	0
	Storage	77,77%	22,22%	0

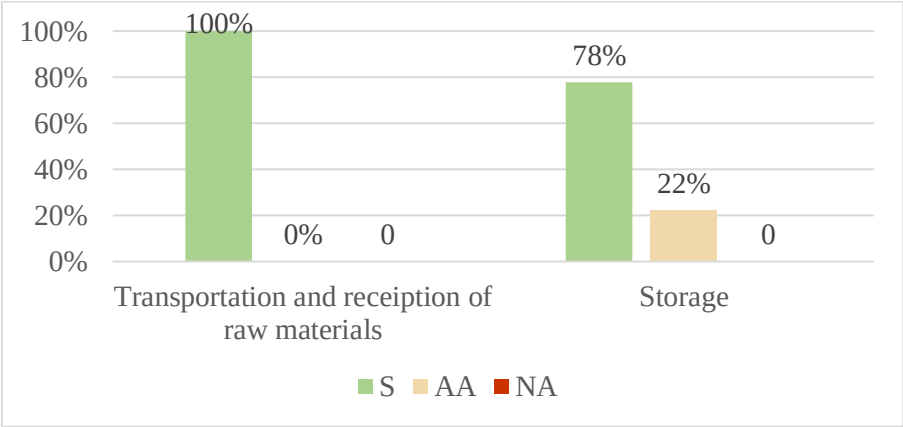


Figure 11:Distribution of satifaction scores for raw material

The audit reveals a high level of compliance in this area in both sub-items, indicating that traceability systems and cold chain control are generally respected from the reception until the storage of the raw material.

The noticeable weakness represented by 22% AA in the storage is related to the hygiene of the storage room.

4. Evaluation of Man power: A sufficient staff hygiene, training and behaviors are critical elements to the success of any HACCP system. Staff not only are in direct contact with food products, but also bear responsibility for monitoring CCPs and applying corrective actions. The findings of the evaluation of this item are presented in table 10 and figure 12.

Table 9: Percentage of satisfactory and non-satisfactory ratings for item 4 (manpower)

Items	sub- items	S	NS	
			AA	NA
manpower	Staff hygiene	84,6%	15,38%	0
	Staff training	100%	0%	0%

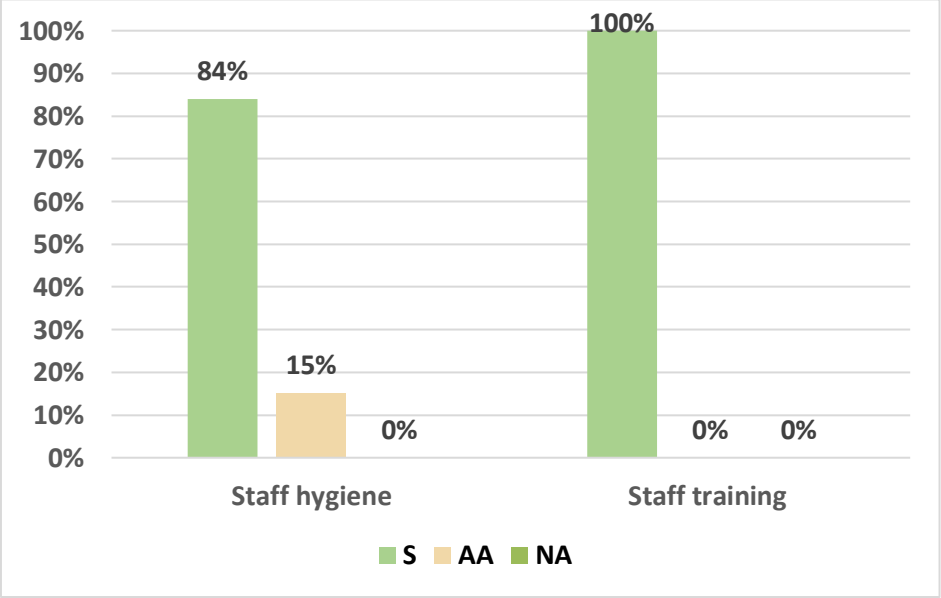


Figure 12: Distribution of satisfaction scores for manpower sub-items

The assessment of manpower focused on two key sub-items: staff hygiene and staff training. Overall, results were highly satisfactory both exceeding 80%, with staff training achieving 100%, which indicates an effective training protocols and the respect of work.

Nevertheless, the presence of AA rated non-satisfactory in staff hygiene (15%) mainly due to criteria that require improvement such as Gaps in gloves wearing and inconsistent handwashing practices .These minor but recurrent behaviors requires continuous reinforcement through supervision, retraining, and behavioral auditing.

6. Evaluation of Methods:

Relies on the standard operating procedures (SOPs), Good hygiene practices (GHP) and CCP monitoring procedures. The findings of the evaluation of this item are presented in table 11 and figure 13.

Table 10: Percentage of satisfactory and non satisfactory ratings for item 5 (Method)

Items	sub- items	S	NS	
			AA	NA
Methods	Cold preparation area	57,14%	42,85%	0
	Vegetable preparation area	66,66%	0	33,33%
	Hot temperature area	54,54%	27,27%	18,18%
	Packaging and Wrapping of Foodstuffs	100%	0	0
	Cleaning schedule	66,66%	33,3%	0
	Cleaning and maintenance products	75%	25%	0
	Dishwashing	50%	50%	0
	Waste management	100%	0	0%

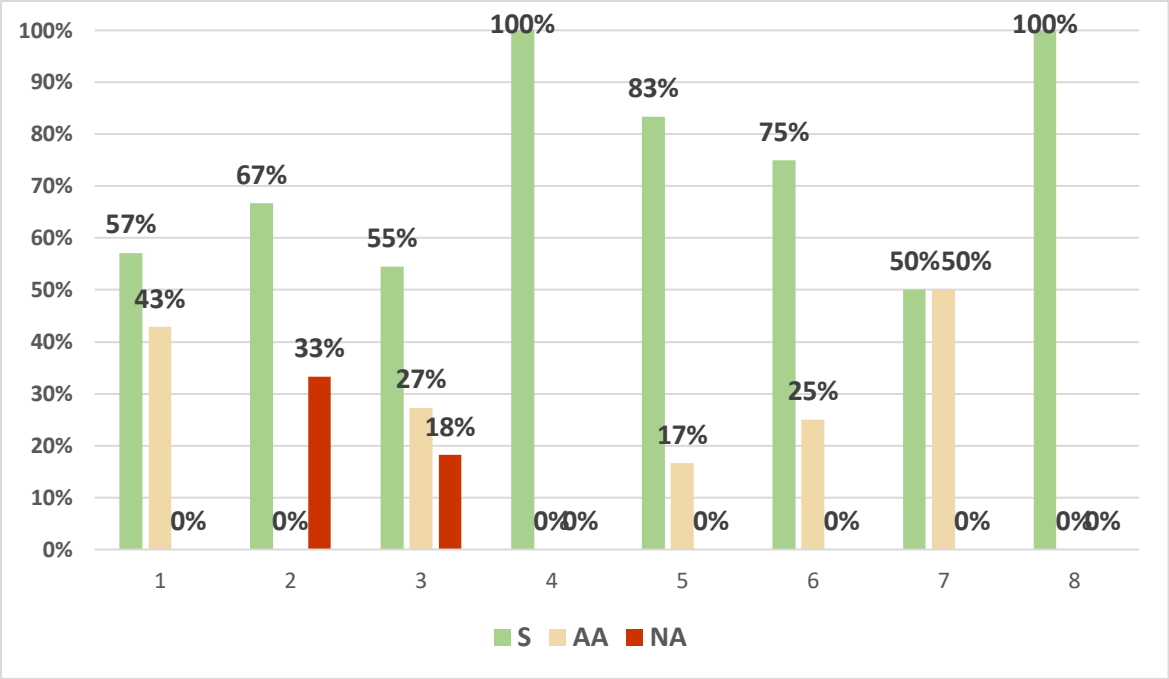


Figure 13: Distribution of Satisfaction scores for method sub-items

The evaluation of item 5 "Method" covered seven sub-items related to: food preparation, cleaning practices, and waste management. The results show a variable level of compliance, with several areas requiring improvement to ensure process hygiene.

The cold preparation area showed 57% satisfaction, while 43% of criteria requires improvement.

Similarly, the hot preparation area had one of the lowest satisfaction rates (55%) with 27% requiring improvement .Both cases are mainly due to hygiene lapses during service such as the use of unclean utensils when handling raw material and dirty floor. These are especially dangerous in a collective catering context where large quantities of food are handled and served within tight timelines, amplifying the consequences of procedural errors.

The 18% of Not applied sub-items in the hot preparation area were linked to the absence of ventilation and cooling system during the audit period. However, this requirement is no longer applicable, as the facility has since shifted to serving only freshly cooked meals.

The vegetable preparation area scored 66% satisfaction, though 33% of criteria was not applied due to its use for other operations such as the meat and poultry processing. Which significantly increases the risk of cross contamination.

In contrast, packaging and wrapping of foodstuffs achieved 100% satisfaction, reflecting full compliance with hygiene handling post-preparation.

Regarding cleaning operations, the cleaning schedule had a result of 66% whereas maintenance product showed generally satisfactory results scoring both above 70%.This reflects the availability of appropriate cleaning agents and the presence of documented procedures. However, the items requiring improvement in both sub-items point to the inconsistency implementation and the improper use of products. More concerning is the dish washing process which received only 50% satisfaction , indicating a lack of standardized cleaning and sanitizing procedures for kitchenware .These include cleaning operations deficiencies (poor dishwashing practices), and ineffective utensils storage .

Finally, waste management scored 100 % satisfaction indicating a well-implemented and effective system.

I.5. Comparison with previous studies:

A student from The Higher National Veterinary School (ENSV) conducted a previous study as part of her final-year project .the study took place in a different catering service located in Algiers. Her results reported a compliance rate of 77, 05% and a non-compliance rate of 23% (Meghraoui, 2016). These results are relatively close to those found in the present study, which recorded a compliance rate of 87% and noncompliance rate of 13%.

Despite the difference in location and study period, a comparison between the two studies revealed similar recurring non-conformities. Suggesting that certain hygiene weaknesses may be common across similar catering services in Algiers. The shared issues include lack of Good Hygiene Practices especially staff hands hygiene and color coding system, the hygiene of the work environment and inadequate ventilation. These deficiencies, while recurring are not critical and can be easily corrected.

Further support for these findings is provided by a study conducted in 2022 by two researchers Fatima Brabez and Nouara Boulfoul, titled " Implementation of Food Safety Management in the Food Industry in Algeria: Benefits and Barriers Factors". This research was done through questionnaires and direct interviews with the manager in charge of different processing companies around the capital of Algeria. Its results highlights the necessity of adopting HACCP- based food safety management in Algeria. Common challenges faced by establishments such as : the inadequate basic hygiene , the insufficient staff training and the lack of local information and resources .They further emphasize that, despite observable progress , the consistent and long-term application of HACCP principals continues to pose challenges within the sector .

II.MICROBIOLOGICAL ANALYSIS

II.1.Material and methods:

I.1.1 Material:

A. laboratory material:

- Bunsen Burner
- FRAZER broth
- Incubator
- Micropipettes
- Pasteur Pipette
- Petri dishes
- Precision Balance
- Sterile Flasks
- Sterile swabs and transport tubes
- Stomacher bags
- TSE diluent
- Vortex shaker

B. biological samples

Forty samples were taken from different areas in the facility

- 35: From food contact surfaces, (e.g. cutting boards, knives, counters...)
- 5: from ready to eat sandwiches (cheese , tuna , and charcuterie Surface

I.12. Method:

Sampling procedure: The method involves taking a sample from specific flat surfaces using a sterile and moist swab. The swab is then placed in a diluent (Frazer) to suspend the microorganisms. The swabbed surfaces must be clean.

Swabbing of the surfaces was carried according to the recommendations of the ISO 18593 (2004) standard. Each swab was applied to a 100 cm^2.

The swabbing is done as follows: the tip of the swab is moistened with Frazer diluent without additives, then the entire chosen surface is carefully rubbed using a defined horizontal and vertical stroke pattern, while rotating the swab in order to collect all the adhered microorganisms.

For non-flat surfaces, the entire surface is swabbed.

The swab is then placed back in its container, labeled and kept at 4°C for transport to the laboratory.

- Sandwich samples were aseptically collected and placed into sterile containers

II.2.Microbiological Analysis:

A primary suspension is prepared for each sample by adding the swab and the contents of the container to 90ml (ISO 18593, 2004) of FRAZER broth .the suspensions are then incubated at 30°C for 24 Hours for the pre-enrichment step.

From the pre-enrichment product, a surface and streak inoculation is performed on petri dishes containing ALOA agar (ISO 11290-1-2017)

The plates are then incubated at 37°C for 24 Hours.

Characteristic colonies of *Listeria monocytogenes* appear blue to blue-green and are surrounded by an opaque halo .Other *Listeria* species appear from blue to blue-green without a halo.

II.3.Results:

II.3.1. Global results:

The overall results of the microbiological analysis are presented in table 12

Tableau 11: Overall results of microbiological analysis

Sample type	Total Samples (N)	Listeria Positive(N)	Listeria Negative (N)
Food contact surfaces	35	14	21
Sandwiches	5	2	3
Total	40	16	24

N: number

II.3.2. Samples Breakdown:

The samples taken and the results of the analysis are shown in the table 13 and figure 14.

Tableau 12: Samples breakdown and contamination rate

Sampling Zone	Sample code	Item	Result	Contamination%
1. Sandwiches preparation area	S.S	surface	Negative	40%
	S.C	Cutting Board	Positive	
	S.e1	Shelf 1	Negative	
	S.e2	Shelf 2	Positive	
	S.m	Wall	Negative	
2. Preparation Table	P.S	Surface	Negative	33%
	P.C	Cutting Board	Positive	
	P.m	Wall	Negative	
3. Dish Storage Shelves	E2	Shelf 2	Positive	50%
	E3	Shelf 3	Negative	
4. Cold storage room	CFm1	Wall 1	Negative	33%
	CFm2	Wall 2	Positive	
	Cfe1	Storage Shelf 1	Negative	
5. Vegetables table	T.S	Surface	Negative	0%
	A.A	Cutting Machine	Negative	
	T.m 1	Wall 1	Negative	
	T.m 2	Wall 2	Negative	
6. Mini fridge	R.F.I	The interior of a mini-fridge	Positive	50%
	R.F.S	The surface for the mini fridge used for the defrosting and preparation of pizza	Negative	
7. final products area	R.S.P	Surface	Positive	50%
	R.S.m	Wall	Negative	
8. Equipment	Pa	Colander	Negative	50%
	Sa1	Salad Bowl	Negative	
	Sa2	Salad Bowl 2	Positive	
	C1	Knife	Positive	
	C2	Knife 2	Positive	
	F	Whisk	Negative	
	R	Grater	Positive	
	RP	Pizza cutter	Positive	
	PR	Rotisserie rod	Negative	
	PO	Frying pan	Positive	
	Ba	Chafing dish	Positive	
	Cu	Spoon	Negative	
	Cass	Sauce pan	Negative	
	mix	Mixer	Negative	
9. Sandwiches	SF1	Cheese Sandwich	Positive	50%
	SF2	Cheese Sandwich	Positive	
	ST	Tuna sandwich	Negative	
	SP	Paté sandwich	Negative	

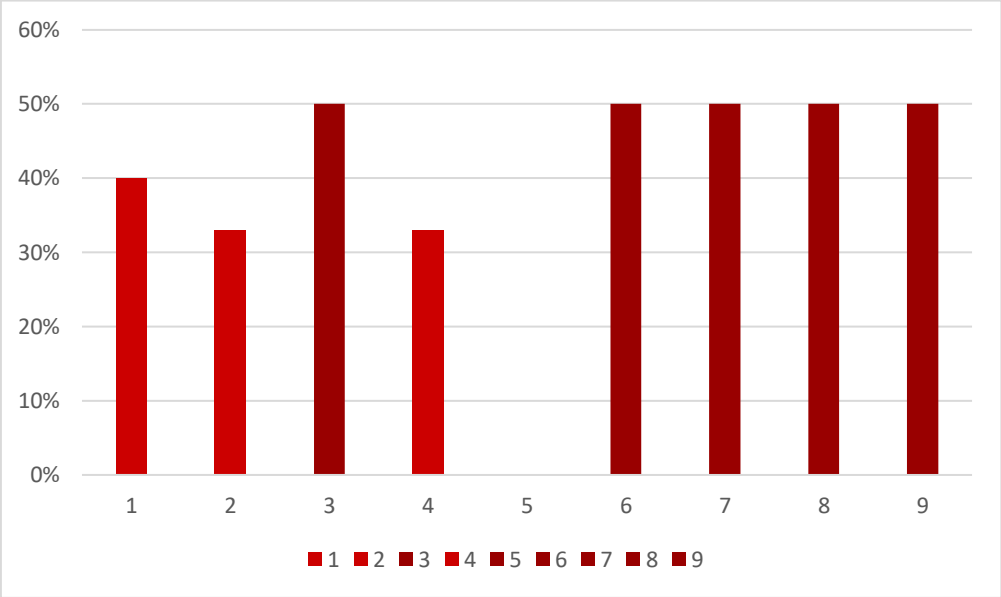


Figure 14: Contamination rate per zone

II.4.Discussion:

- The microbiological analysis revealed presence of *Listeria* spp. in 16 out of 40 samples, representing a contamination rate of 40% .Notably, 14 positives results were identified on food-contact surfaces while 2 were detected in sandwich products. These findings highlights significant hygiene shortcomings within the food preparation and storage environment.
- The Highest contamination rate (50%) were recorded in the mini fridge, the dish Storage shelves, equipment and cheese sandwiches. The sandwiches preparation area also showed a high contamination level of 40%.These results suggest that specific zones and equipment especially those associated with cold storage and sandwich assembly, are critical points of concern.
- Surfaces and equipment in contact with food with positive results such as the cutting board, salad bowl and knives indicate their role as major vectors of cross-contamination as these tools are used frequently in different food handling operations.
- Items like rotisserie rod, chafing dish, spoons, saucepan, and mixer tested negative, indicating some degree of hygiene consistency .However the high contamination rate of the storage shelves might lead to their secondary contamination after their storage.

- Cold areas such as walk-in coolers and mini-fridges can act as reservoirs for *Listeria*, providing the perfect environment for its survival and slow proliferation. *Listeria monocytogenes* is a psychotropic bacterium that can still multiply at temperatures as low as +1°C **(Bourgois et al., 1996).** These characteristics make cold areas particularly vulnerable to persistent contamination, especially where cleaning and disinfection may be less frequent or less suitable for *Listeria*.
- Product testing showed that 2 out of 5 sandwiches were positive for *Listeria* (40%) specifically the cheese sandwiches (SF1 and SF2) whereas the tuna and paté-sandwiches were negative. This aligns with contamination found on tools and surfaces involved in cheese sandwiches preparation (e.g., knives, cutting boards, surfaces). The potential of recontamination during food processing is significant, as Listeria *monocytogenes* has the ability to persist in food processing environments and on food production equipment (ANSES, 2020).

  Additionally ,Raw material such as : cheese and vegetables (e,g., lettuce and cabbage) are recognized reservoirs of *L. monocytogenes* and have been implicated in two listeriosis outbreaks **(Bourgois et al., 1996**).Therefore, contamination may arise from both environmental sources and raw ingredients.
- These finding underscore the inadequacy of current cleaning and disinfection protocols, and its non-adaptability to *Listeria*.spp. particularly in areas designated as Critical Control Points (CCPs) ,especially in the final product zone, since it directly affect ready to eat products . The contamination suggests inadequate cleaning and sanitizing protocols, which is a clear breach of HACCP system.

CONCLUSION AND RECOMMENDATIONS

This study has provided a comprehensive evaluation of HACCP implementation within a retail-catering context. Combining systematic on site auditing with microbiological analysis to assess both procedural compliance and actual hygiene performance. The audit findings confirm that while the infrastructure and essential regulatory elements, such as staff training and raw material control, are largely in place, the operational discipline and enforcement of hygiene procedures remain insufficient, particularly in areas involving high-level operational methods and routine hygienic practices.

These results indicates that the establishment is still in a transitional phase , shifting from a reactive hygiene model that is focused on responding to issues as they arise , toward a more proactive , risk-based HACCP system. In this transition, the role of personnel emerges as critical, since the effectiveness of any food safety management does not solely rely on written protocols or infrastructure. It depends fundamentally on the understanding, commitment, and behaviour of the staff. In addition, hygiene and safety must be integrated into the daily routine of all food handlers, becoming a natural part of the work culture, rather than being viewed as externally imposed obligations. Promoting this mind-set, where Good Hygiene Practices (GHPs) are understood, respected, and consistently applied, is essential in achieving long-term compliance and building a resilient food safety system, especially in the context of collective catering, where risks are amplified by volume and complexity.

Furthermore, the detection *Listeria* spp.in both food-contact surfaces and ready to eat products highlights a serious gap in contamination control and hygiene management. This microbiological evidence reinforces the audit's findings and underscores the urgent need for corrective actions. These should include targeted improvements at identified Critical Control Point (CCPs), such as enhanced cleaning and disinfection protocols implementation, more frequent staff training, and rigorous verification procedures.

In conclusion, this research emphasizes that true food safety is achieved not only through systems and standards, but also through daily commitment and a shared culture responsibility. Strengthening the implementation of HACCP in real operational settings requires not only tools, but also people who are empowered, informed, and fully engaged in the process.

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Annexes

Item	Frequency of cleaning					Precautions e.g. wear gloves or goggles	Method of cleaning
	After use	Every shift	Daily	Weekly	Other		
Work surface	X					Wear gloves	1. Remove any obvious food and dirt. 2. Wash the surface with hot soapy water (detergent diluted according to manufacturer's instructions) to remove grease and any other food and dirt. 3. Rinse with clean water to remove the detergent and loosened food and dirt. 4. Apply a disinfectant. Make sure you leave it on for the contact time recommended by the manufacturer. 5. Rinse with clean water to remove the disinfectant. 6. Leave to dry naturally or use a clean disposable cloth.
Fridge				X		Wear gloves	1. Remove all food and store it in a cool place, ideally another fridge or cool box. 2. Remove shelves and compartments from the fridge and wash them in hot soapy water and then disinfect. Allow to dry naturally or use a clean or disposable cloth. 3. Wash and then disinfect all surfaces of fridge with hot soapy water and dry with a clean or disposable cloth. 4. Replace shelves and compartments, and put the food back in the fridge. 5. Clean the outside and door seals, and disinfect the handles.

Figure 15: Example of a cleaning schedule (FSA,2024)

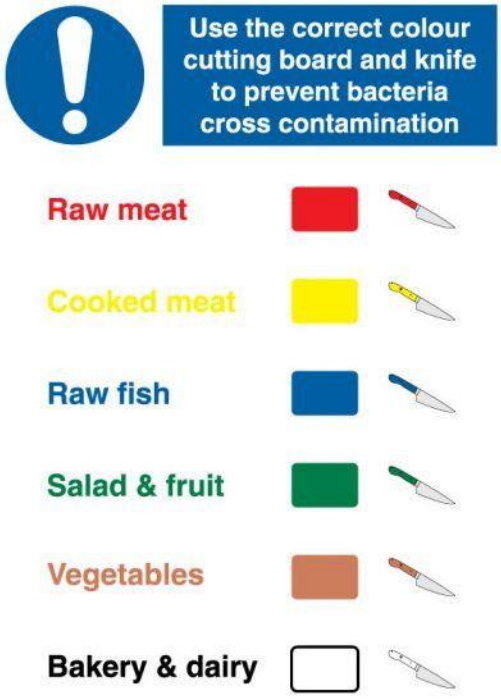

Figure 16: Material colour code (ISO 7010,2019)