CHAPTER 2: Policy of Microbiological Control

Introduction

The microbiological control policy establishes a structured framework to ensure food safety and quality. It coordinates all actions related to microbial monitoring, analysis, and prevention throughout the production chain. This policy protects public health, builds consumer trust, and enhances industrial competitiveness.

1. Levels of Control

Microbiological control operates at several levels of the food production process. Each level targets a specific stage to maintain consistent hygiene and safety, forming a preventive and complementary system.

1.1. Control of Raw Materials

This is the first and most crucial level, as raw materials are the primary source of contamination. Analyses focus on initial microbial load before processing. Suppliers must meet hygiene standards, and sampling is conducted before accepting raw materials.

1.2. Control During Manufacturing Process

The second level ensures hygiene during production, packaging, and storage. It includes checks on personnel, equipment, and the environment—such as surface and air sampling. Staff training is essential to prevent secondary contamination.

1.3. Control of Finished Products

Final microbiological tests confirm compliance with safety standards before market release. They detect pathogens like *Salmonella*, *Listeria monocytogenes*, and *Staphylococcus aureus*. Non-compliant products are withdrawn, and corrective actions are applied to production.

2. Frequency and Control Parameters

2.1. Frequency of Microbiological Control Operations

The frequency of microbiological monitoring depends on three main factors:

1. Type of food product.
2. Level of microbiological risk.
3. Quality management system implemented.

A. Type of Food Product

The physical, chemical, and biological properties of food determine its vulnerability to microbial growth.

- Products rich in water and protein with neutral pH require frequent testing (e.g., milk, raw meat).
- Pasteurized or canned foods need less frequent control due to lower contamination risk.

Examples:

- Dairy plants: daily analyses on milk and packaging lines.
- Juice factories: weekly or per-batch monitoring.
- Canned/dry goods: monthly or seasonal control.

B. Level of Associated Risk

The risk level is evaluated through HACCP principles, based on:

- Probability of contamination.
- Severity of health consequences.
  High-risk foods (e.g., fresh cheese) require daily or continuous monitoring, while cooked or heat-treated products can be checked weekly.
  Canned foods must be tested each batch to verify sterilization efficiency, since small deviations may cause *Clostridium botulinum* growth.

C. Quality Management System

The presence of structured systems like **HACCP** or **ISO 22000** ensures systematic, preventive, and scientifically controlled monitoring.
Critical Control Points (CCPs) are identified, and testing schedules follow precise, risk-based plans.
In certified companies, microbiological results are regularly reviewed and used to improve process control.
Conversely, non-certified or small companies often perform monitoring reactively—only after product issues—reducing effectiveness and consumer confidence.

2.2. Parameters of Microbiological Control

Microbiological control depends not only on how often analyses are carried out but also on the type of parameters monitored, which reflect both the microbiological safety of products and the hygiene of the production environment.
The main parameters include:

- **Total Viable Count (TVC):** indicates the general microbial load and overall hygienic quality of the product.
- **Detection of Pathogens:** focuses on microorganisms such as *Salmonella spp.*, *Listeria monocytogenes*, and *Staphylococcus aureus*, directly related to foodborne illnesses.
- **Surface and Equipment Hygiene:** evaluated through swab and contact plate tests to check cleaning and disinfection effectiveness.
  All analyses are performed using standardized and validated methods to ensure reliability, comparability, and traceability of results over time.

3. Quality Assurance and Traceability

3.1. Quality Assurance in Microbiological Control

Quality assurance includes all actions and preventive measures that guarantee consistent compliance of food products with safety and hygiene requirements. It covers the entire production chain — from raw materials to final distribution — and ensures that each batch is produced under controlled conditions minimizing microbial risks.

a. Good Hygiene Practices (GHP)

GHP form the foundation of all food safety systems. They include maintaining hygiene among workers, cleaning and disinfection of equipment, and ensuring sanitary conditions in production areas. Their primary goal is to prevent contamination before it occurs.

b. Hazard Analysis and Critical Control Points (HACCP)

The HACCP system is a preventive, scientific method for identifying and controlling biological, chemical, and physical hazards that may threaten food safety. It relies on seven main principles, particularly identifying **Critical Control Points (CCPs)** — stages where monitoring and corrective actions can prevent or eliminate hazards. This approach shifts attention from end-product inspection to continuous preventive control during the entire production process.

c. ISO 22000 Standard

ISO 22000 integrates GHP and HACCP principles into a single, comprehensive Food Safety Management System (FSMS). It defines international standards for documentation, monitoring, verification, and continuous improvement, allowing companies to prove compliance with global requirements and strengthen consumer trust.

Relationship between GHP, HACCP, and ISO 22000

These systems operate as complementary and progressive levels of food safety management:

Level	System	Main Objective	Relationship
Basic	GHP	General hygiene and contamination prevention	Foundation for HACCP
Intermediate	HACCP	Identification and control of specific hazards	Builds upon GHP
Advanced	ISO 22000	Integrated management of food safety and quality	Combines and expands GHP and HACCP

Practical Application in the Food Industry

Small enterprises such as bakeries or restaurants generally apply only **GHP**, focusing on hygiene and cleaning.
Medium-sized industries often combine **GHP and HACCP**, as national regulations — including in Algeria — encourage or require HACCP implementation.
Large or exporting enterprises apply **all three systems (GHP, HACCP, ISO 22000)** to ensure complete documentation, verification, and regular audits, thereby achieving higher reliability and international compliance

3.2. Traceability in Microbiological Control

Traceability is a fundamental component of microbiological control and food safety management. It ensures that every product can be followed and verified throughout all stages of its journey — from the origin of raw materials to the final consumer. This system relies on systematic documentation connecting production, processing, storage, and distribution. Typical traceability records include supplier identification, batch or lot numbers, production and expiry dates, storage conditions, and transport details.

In microbiological control, traceability enables the precise identification of the source and timing of contamination. When a sanitary incident occurs, it allows rapid isolation of affected products and immediate corrective action, protecting consumers and minimizing economic damage.

-- Functional Role of Traceability

Traceability plays an essential role in identifying, isolating, and controlling microbiological hazards during food production and distribution. In case of contamination, it permits targeted recalls instead of halting entire production lines, thereby preserving both operational continuity and brand reputation. For instance, if a batch of yogurt is contaminated with *Listeria monocytogenes*, traceability records allow the company to pinpoint the exact batch, supplier, and distribution area concerned.

Beyond its technical function, traceability enhances transparency and accountability among producers, control authorities, and consumers. This mutual trust strengthens public confidence in food safety and supports regulatory compliance.

Example (Algeria): In Algerian dairy industries, each milk batch carries a barcode or digital identifier linked to a database that records microbiological test results, supplier information, and distribution data. Such systems make it possible to trace and withdraw contaminated products swiftly and efficiently when contamination occurs.

4. National and International Standardization Bodies

Standardization in microbiological control depends on a coordinated network of institutions that define, publish, and monitor the application of food quality and safety standards. These organizations operate at both **national** and **international** levels to ensure harmonization, reliability, and scientific credibility of control systems.

a. National Bodies (Algeria)

In Algeria, several key institutions oversee microbiological control and standardization:

-**IANOR (Algerian Institute of Standardization)**
The official national authority responsible for drafting, approving, and publishing Algerian Standards (NA). It coordinates all standardization activities across industrial sectors, including agri-food production, ensuring that food safety regulations remain consistent and up to date.

-**ALGERAC (Algerian Accreditation Body)**
This institution accredits laboratories for testing, analysis, and calibration according to ISO/IEC 17025. Accreditation guarantees the reliability, traceability, and international recognition of microbiological results, reinforcing consumer and regulatory confidence.

- **Technical Directorates of the Ministry of Agriculture**
These include the Directorate of Veterinary Services (DSV) and the Directorate for Plant Protection and Technical Controls (DPVCT). They supervise the sanitary quality of food products of both animal and plant origin, conducting regular inspections and enforcing hygiene standards.

- **Laboratories of the Ministry of Commerce**
Public laboratories that carry out microbiological and physicochemical analyses to verify the conformity of marketed products with national standards and to prevent fraudulent or unsafe practices.

- **National Agency for Food Safety (ANSSA)**
A forthcoming national authority designed to strengthen coordination between all actors involved in food safety. Its mission includes centralizing safety data, improving risk assessment, and ensuring rapid responses to sanitary alerts.

b. International Bodies

At the global level, several major organizations develop harmonized standards and provide scientific guidance for food safety and microbiological control:

- **ISO (International Organization for Standardization)**
Establishes universal standards such as ISO 17025 (laboratory accreditation) and ISO 22000 (food safety management). These frameworks ensure that analytical results are comparable, credible, and recognized worldwide.

- **Codex Alimentarius (FAO/WHO)**
Serves as the global benchmark for food safety and microbiological criteria. Its guidelines influence national legislation and facilitate international trade through the harmonization of food safety requirements.

- **WHO (World Health Organization)** and **FAO (Food and Agriculture Organization)** Provide scientific expertise, develop risk assessment frameworks, and coordinate international policies on food safety. Together, they supervise the **Codex Alimentarius Commission**, which defines the international standards adopted by most countries.

- Field Reality in Algeria

In Algeria, the practical implementation of a comprehensive microbiological control policy remains uneven and strongly influenced by company size and resources.
Large agri-food enterprises and certified units (ISO 22000, HACCP) usually maintain dedicated quality departments, perform regular microbiological analyses, and manage systematic documentation.
Conversely, small and medium-sized enterprises (SMEs) often conduct testing only in response to contamination suspicions or consumer complaints, lacking continuous training, advanced technical equipment, and proper traceability systems.

Strengthening microbiological control in Algeria thus requires greater institutional support, enhanced intersectoral coordination, and gradual integration of SMEs into national food safety programs to build a consistent and effective quality management framework.

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