CHAPTER 1 : Objectives of Microbiological Control

Introduction

Microbiological control of food is a key pillar in ensuring both food safety and the commercial quality of products intended for human and animal consumption.

Indeed, the presence of pathogenic or spoilage microorganisms can compromise

- public health (foodborne intoxications and infections),
- the preservation of food products,
- and consumer confidence.

This is why the food industry, laboratories, and health authorities carry out regular microbiological analyses to verify the compliance of products with current standards.

I. Main Objectives of Microbiological Control

Microbiological control does not only aim at detecting pathogenic germs, but also at assessing several fundamental dimensions of food quality.

1. Ensuring Food Safety

Food safety is the top priority.

- It consists of detecting the absence (or presence) of microorganisms hazardous to health.
- These germs can cause foodborne diseases, which fall into three categories:
    - **Food infections** : caused by the ingestion of living microorganisms (e.g., *Salmonella*, *Listeria*).
    - **Food intoxications**: linked to the consumption of toxins already present in food (e.g., botulinum toxin produced by *Clostridium botulinum*).
    - **Foodborne toxico-infections**: a combination of both mechanisms (e.g., *Bacillus cereus*, *Clostridium perfringens*).

Practical example : Testing for *Salmonella* in poultry is mandatory, since even a low level of contamination can trigger a salmonellosis outbreak.

2. Guaranteeing Commercial Quality

A food product may be harmless to health but still unmarketable due to microbial spoilage.

- Such alterations affect :
  - **Texture** (e.g., swelling of canned foods caused by gas-producing yeasts or bacteria),
  - **Odor and taste** (production of unpleasant volatile compounds),
  - **Visual appearance** (mold spots, color changes).
- These issues often occur during prolonged storage or when food technology is not properly controlled.

Practical example : Osmophilic yeasts may grow in poorly pasteurized jams, leading to swelling of the containers.

3. Controlling Technological Quality

Some microorganisms are useful and even indispensable.

- They play a role in fermentation processes that give rise to specific foods:
  - *Saccharomyces cerevisiae* → fermentation of bread and beer.
  - Lactic acid bacteria (*Lactobacillus*, *Streptococcus thermophilus*) → yogurt and cheese.
- Microbiological control therefore ensures that the desired flora is present and that undesirable contaminations remain under control.

Practical example : In yogurt production, the simultaneous presence of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* is essential to obtain the correct acidity and texture.

II. Dimensions of Microbiological Quality

The concept of food quality is complex and multidimensional. Several complementary aspects can be distinguished:

1. Hygienic Quality

- Absence of pathogenic microorganisms and their toxins.
- **Objective** : Protect consumer health.

2. Organoleptic Quality

- Preservation of taste, odor, color, and texture.
- **Objective** : Ensure the sensory acceptability of the product.

3. Shelf-life Quality

- Stability of the product throughout its intended shelf life.
- **Objective** : Prevent economic losses and ensure proper distribution.

4. Technological Quality

- The ability of the product to be processed or used in a production chain.
- **Example** : Baking quality of flour, water-holding capacity of meat for charcuterie.

5. Regulatory Quality

- Compliance with criteria established by national and international standards (Codex Alimentarius, European regulations).

III. Role and Responsibility of the Microbiologist

The food microbiologist must :

- Identify the microorganisms present in food:
  - Normal flora (often tolerated at low levels).
  - Contaminating flora (to be strictly monitored).
- Establish acceptability thresholds according to health risks.
- Select the appropriate analytical methods: culture, enumeration, rapid tests.
- Interpret the results and provide advice on corrective measures.

Practical example : If a batch of milk shows excessively high total flora, the microbiologist may recommend improved milking hygiene, reinforced pasteurization, or stricter cold chain control.

VI. Comparative Table of Microbiological Quality Types

Type of Quality	Definition	Consequences in Case of Problem	Examples
Hygienic Quality	Absence of pathogenic microorganisms and their toxins.	Foodborne diseases (infections, intoxications, toxico-infections).	*Salmonella* in poultry, *Listeria* in dairy products.
Commercial Quality	Preservation of acceptable appearance, taste, odor, and texture for marketing.	Product becomes unsellable (sensory spoilage) but not necessarily hazardous to health.	Osmophilic yeasts in jams, molds on bread.
Technological Quality	Presence and control of useful microorganisms	Failure of processing, loss of expected characteristics.	Yeasts in bread, lactic acid bacteria in yogurt or cheese.

Type of Quality	Definition	Consequences in Case of Problem	Examples
	essential to manufacturing.		

Conclusion

Microbiological control is essential to :

- Protect consumer health (**hygienic quality**),
- Guarantee product acceptability and marketability (**commercial quality**),
- Ensure the success of processing methods (**technological quality**).

It therefore represents a key step linking microbiological science to food safety and consumer confidence in the market.

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