THOMAS ADEWUMI UNIVERSITY, OKO, KWARA STATE
Science | Technology | Medicine

MCB 308
Food Sanitation and Control
(2 Units)

Lecturer's name:

Adekemi T. Dahunsi PhD.

Course Outline:

- Hazard Analysis Critical Control Point (HACCP) System
- Definition Of Terms
- HACCP Principles
- Indices of food sanitary quality and sanitizers
- Indicator Micro-organisms
- Sanitary Controls
- Food-borne Pathogens Detection Techniques

Hazard Analysis Critical Control Point (HACCP) System

- HACCP stands for 'Hazard Analysis and Critical Control Points'.
- HACCP system is an internationally recognized food safety management system that helps businesses to identify, evaluate and control the hazards that pose a significant risk to food safety leading to the production of microbiologically safe foods.
- HACCP is a proactive, systematic approach to controlling foodborne hazards.

Lets Define some terms……..

- **Control point:** This is any point in a specific food system where loss of control does not lead to an unacceptable health risk.
- **Critical control point (CCP):** Any point or procedure in a food system where control can be exercised and a hazard can be minimized or prevented.
- **Critical limit:** One or more prescribed tolerances that must be met to ensure that a CCP effectively controls a microbiological health hazard.
- **CCP decision tree:** A sequence of questions to assist in determining whether a control point is a CCP.
- **Corrective action:** Procedures followed when a deviation occurs.
- **Deviation:** Failure to meet a required critical limit for a CCP.

- **HACCP plan**: The written document that delineates the formal procedures to be followed in accordance with these general principles.
- **Hazard**: Any biological, chemical, or physical property that may cause an unacceptable consumer health risk (unacceptable contamination, toxin levels, growth, and/or survival of undesirable organisms)
- **Monitoring**: A planned sequence of observations or measurements of critical limits designed to produce an accurate record and intended to ensure that the critical limit maintains product safety.
- **Risk category**: One of six categories prioritizing risk based on food hazards.
- **Validation**: That element of verification focused on collecting and evaluating scientific and technical information to determine whether the HACCP plan, when properly implemented, will effectively control the hazards.
- **Verification**: Methods, procedures, and tests used to determine whether the HACCP system is in compliance with the HACCP plan

HACCP Principles

PRINCIPLE 1:

- Identify potential hazards in food production and assess their severity and risks.
- Determine points in the process where significant hazards occur and establish preventive measures.
- Evaluate the food product, ingredients, and production sequence to identify critical control points (CCPs) that manage hazardous microorganisms

PRINCIPLE 2:

- Identify points in the production process where control is essential to prevent, eliminate, or reduce food safety hazards.
- Establish CCPs at steps where it is critical to control hazardous microorganisms through measures like heating, refrigeration, pH adjustment, and sanitation.

PRINCIPLE 3:

- Set specific tolerances for preventive measures at each CCP to ensure control of microbiological hazards.
- Critical limits could include temperature ranges, pH levels, and other measurable factors necessary to maintain food safety

PRINCIPLE 4:

- Implement scheduled testing or observations to monitor CCPs and their limits.
- Document monitoring results to track system operation, identify trends, and verify compliance.
- Use physical and chemical measurements for rapid monitoring, supplemented by random checks and microbial testing when necessary
- If feasible, monitoring should be continuous

PRINCIPLE 5

- Define actions to be taken when there is a deviation from established critical limits at a CCP.
- Corrective actions must ensure the CCP is brought back under control and that any affected product is handled appropriately to eliminate hazards

PRINCIPLE 6:

- Use methods, procedures, and tests to verify the HACCP plan is working effectively.
- Verification includes confirming hazard identification, compliance with microbial criteria, and using chemical and sensory testing methods.

PRINCIPLE 7:

- Maintain detailed documentation of the HACCP plan, including team responsibilities, product descriptions, process flow diagrams, hazard descriptions, critical limits, monitoring results, corrective actions, and verification procedures.
- Ensure records are available for government inspection to demonstrate compliance and effective implementation of the HACCP plan.

Indices of food sanitary quality and sanitizers

- Food quality and safety are important consumer requirements.
- Three groups of microorganisms are commonly tested for and used as indicators of overall food quality and the hygienic conditions present during food processing, and, to a lesser extent, as a marker or index of the potential presence of pathogens: coliforms, *Escherichia coli* and Enterobacteriaceae
- Indicator organisms can be employed to reflect the microbiological quality of foods relative to product shelf life or their safety from foodborne pathogens.

Indicator microorganisms

The presence of indicator microorganisms in foods can be used to:

- Assess the adequacy of a heating process designed to inactivate vegetative bacteria
- Assess the hygienic status of the production environment and processing conditions
- Assess the risk of post-processing contamination;
- Assess the overall quality of the food product.

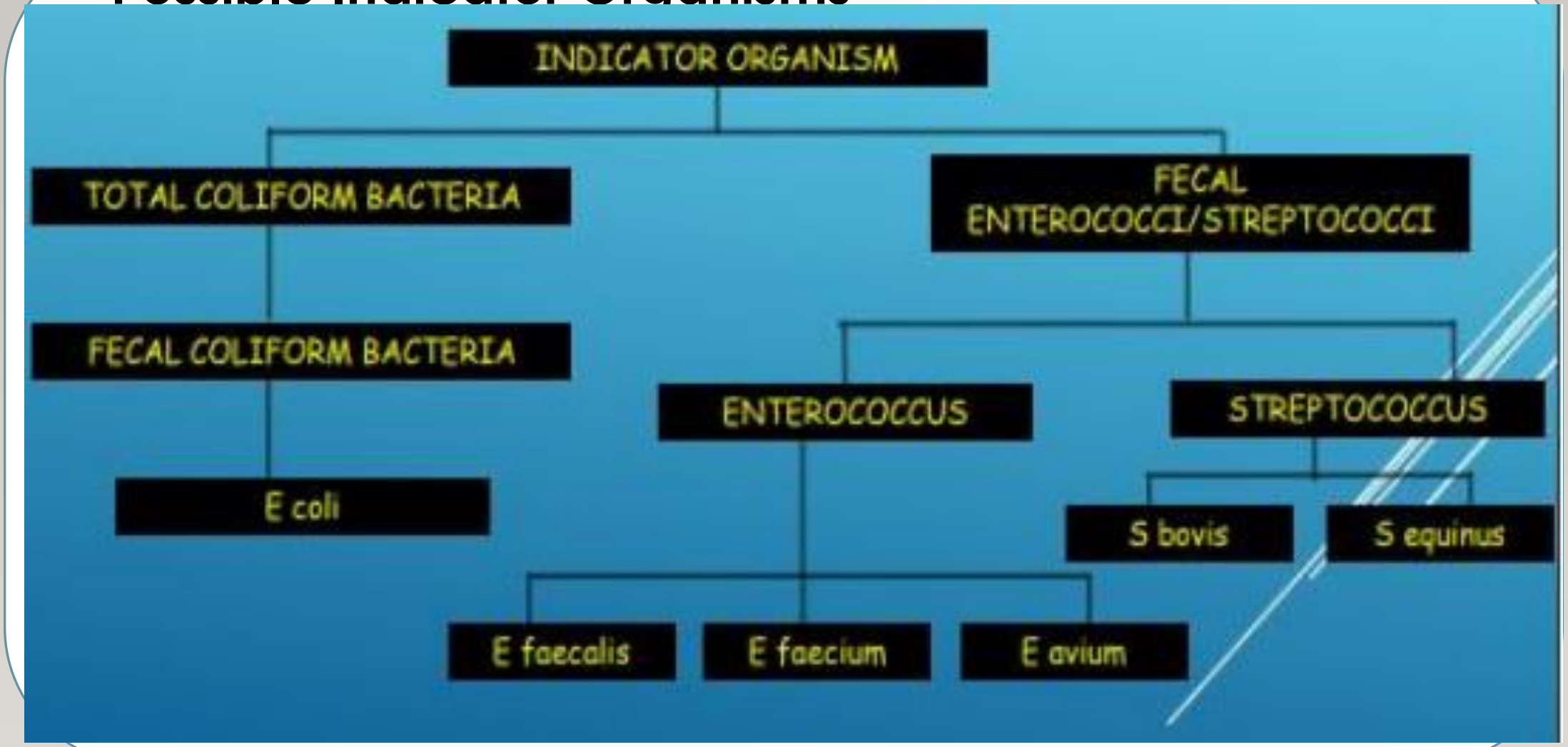
Factors to consider before checking for an indicator organisms

- Physio-chemical nature of the food
- Native microflora of the food
- Extent to which the food has been processed
- Effect that processing would be expected to have on the indicator organism(s)
- The physiology of the indicator organism(s) chosen.

Criteria for ideal indicator for pathogenic microbe in food

- Indicator should contain single-species
- Should be of enteric origin
- Should be non-pathogenic
- Should be detectable and identifiable within short time
- Should have a growth and survival rate as that of the enteric pathogen
- Should preferably be present when the pathogens are present in food; conversely, it should be absent when the enteric pathogens are absent.

Possible Indicator Organisms



Sanitary In Food Processing

- A sanitary processing environment is crucial for food safety, requiring both cleaning and sanitation standards
- Cleaning removes physical soils from surfaces, while sanitation targets microorganisms.
- Foodborne illness can be controlled when sanitation is properly implemented in all food operations
- Inspections are increasingly stringent, with inspectors using the Hazard Analysis Critical Control Point (HACCP) concept to ensure compliance

Sanitation Controls

Sanitation controls must include, as appropriate to the facility and the food, procedures, practices and processes for the:

(i) Cleanliness of food-contact surfaces, including food-contact surfaces of utensils and equipment

(ii) Prevention of allergen cross-contact and cross-contamination from insanitary objects and from personnel to food, food packaging material, and other food contact surfaces and from raw product to processed product

Steps to attain a sanitary environment

1. Inspection and Identification
2. Sweeping and flushing
3. Washing
4. Rinsing
5. Sanitizing
6. Rinse/Air dry
7. Validation

Cultural and Rapid Detection Methods of Food Borne Pathogens in Foods

- Microorganisms, including beneficial bacteria, reside in human gut and skin.
- Pathogenic microorganisms such as bacteria, fungi, and viruses cause foodborne diseases through contaminated water or food.
- Detection of foodborne pathogens like *E. coli, Salmonella*, and *Listeria* is crucial to prevent outbreaks and e have the traditional methods and Rapid methods.
- Traditional microbiological detection and identification methods for foodborne pathogens are well known to be time consuming and laborious as they are increasingly being perceived as insufficient to meet the demands of rapid food testing.

Traditional Methods

- Culture-based methods involve growing bacteria on nutrient media, Biochemical characterization, Sugar fermentation test, Morphological characteristics etc.
- Steps include homogenizing food samples, and identifying them via selective media and biochemical tests.

Rapid Detection Methods

1. Nucleic Acid-Based Methods

- PCR and related techniques amplify specific DNA/RNA sequences.
- hybridization of nucleic acids using probes

Advantages: high sensitivity, specificity, and speed

. Results of these assays are easy to interpret due to the specificity of this type of detection.

Polymerase chain reaction (PCR)

- PCR is currently a widely used and incredibly potent technology
- It allows for rapid exponential amplification of a specific target sequence, reducing the need for culture enrichment.
- It can detect a single copy of a target DNA sequence.

Advantage: sensitivity, specificity, accuracy, speed, and the ability to detect minute amounts of target nucleic acid in a sample.

- **PCR FORMATS**
  - PCR-based detection
  - General PCR
  - Multiplex PCR

2. Immunological-Based Methods

- ELISA and lateral flow immunoassay (LFI)

- A biosensor is an analytical instrument that translates biological signals and responses into electrical signals.

This comprises two key components: a bioreceptor that recognizes the event and a transducer that converts the recognition event into a quantifiable sensitive electrical signal

- **Types:** Optical Biosensors and Immunosensor

Other types are:

- Nested PCR
- Real-Time PCR
- Restriction fragment length polymorphism
- Amplified fragment length polymorphism
- Random amplified polymorphic DNA technique
- Pulse Field Gel Electrophoresis
- Ribotyping
- Multi locus enzyme electrophoresis