



Control of Food Hazards General and Specific

FSKN 9

GFSI Basic Level

- The organisation shall reduce the risk of unsafe food by taking preventative measures to assure the safety and suitability of food at an appropriate stage or stages in their operation by controlling food hazards.

GFSI Basic Level

- The organisation shall control food hazards through the use of systems such as HACCP.
- They shall:
 - Undertake a risk analysis to identify all possible hazards.
 - Identify any steps in their operations which are critical to the safety of food.
 - Implement effective procedures at those steps to defined limits as appropriate for food safety.
 - Monitor control procedures to ensure their continuing effectiveness.
 - Review control procedures periodically, and whenever the operations change.



Presentation Outline

- Food Safety Versus Quality
- What is a Food Safety Hazard
- Biological Hazards and Controls
- Chemical Hazards and Controls
- Physical Hazards and Controls
- Management of Hazards



What is Food Safety?

- Assurance that food will not cause harm when prepared and/or eaten according to its intended use.



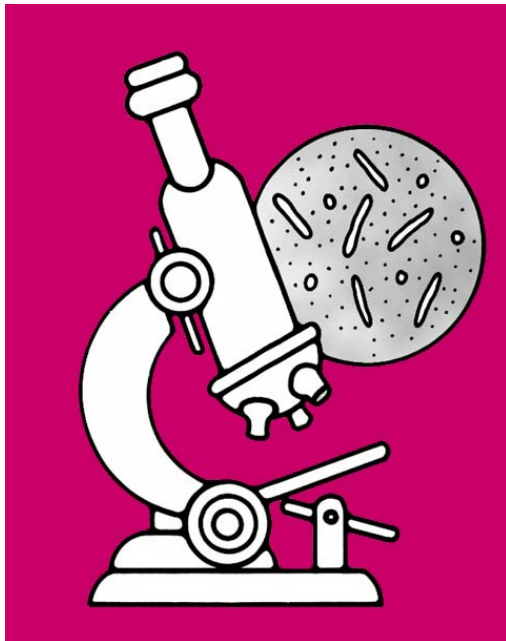
Food Quality Versus Food Safety

- Most food quality attributes can be readily observed by sight, smell, or simple measurement.



Food Quality Versus Food Safety

- Most **food safety** attributes can not be directly observed, but instead require laboratory procedures for their measurement.



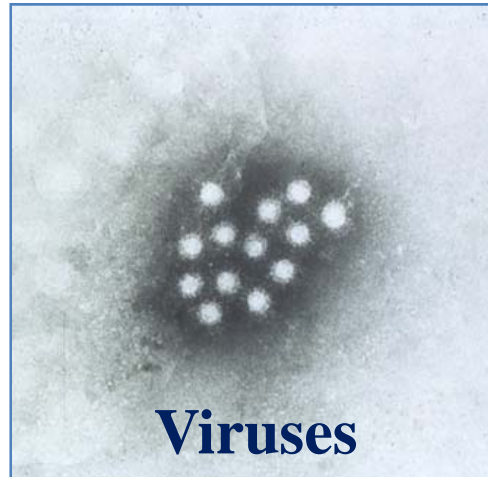
Definition of a Food Safety Hazard

- A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect.

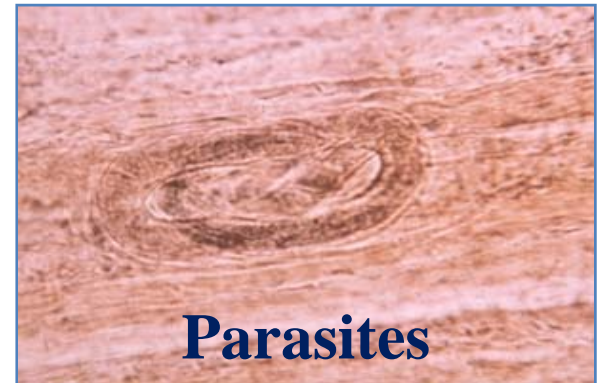


Bacteria

**Hazardous
Chemicals**



Viruses



Parasites

Foreign Materials

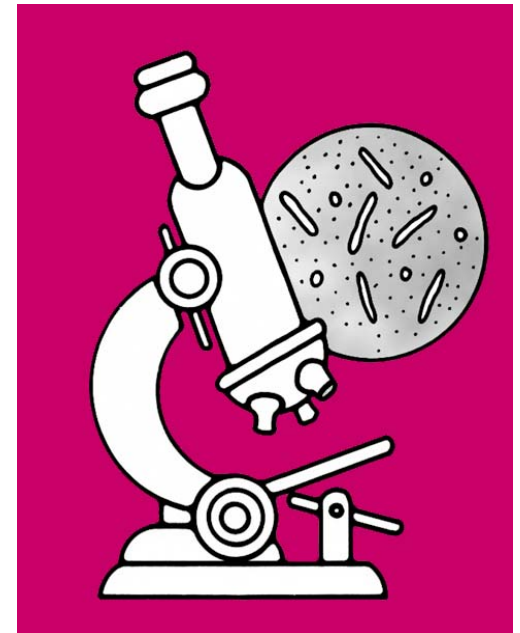
Hazards

- In food safety management systems, “hazards” refer to conditions or contaminants in foods that **can cause illness or injury**.
- Does not refer to undesirable conditions or contaminants such as:
 - Presence of insects
 - Spoilage
 - Fomites such as hair or filth
 - Violations of regulatory food standards not directly related to safety.



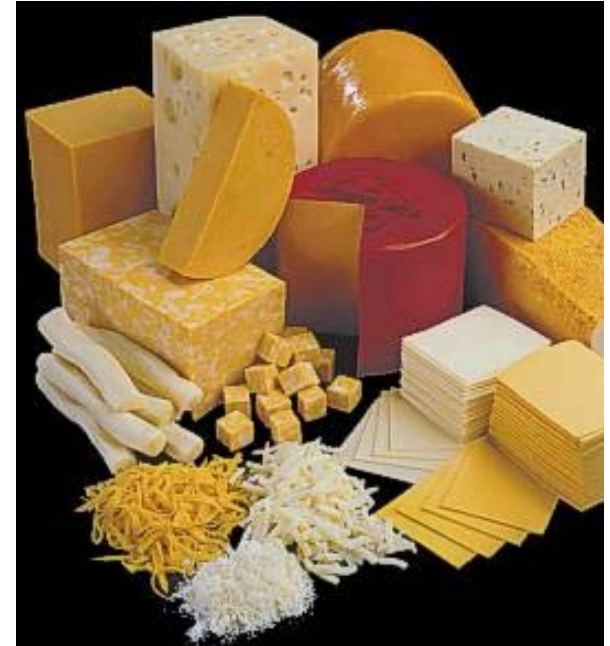
Practical Food Microbiology

- Microorganisms are small, living unicellular or multicellular organisms.
- They include bacteria, viruses, yeasts, molds, and parasites.
- They can be....
 - The good,
 - The bad, and
 - The ugly!



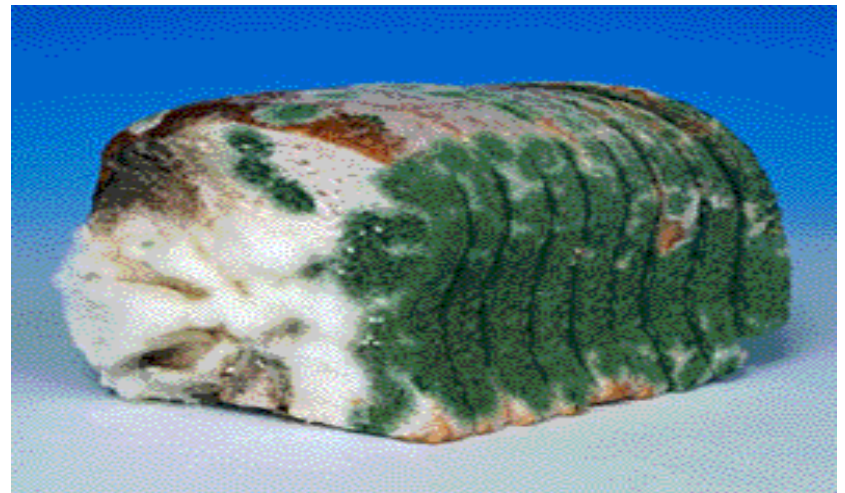
Kinds of Microorganisms

- The Good (or helpful)
 - Add them to foods or they are there naturally.
 - They ferment foods to preserve them and/or create unique flavors and textures.
 - Examples: cheese, yogurt, sour cream, bread, sauerkraut and pickles.



Kinds of Microorganisms

- The Bad (or spoilage)
 - Change foods and cause them to “go bad” or spoil.
 - Affect the quality of the food product, not necessarily the safety of the food.
 - Examples: discolored, mushy, or fuzzy vegetables; sour milk; and slimy, putrid meat.

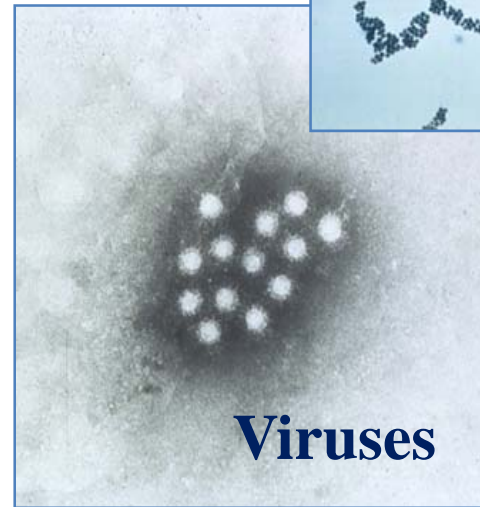


Kinds of Microorganisms

- The Ugly (disease-causing, pathogenic)
 - Cause illnesses that can range from mild to life-threatening.
 - Examples: foods contaminated with Salmonella or E. coli O157:H7. Common signs and symptoms include nausea, vomiting, and diarrhea.

Microorganisms That Cause Foodborne Illness are called PATHOGENS

- Bacteria – Single-celled organisms that live independently.
- Viruses - small particles that live and replicate in a host.
- Parasites - intestinal worms or protozoa that live in a host animal or human.



Where Microbial Pathogens Live

Common in soils...

- *Listeria monocytogenes*
- *Bacillus cereus*
- *Clostridium botulinum*
- *Clostridium perfringens*

Residents of human & animal intestinal tracts...

- *Salmonella* species
- *E. coli* O157:H7
- *Shigella* species
- *Campylobacter jejuni*
- Viruses and parasites

To Grow and Cause Illness, Bacteria Need:

- Moisture, found in most foods, including fruits and vegetables.
- Nutrients, provided by most foods.
- Warmth, especially room temperature or a little higher.
- Time

Viruses

- Viruses are obligate intracellular parasites which invade living cells and then use the cell's machinery to replicate.
- Viruses do not multiply in food.
- Persons who are infected with viruses will “shed” particles in their feces.
- Foodborne viral disease generally results from poor personal hygiene of an infected food handler.
- Contaminated water and ice also can serve as a vehicle for viruses.

Viruses – Control

- Food handlers must practice appropriate personal hygiene.
- Sick employees must not be allowed to work with food.
- Water used in packing, processing and making ice must be potable.

Parasites

- Unicellular or multicellular eukaryotic microorganisms which can colonize the gastrointestinal tract of humans.
- Typically have complex life cycles which include colonization of human and/or animal GI tracts, and the shedding of “cysts” which can be persistent in the environment and can infect others following ingestion.
- Protozoan parasites and parasitic worms are the most common foodborne parasites.

Parasites – Control

- Use appropriate practices when utilizing animal manure and compost as a soil amendment for fruit and vegetable crops.
- Use potable water for all produce washing, packing, processing operations.
- Protozoan parasites and parasitic worms are effectively destroyed by thermal processing and other treatments.

Prevention of Foodborne Disease

- Prevent contamination of foods
- Destroy or remove foodborne disease agents
- Prevent multiplication of foodborne disease agents



General Control Points for Biological Hazards

- Microbiological criteria for raw materials
- Preservative factors (pH, a_w , etc.)
- Time / temperature (cooking, freezing, etc.)
- Prevention of cross contamination
- Food handling / employee hygiene
- Equipment / environmental sanitation
- Packaging integrity / storage, distribution
- Consumer directions for use

Types of Chemical Hazards

- Naturally-occurring chemicals
- Intentionally-added chemicals
- Unintentional or incidental chemical additives



Naturally Occurring Chemical Hazards

- Some chemical hazards are naturally present in foods.
 - Toxic plant components
 - Solanine and other toxins in nightshade family of plants
 - Mushroom toxins
 - Seafood toxins (e.g. fugu)
- Such substances are often prohibited in foods beyond a certain level.
- These hazards often are also classified as biological hazards.
 - The actual classification as chemical versus biological doesn't matter, as long as the hazard is recognized.

Toxins of Microbial Origin

- Toxins produced by *Clostridium botulinum*, *Staphylococcus aureus*, *Bacillus cereus*, etc.
- Scombrototoxin (histamine) - fish
- Saxitoxin (paralytic shellfish poisons)
- Mycotoxins - produced by molds (fungi)
 - Aflatoxin
 - Vomitoxin
 - Patulin
 - Ochratoxin A

Chemicals are Commonly Used in Food Production and Processing

Point of Use	Chemical Type
Growing crops	Pesticides, insecticides
Raising livestock	Hormones, antibiotics
Production	Food additives
Plant maintenance	Lubricants, paints
Plant sanitation	Cleaners, sanitizers



Intentionally Added Chemicals – *Food Additives*

- **Direct** additives
 - Preservatives (e.g., nitrite, sodium benzoate, sulfiting agents)
 - Nutritional additives (e.g., niacin, retinol)
 - Color additives
- **Indirect** Food Additives
 - Adhesives
 - Paper and paperboard components
 - Polymers
 - Adjuvants, protection aids and sanitizers



Examples of Direct Food Additives That May Become Chemical Hazards if Used Improperly

Source	Why a Hazard?
FD&C Yellow No. 5 (food coloring)	Can produce an adverse reaction in sensitive people
Sodium Nitrite (preservative)	Can be toxic in high concentrations
Vitamin A (nutritional supplement)	Can be toxic in high concentrations
Sulfiting Agents (preservative)	Can cause an intolerance reaction in sensitive people



Unintentionally Added Chemicals

- Agricultural chemicals
 - Pesticides
 - Fungicides
 - Herbicides
 - Fertilizers
 - Antibiotics
 - Growth Hormones
 - Etc.
- Prohibited substances specified by regulations.
- Many “Private Standards” (e.g. GlobalGAP, Organic Certification) closely scrutinize the use of these substances.



Examples of Incidental Contaminants That May Become Chemical Hazards

Source	Why a Hazard?
Agricultural Chemicals (e.g. pesticides, herbicides)	If improperly applied, some can be acutely toxic or may cause long-term health effects
Cleaning Chemicals (e.g. acids, caustics)	Can cause chemical burns if present in the food at high levels
Equipment Components (e.g. copper pipe fittings)	Acidic foods can cause leaching of heavy metals from pipes and joints (e.g. copper and lead)
Maintenance Chemicals (e.g. lubricants)	Some chemicals that are not approved for food use may be toxic
Packaging Materials (e.g. tin)	High nitrite levels in food can cause excessive detinning of uncoated cans resulting in excessive levels of tin in the food



Controls for Chemical Hazards

Check

- Prior to receipt →
- Upon receipt →
- During processing →
- During storage →
- During use →
- Prior to shipment →

Control

- Specifications
- Inspection before acceptance
- Use “Approved” chemicals
- Avoid cross contamination
- Use approved procedures
- Pre-shipment inspection
 - Record review

Physical Hazard

- Any potentially harmful extraneous matter not normally found in food.
- Generally cause problems for relatively few consumers per incident.
- Typically result in personal injuries that are not life-threatening.
 - Broken tooth, cut mouth, choking, etc.

Examples of Physical Hazards

- Metal fragments
- Glass particles
- Wood splinters
- Rock fragments
- Stones
- Bones or bone fragments (when not expected)



Preventative Maintenance Program

- Routine inspection and maintenance of equipment is an important component of a physical hazard prevention program.
- Screens and filters in liquid processing equipment or lines must be inspected on a routine basis.
 - The presence of metal screws or other foreign materials on these screens should be a cue to inspect upstream equipment.



Physical Hazards – Control or Detection Equipment

- Magnet – ferrous metals
- Metal detector – ferrous and non-ferrous metals
- X-ray equipment – all types of physical hazards
- Screen or sifter – separation by size
- Aspirator – segregation by weight
- “Riffle board” – e.g. removes stones from beans
- Bone separator – mechanically separated meat





Employee Practices and Physical Hazards

- Education, prevention and strong company policies are essential!
- “No metal above the waist” is a common company policy to control potential for physical hazards to fall into food.
- Personal jewelry typically is limited to a single plain wedding band.



Sources and Controls of Physical Hazards

Source

- Raw materials 
- Facilities/equipment 
- Process procedures 
- Employee practices 

Control

- Specifications
- GMPs
- Evaluation, Detection, Separation
- Education

Control of Food Safety Hazards

- Understand the nature of hazards
- Understand acceptable levels of hazards
- Know how to control hazards
 - Destroy / Remove
 - Prevent
 - Reduce to an acceptable level
- Know how to develop and manage a food safety system to control these hazards



QUESTIONS?



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