INTRODUCTION TO FOOD SPOILAGE AND CONTAMINATION

NM

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CONTENT

- What is food microbiology?
- Food spoilage
- Food contamination

WHAT IS MICROBIOLOGY?

Based on your understanding, please write your answer in the Chat Box.

WHAT IS MICROBIOLOGY?

Study of all living organisms that are too small to be visible by naked eyes (microorganism)

Includes the unicellular (single cell), multicellular, or acellular (lacking cells).

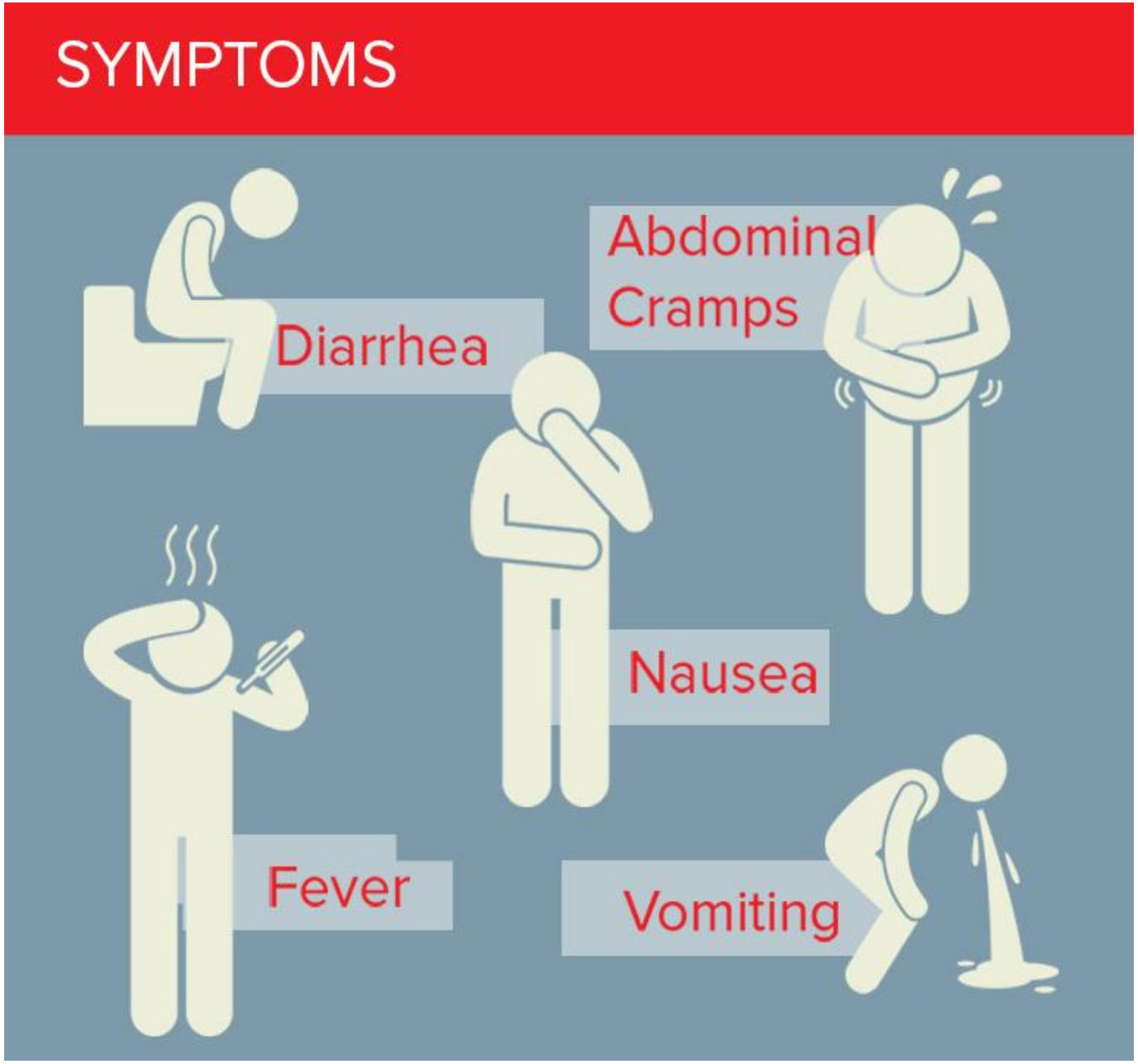
Bacteria, archaea, algae, fungi, protozoa, viruses,

FOOD MICROBIOLOGY?

- Study of microorganism that grow in or are transmitted by foods
- Interaction between food, microbes, & the environment
- Method to preserve food and prevent spoilage & contamination
- Important microbes in food microbiology
  1. Beneficial microbes – fermentation / produce food ingredient
  2. Pathogenic microbes – food contamination & foodborne diseases
  3. Spoilage microbes – food spoilage

FOODBORNE DISEASE

- Foodborne disease is defined as a **disease** that is **carried or transmitted to humans by food**.
- The 3 types of foodborne diseases are:
  1. Foodborne infection
  2. Foodborne intoxication (food poisoning)
  3. Foodborne toxico-infection



Foodborne Pathogens

- *Salmonella* and *Shigella*
- *Clostridium botulinum*
- *Campylobacter*
- *Clostridium perfringens*
- *Bacillus cereus*
- *Staphylococcus aureus*
- *Vibrio cholera*
- *Escherichia coli* O157:H7

How to prevent foodborne diseases?

FOOD SPOILAGE

- Any undesirable changes in food that makes it unacceptable for consumption
  1. **Visual** - colour
  2. **Flavour** – smell & taste
  3. **Texture** – formation of slime, accumulation of gas / foam, accumulation of liquid (exudate)

  OR
- The process in which food deteriorates to the points it is not edible to humans or its quality becomes reduced
- Spoiled food lost its quality and nutritional value

FACTORS DETERMINING THE FOOD SPOILAGE

- Nutrient
- pH
- Acidity / alkalinity
- Water activity
- Moisture content
- Antimicrobial chemical (e.g. essential oil)
- Oxidation-reduction potential
- Biological barriers (e.g. shells)

Intrinsic factors

- Temperature
- Relative humidity
- Presence and concentration of gases
- Presence and activities of other microorganism

Extrinsic factors

TYPES OF FOOD SPOILAGE

Physical spoilage

(dehydration of fresh vegetables(wilting))

Chemical spoilage

(oxidation of fat, enzymatic browning of fruits and vegetables)

Microbial spoilage

(growth of bacteria, yeast, & mold; enzyme production)

MICROBIAL FOOD SPOILAGE

- Various bacteria/yeast/mold can be responsible for the spoilage of foods (meat, poultry, milk, dairy products, fruits, vegetables, etc.)
- When bacteria breaks down the food, acids and other waste products are produced
- While the bacteria itself may or may not be harmful, the waste products may be unpleasant to taste or may even be harmful to one's health.

MICROBIAL FOOD SPOILAGE

- Yeasts responsible for the decomposition of food with a high sugar content
- The same effect in the production of various types of food and beverages, such as bread, yogurt and alcoholic beverages
- The toxic effects from consuming spoiled food (containing pathogenic bacteria / toxins) are known as "food poisoning", and more properly as "foodborne illness”

SPOILED FOODS!!

Food is stored under the growth condition for a sufficient length of time (allow sufficient no. to cause spoilage and enzyme production)

Food environment (intrinsic factors) favor the growth of microbes

Microorganisms in contact with food

CLASSIFICATION OF FOOD BASED ON EASE OF SPOILAGE

HIGHLY PERISHABLE

- Spoils rapidly.
- Include poultry, eggs, meats, most fruits and vegetables, and dairy products, etc

SEMI PERISHABLE

- Spoil less quickly. Include potatoes, apples, etc.

NON PERISHABLE

- Generally kitchen items, like cereals, rice flour, nuts, sugar etc. (mainly dried foods)

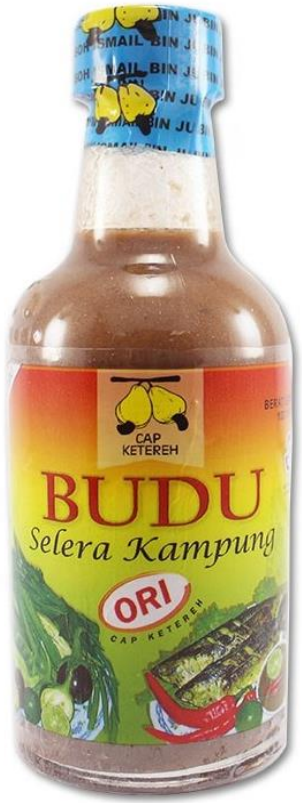
FERMENTED PRODUCT

- Food spoilage organisms can grow in foods, produce **(un)desirable flavors and textures**, and MAY also **inhibit pathogenic organisms**.

- Most of these bacteria belong to the genera
  - *Streptococcus*
  - *Lactobacillus*
  - *Leuconostoc*
  - *Pediococcus*
  - *Micrococcus*

- They are used to make **fermented** dairy products, meats, and vegetables, and to preserve food by **converting the sugars needed by competing microbes to lactic acid**, which inhibits their growth.

Fermented / "Spoiled" products with "desirable" flavour & texture; inhibit pathogenic microbes



IMPORTANT NOTES!!

- **Not all spoiled food are safe to eat!!**
- **Food spoilage** can be the **indicator of time and temperature abuse** during storage (there is a potential for pathogenic bacteria to grow in the foods)
- Food spoiled by **fungi** might be harmful due to the **mycotoxin** production

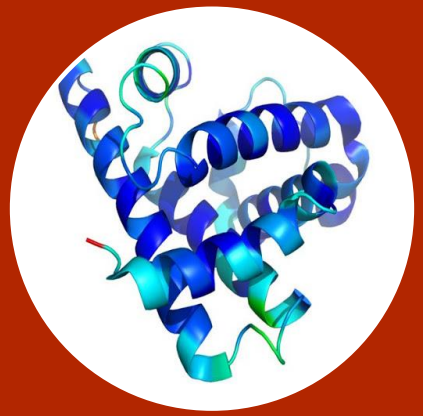
Benefits of bacteria

(manifestation of acceptable “spoilage”)

Hazards / spoilage

(mold can produce mycotoxin which is harmful to our body!!

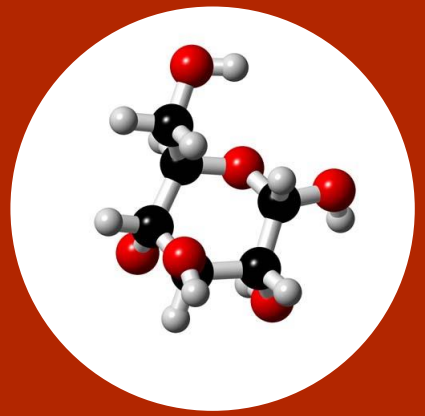
CHEMICAL CHANGES CAUSED BY MICROORGANISMS



DEGRADATION OF N-COMPOUNDS

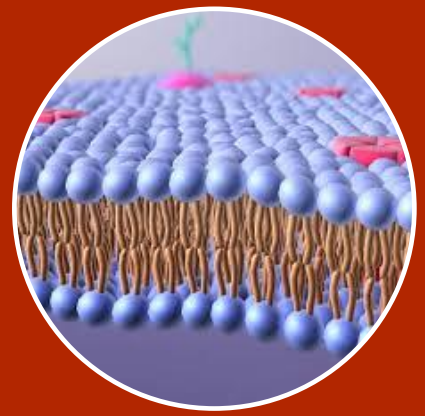
Proteolysis: Protein --> Amino acid

Putrefaction: Amino acids --> volatile compounds (H2S)



DEGRADATION OF CARBOHYDRATES

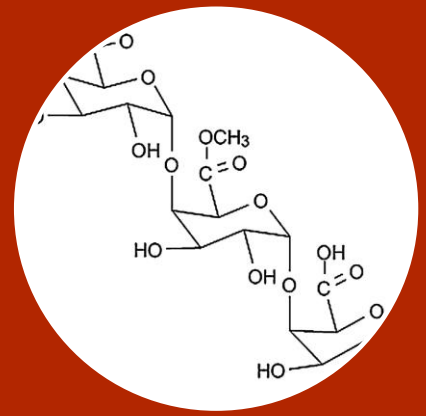
Fermentation, off-flavors, softening



DEGRADATION OF LIPIDS

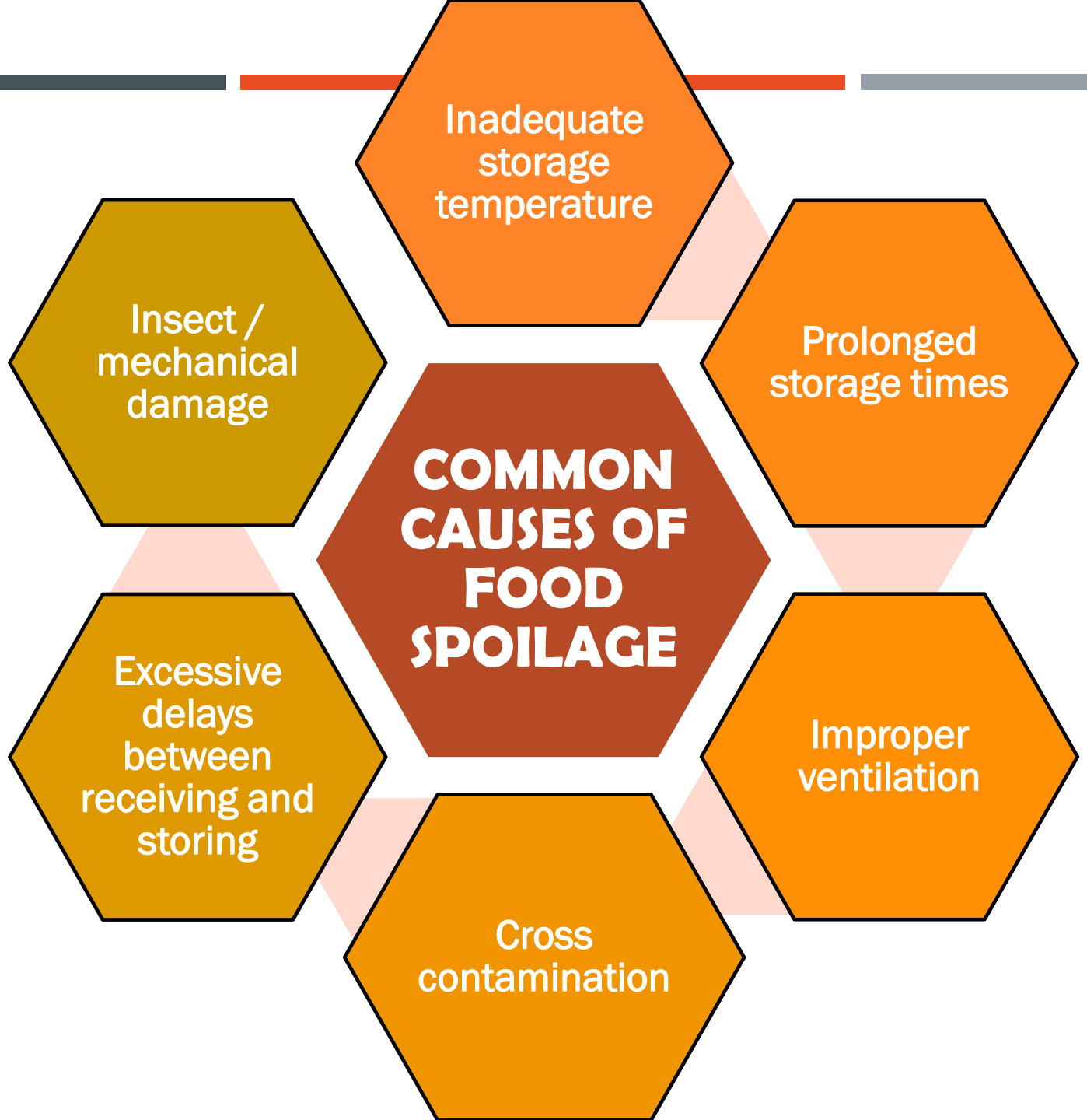
Lipids ->fatty acids -> aldehyde, ketones

Rancidity



PECTIN HYDROLYSIS

Softening of fruits / vegetable


COMMON CAUSES OF FOOD SPOILAGE
Inadequate storage temperature
Prolonged storage times
Improper ventilation
Cross contamination
Excessive delays between receiving and storing
Insect / mechanical damage

SIGN OF FOOD SPOILAGE

- **Visible growth**
  - Green/blue mold on citrus fruits
- **Gas production**
  - Bubbling packages and can
- **Slime**
  - Surface accumulation of microbial cells
  - Manifestation of tissue degradation
- **Off-flavours**

SIGN OF FOOD SPOILAGE

- **Souring**
  - production of acid from fermentative bacteria (lactic acid bacteria)
  - eg: sour milk due to fermentation of lactose to lactic acid

- **Discoloration**
  - In addition to the color change, meat or poultry will have an off-odor, be sticky or tacky to the touch, or it may be slimy

- **Odor**
  - Putrefaction - anaerobic breakdown of proteins, with the production of foul-smelling compounds such as hydrogen sulfide and amines)

    eg: Rotten egg smell

WHY WE NEED TO STUDY FOOD SPOILAGE?

Understand the factors associated with microbial food spoilage

Recognize the cause of an incidence

Develop an effective means of control (food preservation)

FOOD PRESERVATION

Why?

- To kill microbes or prevent microbial growth
- To slow down the spoilage of food
- Prevent foodborne illness
- Maintaining nutritional value, texture and flavour of the food

How?

- Fermentation
- Drying
- Boiling
- Refrigeration & freezing
- Canning
- Using chemical preservatives
- Using salt, sugar, oil, vinegar
- Pasteurization
- Retort
- Vacuum packaging /MAP

WHAT ARE THE DIFFERENCES BETWEEN FOOD SPOILAGE ORGANISMS AND FOODBORNE PATHOGENS?

https://www.menti.com/99ogvjujqv

WHAT ARE THE DIFFERENCES BETWEEN FOOD SPOILAGE ORGANISMS AND FOODBORNE PATHOGENS?

Food spoilage organisms

- Caused by bacteria, yeasts, & molds
- These organisms are often smelled, seen, or tasted
  - E.g. the smell of spoiled milk
  - Moldy bread
- Generally, food spoilage organisms do not cause life-threatening infections.

Foodborne pathogens

- Caused by bacteria, viruses, parasites
- Do not generally affect the taste, smell, or appearance of food.
- Pathogenic bacteria cause illness.

SHARE WITH US
WHAT HAVE YOU LEARNED TODAY?