Chapter 32 Food Microbiology

Summary Outline

32.1 **Principles of food microbiology**

A. Food is an **ecosystem** in which microorganisms compete to metabolize the nutrients, making **end products** such as **acids, alcohols and gas**.

B. Foods that have been altered by controlling the activity of bacteria, yeasts or molds are called **fermented**.

C. Biochemical changes in foods, when perceived as unpleasant are called **spoilage**.

D. Growth of pathogens generally does not result in perceptible changes in quality of food, but can result in **food-borne disease**.

E. **Spoilage** can be delayed or prevented and **food-borne illness** can be avoided by slowing the growth of microorganisms, or by reducing or eliminating the initial numbers of them on foods

32.2 **Factors influencing the growth of microorganisms in food**

A. **Intrinsic** and **extrinsic factors** determine which microorganisms can grow and predominate in a food product.

B. **Intrinsic factors**

1. **Bacteria require a high a_w (water activity)**. They grow quickly on fresh, moisture-rich foods but not on dry, sugary or salted foods. **Fungi** can grow on foods which have an **a_w too low to support the growth of bacteria**.
2. The **pH of a food** is important in determining which organisms can survive and thrive on it; many species of **bacteria**, including most pathogens, are **inhibited by acidic conditions**.
3. **Coverings** help **protect** some foods from the **invasion of microorganisms**.
4. Some foods contain **natural antimicrobial chemicals** that may help prevent spoilage.

C. **Extrinsic factors**

1. **Low temperatures halt or inhibit the growth** of most food-borne microorganisms.
2. The **presence or absence of oxygen** impacts the type of microbial population able to grow on a food.

32.3 **Microorganisms in food and beverage production**

A. The **acids produced in fermented foods inhibit** the growth of many **spoilage organisms** as well as **food-borne pathogens**.

B. The tart taste of yogurt, pickles, sharp cheese and some sausages is due to the production of **lactic acid** by species of ***Lactobacillus, Lactocossus, Streptococcus, Leuconostoc*** and/or ***Pediococcus***.

C. **Alcoholic fermentations**: The yeast ***Saccharomyces*** **ferments sugar to produce ethanol and carbon dioxide** in the production of **wine**, **beer**, and **distilled spirits**. **Vinegar** is the product of the **oxidation of alcohol** by ***Acetobacter*** and ***Gluconobacter***. In bread-making, the **CO_2 produced by yeast causes bread to rise**, and the **alcohol is lost to evaporation**.

D. Changes imparted by mold: Some **cheeses and other dishes** are produced by **encouraging the growth of molds** on foods. **Soy sauce** is made by allowing species of ***Aspergillus*** to degrade a mixture of **soybeans and wheat**, which is then **fermented in brine**.

32.4 **Food spoilage** is often due to the metabolic activities of microorganisms as they grow and utilize the nutrients in the food.

A. Bacteria: **Psychrophilic species of *Pseudomonas*** can multiply at refrigeration temperatures and metabolize a wide variety of compounds, causing spoilage of foods including meats and vegetables. Other important causes of food spoilage include ***Ervinia, Acetobacter, Alcaligenes,*** **lactic acid bacteria** and **endospore formers**.

B. **Fungi** grow in **acidic** and **low moisture environments**, therefore fruits and breads are more likely to be spoiled by fungi than by bacteria.

32.5 **Food-borne illness**

A. **Food-borne intoxication** is an illness that results from the consumption of a **toxin** produced by a microorganism growing in a food product. Strains of ***Staphylococcus aureus*** produce a toxin that can cause nausea and vomiting. The anaerobic, spore-forming, Gram-positive rod ***Clostridium botulinum*** produces a **neurotoxin**, which can be destroyed by boiling for 10-15 minutes.

B. **Food-borne infection** requires the **consumption of living organisms**. Cooking of food immediately before consumption prevents food-borne infection. ***Salmonella, Campylobacter* species** and ***E. coli* O157:H7** are significant causes.

32.6 **Food preservation** can be accomplished by **killing microorganisms** or **altering conditions to inhibit their growth.** Methods used to preserve foods include **canning, pasteurization, cooking, freezing, refrigeration, reducing the a_w, lowering the pH, adding antimicrobial chemicals,** and **irradiation**.