

*College of Applied Medical Sciences*

*Department of Environmental Health*

*Introduction to Food Safety and  
Microbiology*

*Lecture 3*



## **MICROBIAL HAZARDS (Microbial Contaminants)**

Microorganisms are everywhere. They can be found in the air, in water, in soil, on animals, and even on humans. Some are beneficial, such as those used to make fermented dairy and meat products. Others cause spoilage.

### **•Spoilage**

- Cause food to become inedible due to changes in color, flavor, odor, appearance or texture.
- Grow to high levels and break down food components
- Commensal organisms that have reached high populations (10<sup>5</sup>-10<sup>7</sup> CFU/g)
- Different products have different spoilage flora

### **Signs of Spoilage**

- 1- Discoloration .
- 2- Off odor .
- 3-Fuzzy growth on the surface .
- 4- Slimy feel on the surface .
- 5-Foaming or gas bubbles in the product .
- 6- Bulging or corroded can .
- 7-Cloudy appearance .
- 8- Off flavor .
- 9- Mushy texture .
- 10- Soft spots or breaks in the skin on fruits and vegetables .

This list describes noticeable changes in food or food packaging that indicate food spoilage has occurred. However, note that some foods in early stages of spoilage may not exhibit any of these signs.

### **Spoilage Organisms**

•**Bacterial** (hundreds of bacteria cause spoilage)

–*Erwinia, Pseudomonas, Flavobacteria, & Enterobacter* spp.

–Lactic acid bacteria

•**Fungal**

–*Penicillium, Aspergillus, Fusarium, and Candida* .

And, a small number are pathogenic (or harmful) and so can cause disease, such as foodborne illness.

Three types of microorganisms can contaminate food and cause foodborne illness –bacteria, viruses, and parasites. Another group of microorganisms that one also needs to be concerned about are fungi, which are yeast and molds. Yeast and mold cause food to spoil but do not cause foodborne illness.

When harmful microorganisms get into food and your customers then eat the food, foodborne illness could result. The most common symptoms of foodborne illness are: diarrhea, vomiting, fever, sore throat with fever, and jaundice.

Many changes in food caused by spoilage make the food unpleasant to eat. This does not necessarily mean the food is unsafe. However, microorganisms often bring about unpleasant changes in food that can also cause illness. A sickness caused by eating contaminated food is called *foodborne illness*.

### Three types of foodborne illness and their definition

Infection	Eating food contaminated with harmful microorganisms
Intoxication	Eating food contaminated with the toxins (poisons) formed by some types of bacteria or mold; eating food contaminated with other biological or chemical toxins (poisons)
Toxin-mediated infection	Eating food contaminated with harmful microorganisms. These microorganisms grow in the body and then form toxins (poisons).

### Common Foodborne Microorganisms that Cause Foodborne Illness

FOODBORNE BACTERIA		
Bacteria	Foodborne Illness	Common Foods
<i>Bacillus cereus</i>	Intoxication	Temperature-abused cooked rice, sauces, puddings, soups, casseroles
<i>Campylobacter</i>	Infection	Unpasteurized milk and dairy products
<i>Clostridium botulinum</i>	Intoxication	Improperly home canned food; garlic-and-oil mixtures that are not acidified; temperature-abused baked potatoes, stews, sautéed onions, modified atmosphere packaged (MAP) foods

**FOODBORNE BACTERIA (continued)**

<b>Bacteria</b>	<b>Foodborne Illness</b>	<b>Common Foods</b>
<i>Clostridium perfringens</i>	Intoxication	Temperature abused cooked meat, meat dishes, cooked beans
<i>Escherichia coli</i> 0157:H7 and 0157:NM	Toxin-mediated infection	Improperly cooked ground beef, lettuce; unpasteurized apple cider
<i>Listeria monocytogenes</i>	Infection	Deli meats, soft cheese, seafood/seafood products, hot dogs, unpasteurized milk
<i>Salmonella</i>	Infection	Improperly cooked poultry, shell eggs; temperature abused sliced melons, sliced tomatoes; improperly processed raw sprouts
<i>Shigella</i>	Intoxication	Salads, lettuce, raw vegetables, milk and dairy products, poultry
<i>Staphylococcus aureus</i>	Intoxication	Temperature-abused meat and meat products, poultry and egg products, mayonnaise-based salads, cream-filled pastries
<i>Vibrio</i>	Infection	Raw or partially cooked oysters
<i>Yersinia</i>	Infection	Unpasteurized milk; tofu; nonchlorinated water; improperly cooked meat, oysters, fish

FOODBORNE VIRUSES		
Virus	Foodborne Illness	Common Foods
Hepatitis A	Infection	Ready-to-eat foods that will not receive a further heat treatment; unsafe water; and improperly handled ice
Norovirus	Infection	Ready-to-eat foods that will not receive a further heat treatment; unsafe water
Rotavirus	Infection	Ready-to-eat foods that will not receive a further heat treatment; unsafe water
FOODBORNE PARASITES		
Virus	Foodborne Illness	Common Foods
<i>Cryptosporidium parvum</i>	Infection	Water, salads and raw vegetables, milk, unpasteurized apple cider, ready-to-eat food
<i>Cyclospora cayetanensis</i>	Infection	Water, raw produce, fish, raw milk
<i>Giardia duodenalis</i>	Infection	Contaminated water, salads, and raw vegetables washed with contaminated water
<i>Toxoplasma gondii</i>	Infection	Contaminated water, raw or undercooked meat
<i>Trichinella spiralis</i>	Infection	Raw and undercooked pork and pork products (particularly sausage), raw and undercooked wild game

## Food Intoxication

Some microbes can give off a by-product that causes illness. Substances released by microbes that are harmful to humans are called ***toxins***. In this case, it is not the microbe that makes people sick but the toxin it produces.

A foodborne illness caused by a toxin released by microbes is called a ***food intoxication***.

It is important to remember that killing the microbes may not be enough to prevent cases of food intoxication. If the toxin is still present and has not been damaged or altered, the person will still become ill. The severity of the illness will depend on the amount of toxins present in the food eaten. It will also depend on how susceptible the person is to illness.

A number of microbes cause food intoxication.

### **Food Infection**

The second major cause of foodborne illness is the microbes themselves. Microbes release digestive enzymes that begin to damage body tissue and cause illness. This type of foodborne illness is called ***food infection***. A food infection cannot occur if the microbes are killed.

Food infections may be caused by bacteria, parasites, and viruses. A large number of living organisms is usually required to cause illness.

Symptoms are related to damage caused by the organisms feeding on their hosts.

### **Prevention of Foodborne Illness**

**1) Cook- Cook all meat, poultry and eggs to at least 160F.** Other than spore-forming bacteria, all bacteria, parasites and viruses are killed quite easily with heating to 160F.

**2) Avoid Cross-Contamination- Do not cross-contaminate one food with another.** Keep raw food totally separated from cooked product.

Clean utensils and work areas etc in between working raw and cooked product. Constantly be thinking of how microorganisms get from raw to cooked products.

**3)Chill Foods- Keep foods cold. After cooking, chill foods as rapidly as possible.** Remember that cooking has destroyed most of the bacteria but spore formers, that are resistant to cooking may become very active and can proliferate rapidly.

**4)Cleaning-Wash fruits and vegetables and all foods possible.** In addition, continually wash work areas. Use only treated or tested water.

**5)Personal Hygiene-** People working with foods should wash their hands regularly, wear hairnets, plastic gloves etc. In addition, food handlers should not work with food if they have a boil, open sores or feel sick themselves .