

Sources of microorganisms in food

1. Different sources of microorganisms in food

The origin of microorganisms in food is rarely from a single source; it is typically the result of **multiple contaminations** at various stages, from production to consumption.

1.1. The raw material itself (primary source)

This is the most fundamental source. Food often comes from living organisms, which are naturally inhabited by microorganisms.

- **Animals:** The skin, feathers, intestines, and respiratory tracts of livestock (cattle, poultry, pigs) carry a vast diversity of microbes (bacteria like *Salmonella*, *Campylobacter*, *E. coli*). During slaughter, these microbes can contaminate the meat.
- **Plants:** Fruits, vegetables, and grains are in contact with soil, irrigation water, fertilizers (manure), and air, all of which carry microbes (bacteria, yeasts, molds). *Listeria*, for example, can be present in soil.
- **Aquatic Environment:** Fish and shellfish filter water or live on the seabed, accumulating natural microorganisms from their environment (e.g., *Vibrio*).

1.2. The environment and contact surfaces

At every stage of processing, food comes into contact with surfaces that can contaminate it.

- **Air and dust:** Air carries mold spores, bacteria, and yeasts. Inadequate ventilation in a processing plant can be a source of contamination.
- **Water:** This is a major vector. Non-potable water used for washing, cooling, or as an ingredient can introduce pathogens like *E. coli* or *Listeria*.
- **Soil:** Directly for root vegetables, or indirectly via boots, vehicle wheels, etc.
- **Surfaces and equipment:** This is known as **cross-contamination**. Knives, cutting boards, conveyor belts, tanks, etc., if not properly cleaned and sanitized, become reservoirs for microbes (e.g., *Listeria* biofilms in damp, cold environments).

1.3. The handling personnel

Humans are a significant reservoir of microorganisms.

- **Skin, hair, hands:** *Staphylococcus aureus* is naturally present on the skin and in the nose. It can be transferred to food by simple contact, especially if hygiene rules (hand washing, wearing gloves/hairnets) are not followed.
- **Respiratory tract:** Coughing and sneezing can project microbes.
- **Health status:** A sick person (with gastroenteritis, a sore throat, etc.) can excrete a large number of pathogens.

1.4. Insects, rodents, and birds (vectors)

These pests are active carriers of microorganisms.

- They carry them on their legs, bodies, or in their droppings.
- Their mere presence in a food production or storage area is a significant health risk.

1.5. Added ingredients

Some ingredients added during manufacturing can be a source of microbes.

- **Spices:** They can naturally contain a high number of bacterial spores and molds, as they are often dried and may have been contaminated by soil.
- **Additives:** Although controlled, they are not always sterile.

2. Why aren't all microbes bad?

It is crucial to distinguish between:

1. **Pathogenic microorganisms:** those that cause disease (food poisoning). Their presence is dangerous.
2. **Spoilage microorganisms:** those that cause food to rot, mold, or make it unfit for consumption (bad odor, color, texture). They are generally not dangerous but render the food inedible.
3. **Useful (or technological) microorganisms:** those intentionally added to produce foods (fermentation). Examples: yeasts for bread and beer, lactic acid bacteria for yogurt, cheese, and sauerkraut.

The effects of harmful microorganisms on food

Harmful microorganisms (bacteria, yeasts, molds) degrade food quality by spoiling its appearance, smell, texture, and taste, and can most importantly make it dangerous to health by producing toxins or multiplying in it.

Their impacts can be grouped into two categories:

1. Spoilage (*deterioration of quality*)

This is the sign that the food is no longer good to consume, even if it is not always directly dangerous.

- **Visual changes:** Appearance of mold (green, white, black spots), slime, bubbles.
- **Olfactory changes:** Rotten, sour, ammonia-like, or rancid odors.
- **Texture changes:** Softening, liquefaction, gas formation (swelling of packaging).
- **Taste changes:** Sour, bitter, or abnormal flavor.

Examples: Moldy jam, spoiled milk, meat becoming slimy.

2. Foodborne illness (the health danger)

This is the most serious effect, often invisible because the food may appear normal.

- **Intoxication:** Microorganisms produce **toxins** in the food. Even if the microbe is killed by cooking, the toxin remains and causes illness (e.g., botulism, staphylococcal food poisoning).
- **Infection:** The food contains **pathogenic** bacteria that multiply in our digestive system after ingestion (e.g., *Salmonella*, *Listeria*).
- **Toxi-infection:** A combination of both: we ingest bacteria that then produce toxins inside our intestines (e.g., *E. coli*).

Consequences for the consumer: Gastrointestinal issues (nausea, vomiting, diarrhea), fever, and in severe cases, complications that can lead to death.