

Hazards

Hazard: biological, chemical and physical agents that is likely to cause illness or injury in the absence of its control.

Hazard characterization: Qualitative and quantitative evaluation of the nature of the adverse effects associated with biological, chemical and physical agents that may be present in foods.

Types of Hazards

Biological Hazards

Biological hazards occur when hazardous or pathogenic organisms are introduced to food and thus pose a food safety concern to consumers. Biological hazards includes

- Bacteria
- Viruses
- Parasites
- Other Biological Hazards - Prions

Biological hazards can be introduced to food from the **environment** (e.g. soil bacteria, agricultural run-off) or from **inadequate sanitation practices and cross contamination** during transportation, handling, processing, and storage (e.g., poor food hygiene practices).

Bacteria

Bacteria are single-celled microorganisms that exist in a range of habitats and can be **free-living** (e.g. in soil, air, water) or **symbiotic** (e.g. in intestinal tract or mucous membranes of animals and humans) and have a broad range of enzymatic, biochemical and/or pathogenic properties. The principal bacteria associated with food borne illnesses include:

- *Bacillus cereus*
- *Campylobacter jejuni*
- *Clostridium botulinum*
- *Clostridium perfringens*
- *Escherichia coli* 0157:H7

- *Escherichia coli* 0104:H4
 - *Listeria monocytogenes*
 - *Salmonella* spp.
 - *Shigella* spp.
 - *Staphylococcus aureus*
 - *Vibrio cholerae*
 - *Vibrio parahaemolyticus*
 - *Vibrio vulnificus*
 - *Yersinia enterocolitica*
 - *Cronobacter sakazakii*
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- Ingesting food contaminated with pathogenic microorganisms and/or their toxic by-products can lead to food-borne illness (Food Poisoning).
 - These illnesses can take the form of infection or intoxication, or both.
 - Food infection is food poisoning or illness caused by consumption of micro-organisms present in food.
 - Food intoxication is food poisoning or illness caused by consumption of toxins produced by micro-organisms present in the food.
 - Infectious microorganisms are detrimental to their host through mechanisms which crowd out beneficial microorganisms, use up host resources, and destroy host tissue.
 - A food-borne illness caused by an infection can take days or weeks to manifest which often makes it difficult to identify the causative agent.
 - On the other hand, illness caused by intoxication often occurs within hours of consuming the suspect food. Intoxications are caused by toxins that are produced by the microorganism, either in the food itself or after ingestion.

Viruses

- In contrast to other microorganisms, active viruses consist of unique sections of DNA or RNA enclosed in a thin coat of protein, and cannot exist independently of their living hosts.

- Depending on the combination of DNA/RNA and the protein coating, viruses can be very infectious and often pathogenic.
- They reproduce by inserting themselves into a host cell and altering the function of that cell to replicate the component pieces that make up the virus.

Viruses commonly associated with food safety issues include:

- Bacteriophage
- Enteric Virus (other than Hepatitis A and Noroviruses)
- Hepatitis A virus
- Norovirus
- Norwalk virus
- Rota virus

Viruses are typically introduced into food either through poor handling practices by people infected with the virus (i.e. poor personal hygiene practices) or via contaminated food ingredients (i.e. water).

Parasites

- A parasite is any organism which obtains nourishment from its host organism in order to grow and reproduce.
- Unlike symbiotic organisms, which reciprocate by supplying their hosts with other resources the host would not otherwise be able to find, parasites do not supply the host with any resources, usually to the detriment of the host.

Parasites commonly associated with food-borne illnesses include:

- *Cryptosporidium parvum*
- *Giardia duodenalis* or *intestinalis*
- *Taenia* spp.
- *Toxoplasma gondii*
- *Trichinella spiralis*
- *Entamoeba histolytica*
- *Entamoeba coli*

Parasites enter food through similar means as viruses (i.e., poor personal hygiene practices and contaminated ingredients).

Other Biological Hazards - Prions

Other biological food safety hazards not belonging to the above mentioned categories include prions, also known as proteinaceous infectious particles, which are infectious agents made of protein. They are known to cause a number of diseases that affect both humans and animals. BSE or "Mad Cow Disease" is a progressive, fatal disease of the nervous system of cattle. It is also known as a transmissible spongiform encephalopathy (TSE). Other TSEs include scrapie in sheep and chronic wasting disease in deer and elk. Creutzfeldt-Jakob disease in humans is thought to be caused by consuming cattle infected with BSE. Although the exact cause of BSE is unknown, it is associated with the presence of prions. There is no treatment or vaccine currently available for the disease.

Chemical Hazards

Types and sources of chemicals in food that many cause illness if eaten include:

- Proteins or other substances that may cause allergic reaction (e.g. peanuts)
- Approved food additives, such as chemical preservatives, used incorrectly
- Residues from cleaning and sanitizing chemicals
- Deliberate or accidental addition of chemicals not approved for use in food.
- Chemical leaching from packaging into food
- Environmental pollutants from industrial waste such as mercury
- Agrochemicals such as pesticide residues, herbicides and veterinary chemicals
- Toxins of microbial origin such as mycotoxins in peanuts and histamines in fish
- Naturally occurring plant toxins such as glycoalkaloids in potatoes

Illness associated with chemicals in food can be caused by eating a high dose of chemical contaminant over a short period (i.e. an acute reaction) or by eating a low level of chemical contaminant over a long period of time (i.e. a chronic reaction).

Physical hazards

Physical contaminants in foods are objects that, under normal circumstances, should not be present in food products. Common contaminants include glass, bone, wood, metal, plastic, rubber, stones etc.