

Food Safety Program, for Processors and Distributors

FACT SHEET #19

Biological Hazards

Biological hazards are organisms, or substances produced by organisms, that pose a threat to human health. They are a major concern in food processing because they cause most food borne illness outbreaks.

Risk

These organisms can affect human health, including infection, intoxication and even death. Infection occurs when organisms invade the host and multiply in the body. Intoxication occurs when bacteria produce toxins that affect the body.

Infection can be prevented by properly processing and handling food products because pathogens are easily destroyed by heat. However, some bacteria that produce spores can survive cooking temperatures.

For example, steam cooking significantly reduces non-spore-forming food borne pathogens, but only inactivates spores. Examples of spore forming bacteria include *Bacillus cereus*, *Clostridium botulinum* and *Clostridium perfringens*.

Toxins are produced when toxin producing bacteria are present in high numbers. Bacteria must first grow in the food before producing toxins. These toxins are very difficult to eliminate. They survive normal cooking temperatures and even temperatures higher than 80°C (176°F).

The risk of intoxication is prevented by controlling the growth of toxin producing bacteria. These include: *Clostridium botulinum*, *Bacillus cereus*, and *Staphylococcus aureus*.

Major biological hazards

- **Bacteria** ex: *Salmonella spp.*, *Enterohaemorrhagic Escherichia coli*, *Campylobacter jejuni*, *Yersinia enterocolitica*, *Listeria monocytogenes*, *Bacillus anthracis*, *Bacillus cereus*, *Staphylococcus aureus*, *Clostridium botulinum*, *Clostridium perfringens*, *Vibrio vulnificus*, *Vibrio parahaemolyticus*
- **Virus** ex: hepatitis A virus, Norwalk viruses, Rotavirus
- **Parasites** ex: *Toxoplasma gondii*, *Cryptosporidia*, *Giardia spp.*, *Trichinella spiralis*, *Taenia solium*, *Anisakis spp.*

Sources

The major sources of biological contaminants in food are:

- animal guts: faecal contamination
- soil and water contaminated by non-treated manure
- cross contamination:
 - human contamination due to poor personal hygiene, faecal contamination, failure in infection control (illness not reported)
 - cross-contamination of food products spread from processing environment due to poor/improper sanitation

Factors affecting the growth of microorganisms in foods

- The **temperature** values for microbial growth depend on the type of microorganism. For example, psychrotrophs such as *Listeria monocytogenes* grow at refrigeration temperature (4°C or 39°F), while thermotrophs can grow at higher temperatures (45°C or 113°F).
- The **pH** of a product is related to the acidity or alkalinity of the product. The pH of products affects the growth of bacteria. Most bacteria grow in a pH range between 5 and 9.
- The **Water Activity (a_w)** refers to the water available in the product. The more water available, the better bacteria will grow. Table 1 shows the impact of water activity on bacterial spoilage.

a_w of product	Bacterial Spoilage	Examples
>0.90	spoilage easily	fresh vegetables, fresh meat, processed meat, milk, fish
0.78-0.90	susceptible to spoilage	dry cheeses, flour, cakes, beans, cereals
<0.78	little bacterial spoilage but mould may grow	rolled oats, dried fruits, caramels, dehydrated foods

Each of these factors is important for the control of microbial growth. It is the interaction among these factors that determines the growth or control of microorganisms.

Control and prevention

The most effective way to control biological hazards is by prevention. The implementation of Good Manufacturing Practices (GMPs) and Hazard Analysis and Critical Control Point (HACCP) will help prevent biological hazards in your facility.

GMPs ensure hazards associated with personnel and environment are controlled during food production. HACCP controls hazards that may be present in ingredients and packaging materials and also those that occur during food processing, packaging and storage.

Processing strategies to control biological hazards:

- effective thermal processing used as a kill step (ex: cooking, pasteurization)
- use of appropriate process controls:
 - storage temperatures (ex: cooler, freezer)
 - processing parameters (ex: temperature and time for cooking, water activity during dehydration)
 - adequate cooling system
- effective cleaning and sanitizing procedures (ex: SSOPs)
- use of food technologies to prevent the growth of bacteria or other biological hazards:
 - packaging techniques (ex: use of vacuum packaging, modified atmosphere packaging)
 - preservatives
 - processing techniques (ex: dehydration)

For information on the Food Safety Program contact the [CVO/Food Safety Knowledge Centre](#).

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For general information, contact your local [GO Centre](#).