

Food spoilage and contamination

Food spoilage may be caused by many various microorganisms – bacteria, yeast and moulds – as well as by enzymes naturally present in the food products. It is important to correctly store food and apply food safety principles to avoid spoilage and contamination of other products.

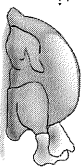
Microorganisms

Tiny organisms visible only under a microscope, e.g. bacteria, yeast and mould

Growth conditions

- Warmth** – ideally a temperature between 5 °C and 63 °C
- Water** – microorganisms grow better in moist conditions
- Food** – ideally protein, but sometimes also sugar
- Time** – the longer the time, the more time microorganisms have to multiply

Most microorganisms will grow rapidly in **danger zone temperatures** (5 °C to 63 °C) but will not grow below or above this limit. This is because enzymes necessary for replicating the cell become inactive at temperatures below 5 °C and over 63 °C.



Microorganisms' growth can be controlled by:

- ✓ Storing food in proper conditions
- ✓ Freezing or refrigerating fresh food
- ✓ Cooking food thoroughly before eating
- ✓ Not refreezing food once it has been defrosted



High-risk foods

Foods which have optimal conditions for microorganisms' growth

- Protein-rich, moist and usually raw
- Include meat and poultry, fish and seafood, eggs and milk

Use in food production and signs of food spoilage

Many species of microorganism and some enzymes can cause food spoilage or diseases. Others are used in manufacturing of various food products.

	Food spoilage	Use in food manufacturing	Why does this work?
Bacteria	<i>Clostridium botulinum</i> produces a toxin which causes meat preserves to bulge. Most bacteria do not cause visible signs of spoilage, so poisoning is possible even if the food looks and smells normal.	Cheese uses a starter culture called <i>Lactobacillus</i> bacteria to give it a balanced aroma taste and texture. Yoghurt also uses the same starter culture to help milk clot. Probiotics are also used to help benefit health.	Bacteria ferment lactose from milk and turn it into lactic acid, which gives the food a sour taste and coagulates protein in milk, which, for example, causes yoghurt to become thicker.
Yeast	Ferments sugar in juices and beverages, making them sour, fizzy and foamy.	Bread, doughnuts and other baked goods use yeast to help them rise.	Yeast ferments sugar in foods and produces carbon dioxide to help it rise. It also creates fizz in some alcoholic drinks.
Mould	Creates a green, white or black coating on food products such as bread, grapes, tomatoes and jams.	Blue cheeses, such as Stilton, have a mould called <i>Penicillium</i> added to give them a distinctive texture, taste and aroma.	Mould breaks down polysaccharides into shorter chains, which changes the taste of the food.
Enzymes	Turn bananas, apples, potatoes and other foods brown.	Rennet is an enzyme used in cheese production to coagulate milk.	Enzymes react with oxygen and turn yellow pigments in food into brown melanin.

Cross-contamination

- ⊗ **Cross-contamination** is when bacteria, toxins or food particles are transferred to a food product.
- ⊗ Cross-contamination can cause **food poisoning** and allergic reactions.
- ⊗ **Anaphylactic shock** is a life-threatening reaction of the immune system to an allergen, e.g. food

Food can become contaminated by:

- ✗ waste food and rubbish
- ✗ pests and rodents
- ✗ the cook's hands
- ✗ work surfaces and equipment
- ✗ other contaminated foods, including high-risk foods

Enzymes

Biologically active protein-based molecules. They are **catalysts**, which means that they can speed up the rate of chemical reactions. Enzymes are necessary for fruit to ripen.

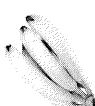
Darkening of fruit and vegetables caused by enzymes is called **enzymic browning** and should be avoided to preserve nutritional value of food.



Enzymic action can be stopped by:

- Blanching vegetables before freezing
- Blanching means that food is put into boiling water then immediately plunged into cold water or ice.
- **Use of acids** (lemon juice or vinegar) Acid denatures and deactivates enzymes, because they are built of protein.

Enzymes are also used in food production.



Food poisoning

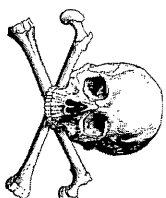
- ⊗ Food poisoning is a disease caused by eating spoiled or contaminated food. Such food may contain certain microorganisms, toxins or enzymes.
- ⊗ Microorganisms which cause diseases are called **pathogenic**.
- ⊗ A person who carries a pathogen but shows no symptoms of a disease is called a **carrier**.

Food poisoning bacteria and where to find them:

- ✗ **Camphylobacter** → raw poultry and unpasteurised milk
- ✗ **E. coli** → undercooked beef, unwashed vegetables, dirty hands
- ✗ **Salmonella** → raw eggs, meat and poultry, unpasteurised milk
- ✗ **Listeria** → ready-to-eat foods, unpasteurised milk, dirty hands
- ✗ **Staphylococcus aureus** → salads, ham, eggs, tuna, poultry, cream, hands of an infected person

Symptoms of food poisoning:

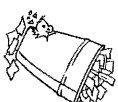
- ⊗ Stomach pains and cramps
- ⊗ Nausea and vomiting
- ⊗ Diarrhoea
- ⊗ Fever
- ⊗ Shivering



Most common allergens:

- Nuts
- Fish and seafood
- Milk
- Eggs

More on p. 14



Cross-contamination and food poisoning may be avoided by:

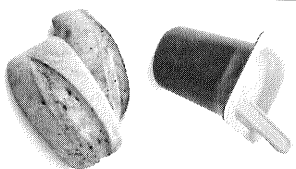
- ✓ washing hands after dealing with high-risk foods, rubbish or using a toilet
- ✓ properly cleaning work surfaces and utensils
- ✓ using dedicated, colour-coded utensils only
- ✓ storing food in proper conditions
- ✓ storing raw and cooked foods separately
- ✓ cooking food thoroughly before eating
- ✓ applying food safety standards and schemes, such as the British Lion Scheme

British Lion Scheme

Food safety mark which guarantees that eggs are produced in the UK and that all the hens have been vaccinated against salmonella.



Faecal contamination
Faecal contamination with *E. coli* may take place when people don't wash their hands after using the toilet or when human and animal body waste is used to fertilise crops.



Temperature control

is important for preventing food spoilage and bacterial growth.

The following temperature guidelines are set out for storing and cooking foods.

Freezing	-18 °C
Chilling	0 °C to 5 °C
Cooking	75 °C
Reheating	75 °C

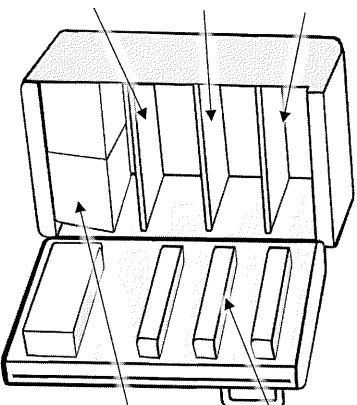
5 to 63 °C

Temperature Danger Zone
Range of temperatures at which microorganisms grow the fastest, posing a risk of food spoilage and food poisoning

Correct use of a domestic fridge and freezer

will ensure freshness and safety of food

Fridge temperature: 0 to 5 °C



Top shelf
Ready-to-eat foods, dairy, yogurt, cream

Middle shelf
Butter, covered cooked meats, packaged foods

Bottom shelf
Raw meat, poultry and fish in sealed boxes

Important storage points

Tainting means that the smell of one food contaminates another food

Always keep food covered or sealed to avoid tainting!

Freezer temperature: -18 °C

Fast-freeze button: -25 °C

Freezer burn involves the dehydration and oxidation of food caused by improper freezing (e.g. inadequate packaging)

Use special freezer bags to avoid freezer burn
Do not overload to enable air circulation

Defrosting = thawing

Defrost foods in a box or on a tray to catch any leaking liquids.

STOP

Never refreeze defrosted food!
The bacteria in food begin to multiply in defrosted food so it's best to use it straightaway to avoid the risk of food poisoning.

Principles of food safety

Applying certain hygiene rules and properly storing food products helps to prevent food spoilage and contamination, and lowers the risk of food poisoning or allergic reaction.

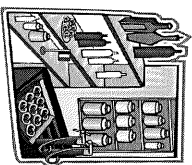
Key Terms

- Shelf life:** Period of time during which food can be safely stored and eaten
- Food poisoning:** Illness caused by eating contaminated food or drinking contaminated water
- First in, first out:** Rule which says that the oldest foods should be eaten first
- Vacuum packing:** Packing food in airtight foil bags to remove oxygen and prevent spoilage

Food covering

- ✓ Protects from light
- ✓ Protects from air, oxygen and dust
- ✓ Protects from pests and rodents
- ✓ Prevents tainting

Ambient Storage

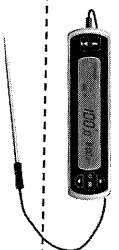


Storing food at room temperature (usually around 20 °C)

Food temperature probe

Helps measure the temperature in the food core and ensures that it is properly cooked

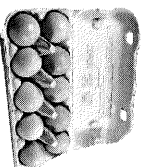
1. Clean and disinfect the probe before using
2. Insert into the thickest part of the food, making sure not to touch the tin or bone with the tip of the probe
3. Wait a couple of minutes for the temperature to stabilise
4. Read the temperature
5. Remove the probe
6. Clean and disinfect after use



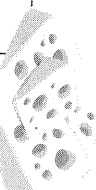
PERISHABLE FOODS

Foods which have a fairly short shelf life and need to be stored in the fridge

- Raw and cooked meat, especially minced
- Raw and cooked poultry
- Raw and cooked fish and shellfish
- Milk and dairy
- Eggs
- Vegetables and fruit



An insulated cold bag can be used to transport high-risk foods and maintain their low temperature.



Date marks

Best before – applies to food quality (look, flavour and colour) and it's relatively safe to eat the food after that date. It is used on dry, frozen or tinned foods and eggs

Use by – applies to food safety so it might be harmful to eat a food after that date; used on fresh foods such as milk and dairy

Food safety principles when cooking and preparing food

Applying these rules will help to keep the food safe for consumption and prevent spoilage

Personal hygiene

- ✓ Always wash hands before and after cooking and dry with disposable paper towels
- ✓ Avoid touching your face or hair
- ✓ Tie your hair back and cover with a hairnet
- ✓ Avoid cooking when you're ill
- ✓ Change clothes and use an apron
- ✓ Cover any wounds with a waterproof plaster
- ✓ Do not wear rings or other jewellery when cooking



Work surfaces

- ✓ Clean thoroughly after dealing with high-risk foods
- ✓ Use soapy hot water or antibacterial spray to clean any spills
- ✓ Use a clean kitchen towel or disposable paper towels

Separate foods

- ✓ Separate raw and cooked foods, both when preparing and storing food
- ✓ Cover prepared food and store in closed containers
- ✓ Use dedicated, colour-coded utensils
- ✓ Wash dishes straightaway in hot water to avoid pests and cross-contamination

Temperature control

- ✓ Make sure the temperature inside food reaches 75 °C both when cooking and reheating
- ✓ Make sure the temperature of served food is above 63 °C
- ✓ Do not put hot food straight into the fridge – let it cool for 90 minutes
- ✓ Ensure correct cooking time to avoid cold spots
- ✓ Defrost thoroughly to avoid cold spots