

**DRAFT ONLY**



# **Food contamination and spoilage**



# Learning objectives

- To know the three methods of food contamination.
- To understand the two different food changes through autolysis and micro-organisms.
- To identify positive food changes.
- To know the conditions which promote bacterial growth.



# Food contamination

There are three ways which food can be contaminated:

- Physical;
- Chemical;
- Bacterial.



# Physical contamination

This can occur in a variety of ways at different stages of food processing and production. Some examples are:

- soil from the ground when harvesting;
- a bolt from a processing plant when packaging;
- a hair from a cook in the kitchen.

Care must be taken at each stage to prevent physical contamination.



# Chemical contamination

This can occur in a variety of ways at different stages of food processing and production. Some examples are:

- chemicals from the farm;
- a cleaning product used in the processing plant when packaging;
- fly spray used in the kitchen when preparing food.

Care must be taken at each stage of food production to prevent chemical contamination.

# Bacterial contamination



As soon as food is harvested, slaughtered or manufactured into a product it starts to change. This is caused by two main processes:

- autolysis – self destruction, caused by enzymes present in the food;
- microbial spoilage – caused by the growth of bacteria, yeasts and moulds.



# Desirable food changes



Autolysis and micro bacterial changes are sometimes desirable (and are not referred to as spoilage), for example enzymes cause fruit to ripen.



Here are some positive micro bacterial changes below.



Bacteria in yoghurt production.

Mould in some cheeses, e.g. Stilton.

Yeast in bread production.



# Autolysis - enzymes

Enzymes are chemicals that are found in food.

These chemicals have important uses in food. They can cause food to deteriorate in three main ways:

- ripening – this will continue until the food becomes inedible, e.g. banana ripening;
- browning – enzymes can react with air causing the skin of certain foods, e.g. potatoes and apples discolouring;
- oxidation – loss of certain nutrients, such as vitamins A, C and thiamin from food, e.g. over boiling of green vegetables.



# Microbial spoilage - bacteria



These are single celled micro-organisms (they cannot be seen by the naked eye) which are present naturally in the environment.

There are many different kinds, some are useful, e.g. in the production of yogurt, and some harmful.

The presence of bacteria in food can lead to digestive upset.

Some bacteria produce toxins which can lead to this also.

Spores can also be produced by some bacteria leading to toxins being produced.



## Microbial spoilage - yeast

Yeasts are single celled fungi which can reproduce by 'budding'. This means that a small offshoot or bud separates from the parent yeast cell. Yeasts can also form spores which can travel through the air. These are easily killed by heating to 100°C.

In warm, moist conditions in the presence of sugar, yeasts will cause foods like fruit to ferment producing alcohol and carbon dioxide gas.

Yeast is used in the production of bread and wine.

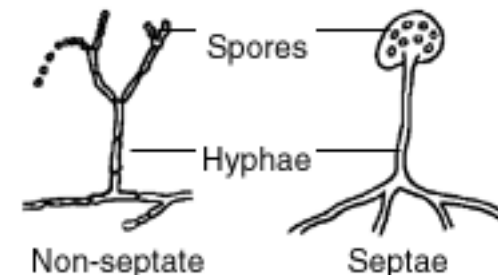
# Microbial spoilage - mould



Moulds are fungi which grow as filaments in food. They reproduce by producing spores in fruiting bodies which can be seen on the surface of foods.

These fruiting bodies sometimes look like round furry blue-coloured growths, e.g. mould on bread.

Some moulds can be seen by the naked eye, e.g. on bread.



# Conditions for bacterial growth

Micro-organisms need conditions to survive and reproduce these can include:

- temperature;
- moisture;
- food;
- time;
- oxygen;
- pH level.



# Conditions for bacterial growth



## Temperature

Bacteria need warm conditions to grow and multiply.

The ideal temperature for bacterial growth is 30°C – 37°C.

Some bacteria can still grow at 10°C and 60°C. Most bacteria are destroyed at temperatures above 63 °C. Bacterial growth danger zone in 5°C - 63°C.

At very cold temperatures, bacteria become dormant – they do not die, but they cannot grow or multiply.

# Conditions for bacterial growth

100°C Water boils

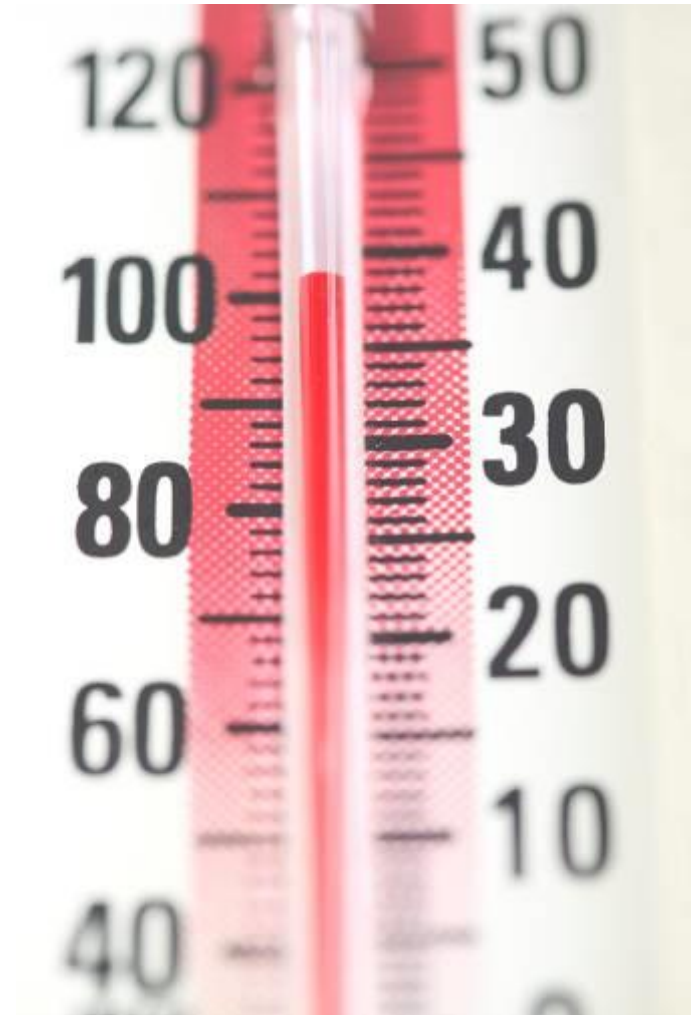
82°C Core temperature of hot food

5°C - 63°C danger zone for rapid growth of micro-organisms

1°C - 4°C temperature of fridge

0°C Freezing point of water

-18°C temperature of freezer





# Conditions for bacterial growth

## Moisture

Where there is no moisture bacteria cannot grow. However, bacteria and moulds can both produce spores which can survive until water is added to the food.

## Food

Bacteria need a source of food to grow and multiple, these food usually contain large amounts of water and nutrients.

## Time

One bacterium can divide into two every 20 minutes. Food where bacteria rapidly multiple in are called perishable foods.

# Conditions for bacterial growth



## Oxygen

Some bacteria need oxygen to grow and multiply. These are called aerobic bacteria. Other bacteria grow well when there is no oxygen present, these are known as anaerobic bacteria.

## pH level

An acidic or alkaline environment can promote or inhibit microbial growth. Most bacteria prefer a neutral pH (6.6 – 7.5). Moulds and yeasts can survive at pH levels of 1-1/5 (very acidic), food spoilage usually occurs by yeast and moulds.





# Review of the learning objectives

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For more information visit

[www.nutrition.org.uk](http://www.nutrition.org.uk)

[www.foodafactoflife.org.uk](http://www.foodafactoflife.org.uk)