



Food and Nutrition

GCSE (9–1) | Eduqas | C560



2016 specification
first exams in 2018

endorsed for
eduqas

Course Companion

for Eduqas GCSE Food Preparation and
Nutrition: Where food comes from

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Teacher's Introduction

This resource is designed to meet the Area 5: Where food comes from element of the Eduqas GCSE Food Preparation and Nutrition qualification.

What it covers

The resource comprises three chapters covering the following:

Chapter 1: Food provenance	Chapter 2: British and international cuisines	Chapter 3: Food manufacturing
• The origins of food (where and how food is caught, grown or reared) • Sustainability and security of food	• British cuisine • International cuisines	• Food processing (primary and secondary) • Technological developments which support health and food production

How to use this resource

The resource covers all aspects of food safety and is designed to increase knowledge of the topic and enable learners to test their understanding and skills through a variety of assessment methods.

Learning Outcomes enable the learner to clearly see what they are expected to know at the end of each chapter.

The **Overview** provides a brief summary of what will be covered in the chapter and the **Key Terms** provides information on key terms within the resource (key terms are emboldened within the chapter text).

Did you know?	These boxes contain handy tips.
Things to think about	These boxes provide learners with a chance to develop cognitive skills, do some research (books, Internet, people) and take part in a discussion.
Apply	These boxes provide the learner with the opportunity to further their skills, either through cognitive or practical application.
Qs	These test learners' knowledge and understanding through quick Y/N questions.
Skills	Based on the suggested application of skills section of the Eduqas GCSE Food Preparation specification, these test learners' food safety skills through practical application.
Study tip	Useful tips to help the learner concentrate on important aspects of the text that may appear in the final assessment.
Check your understanding	Multiple-choice, short-answer and extended-answer questions appear at the end of each section to test knowledge and develop understanding.
Quiz-ine	A crossword-style quiz at the end of each chapter to test learners' understanding of key terms used in the resource. The shaded squares spell out a word associated with the chapter text.
Answers	Answers to questions are provided at the end of the resource.

A webpage containing all the links listed in this resource is conveniently provided on ZigZag Education's website at zzed.uk/8253

You may find this helpful for accessing the websites rather than typing in each URL.



M Golebiowska, March 2018

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Register your email address to receive any future free updates* made to this resource or other Food and Nutrition resources your school has purchased, and details of any promotions for your subject.

* resulting from minor specification changes, suggestions from teachers and peer reviews, or occasional errors reported by customers

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Chapter 1: Food provenance

Overview

In this chapter you will learn how foods are grown, reared and caught. You will discover various methods of farming, and their advantages and disadvantages. You will also learn to recognise various types of fruit, vegetable, meat and fish. In the second section of this chapter you will learn about food security and sustainability of resources.

Learning outcomes

After studying this chapter, you should be able to do the following:

- ☐ know and distinguish between grown, reared and caught
- ☐ classify fruit, vegetables, meats and fish
- ☐ understand the advantages and disadvantages of various methods of food production
- ☐ understand the impact of food production on the environment
- ☐ describe various aspects of food security and efficiency

Key Terms

Affordable	When something, e.g. food is not too expensive for most people
Availability	When it is possible to buy or get a sufficient amount of something
Carbon footprint	How much energy has to be used, and, therefore, how much carbon dioxide is produced, in the production, processing and transportation of foods
Factory farming	Type of agriculture focused on intensifying food production by keeping large numbers of animals in small areas of land, to increase production of milk and meat, but at high potential costs
Fairtrade	Ethical category that enables fair wages and prices for food producers in developing countries; designed to prevent human exploitation
Fish farms	Tanks or enclosed sea areas in which fish or seafood is reared
Food miles	How far the food has to travel from the producer to the consumer
Food poverty	Inability to provide oneself with enough food, both in terms of quantity and quality
Food security	A term created by the United Nations, meaning that, at any time, in any place, in the world, each person should have access to a sufficient quantity of safe and nutritious food
Food waste	Food that is rotten, spoiled or wasted in another way, and hence not fit for consumption
Free-range	Farming method in which animals and birds are allowed to move freely outdoors for at least part of the day
Game	The meat of hunted animals and birds
Genetically modified (GM)	When the DNA of a given organism is manipulated by genetic engineering
Greenhouse gases	Gases which tend to trap heat in the atmosphere, increasing the temperature. They include water vapour, carbon dioxide, methane, nitrous oxide and ozone
Intensive farming	Type of agriculture focused on intensifying food production by using large amounts of fertilisers, herbicides, GM crops and other methods
Livestock	All animals kept, bred and reared to provide food, work or transport
Local food	Food produced locally, in a given region
Orchard	Enclosed area of land used to grow fruit or nut trees
Organic	Grown or reared with restricted use of any chemicals, pesticides, herbicides or GM feed and GM organisms, under strict conditions
Polytunnel	Tunnel frame covered with polyethylene, used to grow plants
Poultry	The meat of farmed birds, e.g. chicken and turkey
Seasonal food	Food characteristic for a given season of the year
Sustainability	Ability to maintain the natural environment and produce goods and services
Venison	The meat of a deer

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The origins of food: where food comes from

For a long time, people were hunter-gatherers, which means that their diet was based on what was available in their surroundings. This included wild animal meat, fish, and some fruit and herbs. Agriculture was invented and started to revolutionise humans' diet. Today, most of our food is produced using modern technologies; only a small amount of the food we eat is still gathered from the wild.

Food has to be grown, reared, caught or gathered, before it is processed and can be served on plates. In this section we will discuss the different methods of food production and how they affect the food we eat.

Grown foods

Foods may be grown in fields, orchards or polytunnels.

The most traditional way of growing foods includes fields and **orchards**. These are large areas in which roots, bushes and trees are grown to produce vegetables, fruits, nuts and seeds. They are kept under the open sky, which means that they are susceptible to all weather changes, low and high temperatures, droughts and floods, soil overexploitation, pests, rodents, wild animals and birds. Managing a field or an orchard in a certain region also involves deciding what plants are actually capable of living in given conditions. All these factors mean that crops from fields and orchards are very unpredictable and require various treatments to overcome all possible dangers. To increase crops and prevent possible damage, most farmers decide to use pesticides, herbicides and many other chemicals.

Did you know?

The UK has a lot of 'arable' land, which is land used for growing crops.

Did you know?

51% of the UK is made up of arable land, which is the least of any European country.



Picking apples in an orchard



Field of crops

Polytunnels were invented in the 1940s to enable the growth of tropical fruits and vegetables. They are long, plastic tunnels created to ensure the warmth and humidity necessary for proper development of such plants. Thanks to polytunnels, we can enjoy strawberries, cucumbers and lettuce all year long. Polytunnels protect the plants from external hazards such as weather changes or insects, and, therefore, it is easier to predict how much food will be produced.



Strawberries in a polytunnel

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Where food is grown	What food is grown there	
Field	grains	cereals such as wheat, barley, oats
	oil plants	flax seed, rapeseed
	root vegetables, cruciferous plants and brassicas	potatoes, carrots, cabbages
Orchard	mostly hard fruit and nuts	apples, cherries, pears, olives, walnuts
Polytunnel	mainly soft fruit	strawberries, raspberries, tomatoes
	vegetables	lettuces, cabbages, aubergines
	herbs and mushrooms	white mushrooms, oyster mushrooms

Did you know?

Some vegetables such as lettuce, basil or wasabi may be grown using hydroponics. This means they are not planted in soil, but their roots are put directly in water.

Research

Find out what plants can be grown hydroponically at <http://modularhydro.com/ArticleLibrary/WhatCanYouGrowHydroponically>



Hydroponic farming

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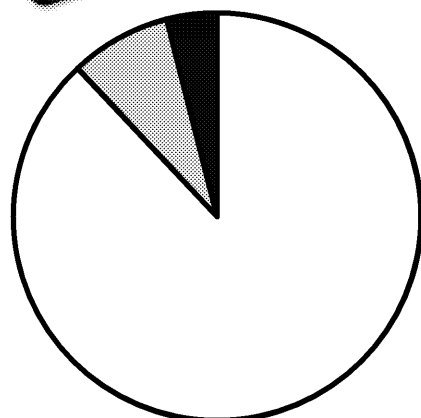


The region in which people live often determines what can be grown and, therefore, determines their diet. This usually is embodied in national dishes; for example, Mexican cuisine uses a lot of sweetcorn because maize grows in Mexico, but traditional British cuisine doesn't have any sweetcorn in it because the grain was introduced to the UK only at the end of the fifteenth century, and for a long time couldn't even be grown here because of the climate.

The charts below illustrate the main three grains consumed around the world – wheat, rice and maize.

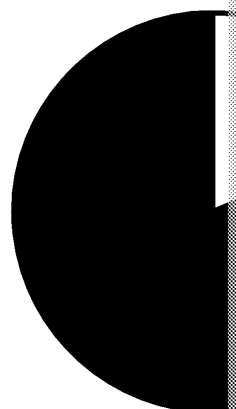
Notice how consumption patterns change with the region and climate of each country. Rice is the most popular food in the world (30% of total consumption), followed by wheat (18% of total consumption). Next, there are vegetables (8%).

 United Kingdom



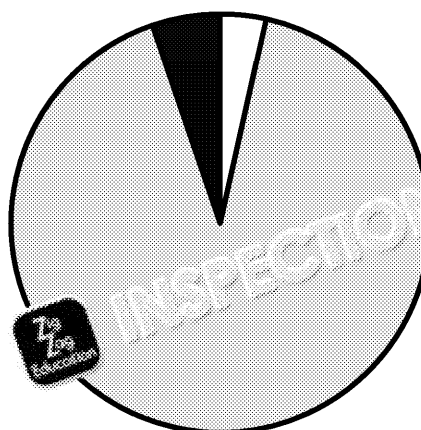
■ Wheat ■ Rice ■ Maize

Mexico



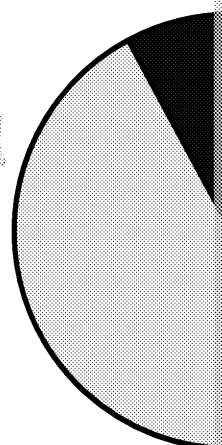
■ Wheat ■ Rice ■ Maize

Vietnam



■ Wheat ■ Rice ■ Maize

Japan



■ Wheat ■ Rice ■ Maize

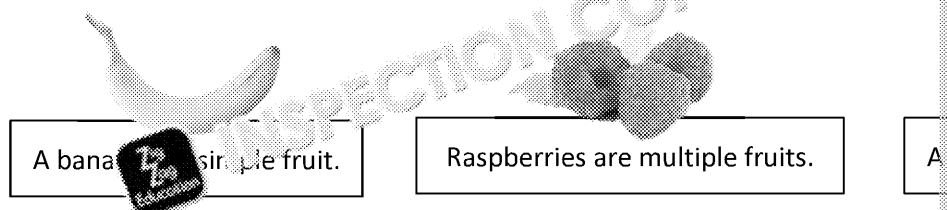
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Classification of fruit and vegetables

Botanically, fruits are plant parts which develop from fertilised flowers. They usually carry one or more seeds, which allow the reproduction of the plant. Due to the development of technology, it is possible to produce fruits which are seedless. Generally, a fruit consists of a seed or seeds surrounded by a pericarp (the soft or hard fleshy part) and covered with skin. An exception is the strawberry, which has its seeds on the outside.

Fruits can be classified according to how many flowers they have developed from. This means we can differentiate between simple fruit (developed from one ovary / flower), multiple fruit (developed from multiple flowers gathered into a mass) and aggregate fruit (developed from multiple ovaries of a single flower).



Fruits can also be classified according to their type / culinary use.

Tree fruits	grow on trees, have an edible skin and firm texture	apple, pear
Stone fruits	have a hard stone in the middle, usually surrounded by a soft, fleshy pericarp	plum, cherry
Berries / soft fruits	soft texture and small pips	strawberry, raspberry
Dry fruits	their skin becomes dry once they reach maturity	plum, cherry
Exotic fruits	characteristic of tropical countries, not grown in the UK	banana, mango, kiwi
Citrus fruits	surrounded by tough, aromatic skin; have a juicy texture	orange, lemon, lime

Vegetables can be classified according to which part of the plant they come from.

Fruits	ingredients which are botanically fruit, but are used as vegetables in cooking	courgette, cucumber, aubergine
Seeds	those which grow in pods (which are also sometimes eaten)	green peas, beans
Flowers	the edible flowers	artichoke, broccoli
Leaves	formed by the leaves	lettuce, kale, cabbage
Stems	the edible stem which constitutes the main part of the vegetable	asparagus, celery
Roots	usually long or rounded in shape	carrot, parsnip, beetroot, sugar beet
Bulbs	grow just below the surface of the ground and are formed of many layers	garlic, onion, leek
Tubers	developed from the root of the plant	potato, yam, Jerusalem artichoke
Fungi	many mushrooms can grow both above and below the ground	Portobello, button

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Things to think about

Discuss the advantages and disadvantages of growing foods in fields.

Cereals can be generally classified as starchy cereals (e.g. wheat, barley, oats, rice).

Reared foods

People have learnt to rear a number of species to satisfy the needs of growing populations (among others) cattle, goats, sheep, pigs, rabbits and poultry. Animals are reared for their milk and wool, and for their muscle power (for example, horses are still used as working animals in some countries). Also their excrement is used to produce energy or as a fertiliser. According to local habits or requests, people can rear camels, reindeer or even snails.

The need to maintain economic growth and produce more and more food has led to the development of **factory farms**. These are usually large enterprises, rearing hundreds or often thousands of livestock. This applies especially to cows (milk farms), pigs (reared mainly for pork) and hens (reared for eggs or meat). Factory farms often apply the rules of **intensive farming** to increase production and the profit it brings.

Apply

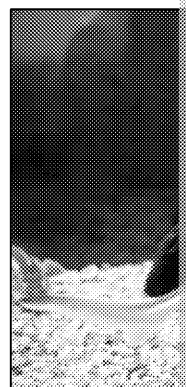
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The following table is a summary of what animals people rear and why.

What people rear...	
Cattle	Leather, beef, milk
Poultry	Meat
Horses	Meat, entertainment
Pigs	Pork, leather

Also, some fish are considered reared foods. These include salmon, trout, cod, carp, catfish and some shellfish raised on **fish farms** that were created especially for human needs. In fish farms, fish are kept in large containers (fish tanks), which are sometimes seriously overcrowded.

Although this might be ethically dubious, fish farms help to prevent and avoid overfishing of the seas and oceans, and help to preserve naturally occurring species. The fish in fish farms is reared for meat and caviar, and leftovers or non-edible parts are used to produce animal feed.



Sturgeon

Research

Read more about fish farming in the UK at <https://www.rspca.org.uk/adviceandwelfare/fish/farming> and draw up steps in fish production. Do fish farms use organic or conventional farming methods?

Poultry, such as chickens, geese and turkeys, is also reared around the world for meat and eggs. The animals are kept in henhouses. The birds may be kept in tight cages, or more free-range around the house and even be allowed to go outside. The way in which poultry is reared affects the quality of meat and eggs produced. Also, **organic farming** rules may apply here – this is why organic meat and eggs are not given antibiotics if not necessary, etc.

Nowadays, it is more and more popular to rear animals which were traditionally hunted.

You may sometimes meet ecologists or animal welfare activists who are protesting about the conditions the animals are kept in or the way they are treated.

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An example of this is rearing geese in France using a method in which feed is forced into their stomachs via tubes to increase the growth of liver and fat tissue, for the production of foie gras. This method of rearing has been labelled as cruel and, therefore, banned in the UK, although it is legal to buy foie gras.

Another example is squeezing many animals in tight boxes placed on top of each other, as is the case in battery farms (cage egg farms). The hens can also have their wings cut to prevent them from moving too much and their beaks trimmed to prevent them from fighting with each other.



Force-feeding
fattening

Other concerns include:

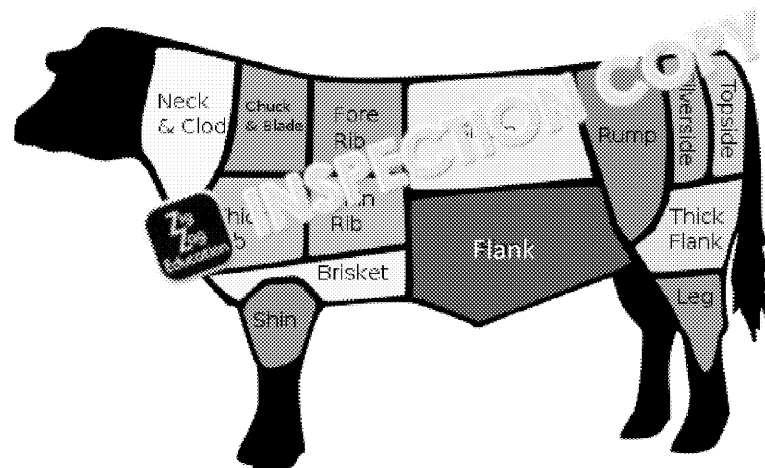
- keeping animals in closed buildings without access to natural sunlight
- cramming in animals so they can't turn around or move (e.g. cows in feedlots)
- using antibiotics to prevent diseases and speed up the growth of animals, which can lead to the development of antibiotic-resistant strains (which, in the near future, may lead to creation of new, lethal diseases)
- genetically manipulating DNA of animals to produce more muscle tissue, eggs, etc. (e.g. transgenic animals would produce more meat)
- overexploiting animals, which shortens their life (an intensely reared cow lives for around 20 months for one living in the wild)
- transport conditions – when animals are finally transported to slaughterhouses in trucks and often spend a couple of days without food or water before they are slaughtered
- slaughtering conditions, in which animals' throats are slit open and the animals are bled out

Classification of meat and poultry

Meat is the muscle tissue of animals. Usually it can be divided into:

- lamb (meat from sheep younger than 12 months)
- beef and veal
- pork (from pig)
- poultry (from chicken, duck, turkey, goose, etc.)
- game (both from mammals and birds – see caught foods for more info)
- offal (the edible internal organs of the animal)

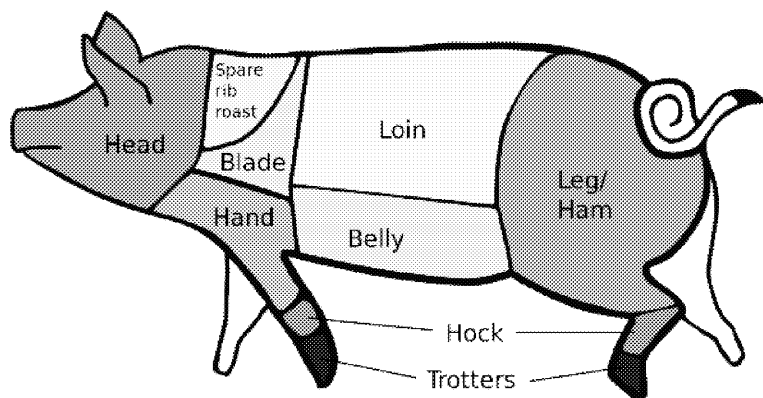
The origin of meat and the way the animal was reared determines its quality, flavour and texture. Different cuts of beef, pork and lamb, and their culinary uses, are shown in the diagrams below.



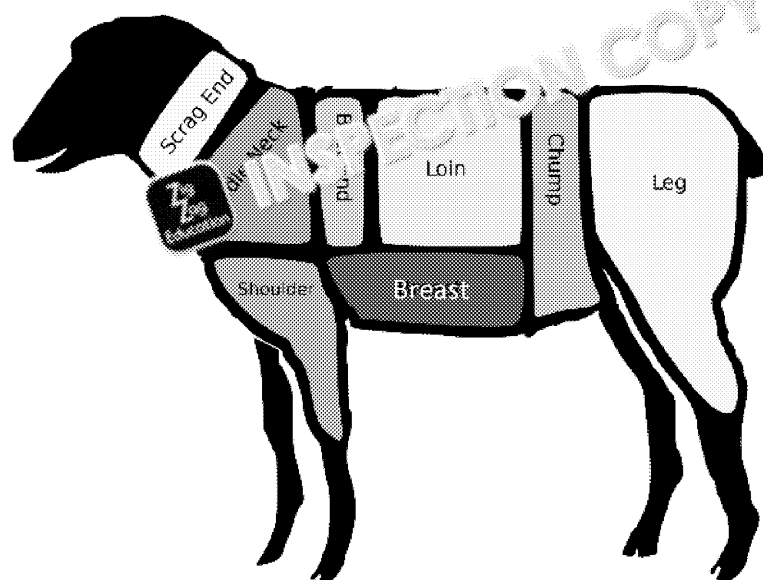
- Chuck and blade – used for braising
- Fore rib – used for roasting
- Sirloin – steaks, also used in mince
- Rump – steaks
- Silverside – used for roasting
- Flank (skirt) – used for roasting
- Leg and shin – used for roasting
- Thin rib – used for roasting
- Thick rib – used for roasting
- Brisket – used for roasting

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Head – slow cooking
Spare rib – braising, roasting
Blade – slow cooking
Loin – grilling, roasting
Leg (ham) – braising, roasting
Belly – bacon, roasting, braising
Hand – slow cooking
Hocks and Trotters – slow cooking



Scrag end – braising, roasting
Best end (rack) – roasting
Loin – grilling, roasting
Chump – grilling, roasting
Leg – roasting
Breast – roasting
Shoulder – slow cooking

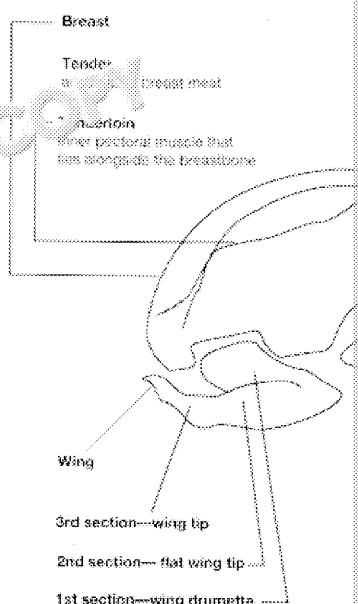
Meat can also be divided into fatty or lean, depending on the amount of fat it contains. Bacon is fatty, while tenderloin is an example of lean meat.

Research

Go to <http://www.yourarticlelibrary.com/home-science/meat/meat-meat-and-classification/86567/> to see how lamb, beef and pork are further classified.

Poultry includes the meat of domesticated fowl, such as chicken, turkey, duck and geese. The diagram (right) shows the main cuts of poultry carcass.

The breast is usually the tenderest part, which requires only a short cooking time. The skin is rich in collagen, which makes it a suitable base for preparing a savoury jelly. After marinating, the meat can be grilled, steamed, stir-fried or roasted. The carcass that is left after portioning (consisting of the neck, backbone, ribs and tail) can be used as a base for preparing soups and stocks. It is important to remember that fat in poultry accumulates mainly under the skin, so removing the skin is a good way of reducing the calorific value of a dish.



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Caught foods

Caught foods include all wild animals that can be hunted and eaten. This includes game and wild fish that live in the seas and oceans (such as tuna, mackerel, herring and shellfish).

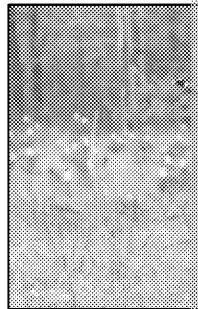
In the United Kingdom, game (or quarry) is defined by the Game Act of 1831 and the Deer Act of 1991. The name applies to such animal species as grouse, ducks, geese, pheasants, hares, rabbits and deer. Meat from a deer can also be called *venison*.

People have been hunting animals for centuries – either for food, horns and antlers, sport or entertainment. Since this has led to the extinction of many species, it is now often either forbidden to hunt certain species or it is allowed in certain seasons only.

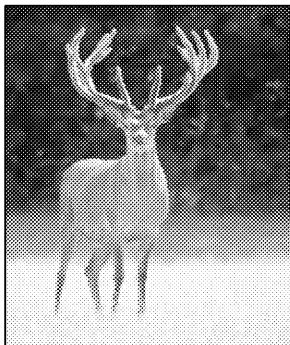
Some wild animals are especially those high in numbers and causing damage to crops can be hunted all year long with a permit. This applies to wild boar, for example.



Pheasant is often hunted for its delicate meat



Certain breeds of pheasant are bred to be hunted



Some species, such as deer, can only be hunted outside the breeding season. This is to protect the species and prevent it from becoming overpopulated.



An angler shows off a catch



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Classification of fish and game

Caught animals can be divided into:

- small birds, e.g. thrush, quail
- winged game, e.g. pheasant, wild geese, woodcock, grouse, partridge
- ground game, e.g. hare, rabbit
- big game, e.g. deer, wild boar, moose, caribou

Since these animals live in the wild, we have no control over what they may have could carry. For this reason, it is advisable to have them checked by a vet before as they could carry parasites such as *Trichinella spiralis*.

Fish for culinary purposes can be divided into subgroups depending on:

- their natural environment – saltwater fish or freshwater fish
- their shape – flatfish or roundfish
- their fat content – lean fish (less than 5% fat), mid-fat fish and oily fish (more than 5% fat)

Examples of quality, type of fish are shown in the table below.

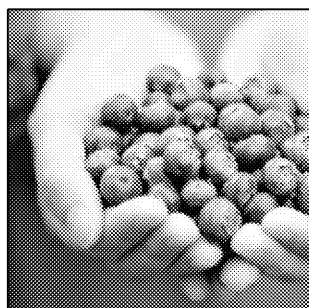
Criterion	Type of fish	Examples
Origin	Saltwater fish	Cod, mackerel, sea bass
	Freshwater fish	Carp, salmon, trout
Shape	Flatfish	Sea bream, plaice
	Roundfish	Carp, salmon, trout
Fat content	Lean fish	Cod, sea bass
	Mid-fat fish	Halibut, sea bream
	Oily fish	Herring, mackerel

Nowadays, more and more animals that have traditionally been classified as caught on farms, such as oyster farms. This helps to control their quality and safety, as well as the environment. It also helps to protect the environment and save wild animals from extinction.

Did you know?

In some countries and communities, gathering foods is still popular. This includes gathering herbs, mushrooms, wild berries and roots.

Herbs such as stinging nettles may then be used for production of herbal teas, certain kinds of cheese, medicines and dietary supplements, cosmetic products and animal feed. Mushroom picking is popular, especially in Eastern Europe, where various kinds of mushrooms are picked from early May (e.g. chanterelles) to late October (e.g. boletus).



Picking mushrooms and forest fruit is popular in many European countries.

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Check your understanding: Where food comes from

1. Cattle are reared for... (1 mark)

a. meat	☐	b. milk	☐
c. biofuel	☐	d. all of the above	☐

2. Reared foods do not include... (1 mark)

a. salmon	☐	b. duck	☐
c. hen	☐	d. triticale	☐

3. Which method allows year-round availability of food? (1 mark)

a. growing wheat in the field	☐
b. growing strawberries in polytunnels	☐
c. growing apples in orchards	☐
d. growing lettuce in the field	☐

4. Name two examples of foods which can be both reared and caught. (2 marks)
.....
.....

5. Explain two reasons behind rearing fish in fish farms. (4 marks)
1
.....
2
.....

6. Evaluate the advantages and disadvantages of growing plants in polytunnels. (4 marks)
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How food is grown, reared or ca

All food ingredients can be grown or reared in various ways. Most commonly use and **factory farming**, although in the past decade **organic** farming has been gaining you will learn about various methods of food production, including various metho production.

Conventional farming

Conventional (or **intensive**) farming is a kind of agriculture in which the main target To achieve that, farmers may choose to use:

- pesticides
- herbicides
- GM seeds which are resistant to poor weather conditions
- artificial fertilisers
- or all of the above

Conventional farming usually leads to deterioration in soil quality, which means it cannot be used for growing any more. Conventional farming may also lead to low compromised ecosystems, since so many chemicals are introduced. Since conventional agriculture) allows the use of fertilisers, pesticides, chemicals and GM organisms, high-yield crops and, therefore, produces a larger amount of food for a greater number used more and more often since it increases production and raises profits.

Studies have shown that various pesticides and chemicals used in conventional farming may be harmful for human health. Also, intensive farming includes the choice of certain breeds to increase crops, which may lead to some species extinction. For example, genetically modified seeds are more resistant to water, so will survive during a flood, while naturally occurring seeds will rot. Also, choosing to rear just one breed of cow because it produces more muscle tissue for meat means that all the other breeds will not be reared any more.

Did you know?

The use of antibiotics on pigs has led to many bacteria becoming resistant.

This is dangerous as there will be no antibiotics to help people with infections.

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Factory farming

Factory farming is an agriculture method in which a large amount of **livestock** is kept in order to increase production of meat, milk or eggs, and to lower possible costs and invest in profit. As profit is the most important consideration, factory farms can choose to rear certain types of animals (with low biodiversity) and use antibiotics to prevent potential diseases. Other practices may include cutting birds' wings or beaks to prevent them fighting with each other, with the aim of improving welfare activists and organisations.

Organic farming

As opposed to conventional and factory farming, organic farming is focused on producing food while maintaining soil quality, ecosystems, natural resources and biodiversity. Organic farming is subject to many legal restrictions; it can only use very restricted chemicals – not including artificial fertilisers, pesticides, herbicides – and cannot use preventive antibiotics, **genetically modified (GM)** crops or animal feed made with the use of GM crops. Organic farmers can sustain their crops through the use of natural methods such as crop rotation and natural fertilisers (e.g. manure) to support soil health. Antibiotics can only be used in case of disease (to cure it, not prevent it).

The way we grow and rear our food is very important due to health and environmental reasons.

Organic farming means that fewer fertilisers and pesticides are used (under restriction) and most are naturally based.

Study Tip



'Organic' means:

- fewer pesticides
- no artificial colours or preservatives
- the highest standards of animal welfare
- no routine use of antibiotics
- GM free

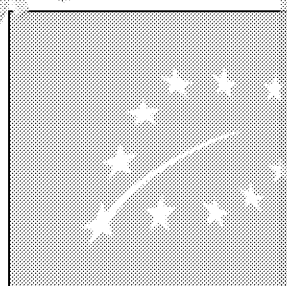
It is believed that organic food is healthier than conventional foods. Organic farming requires more resources and, therefore, is more expensive than conventional foods. Organic farmers use natural ways of preserving nutrients in the soil and natural plants to fertilise the crops and fight off pests. This allows maintenance of species diversity and farmers can plant many different species to ensure crops are resilient as naturally occurring plants have varied characteristics. As water, sunlight and warmth, farmers use different varieties, as others would struggle in different conditions.

Research

Find out more about organic food at <http://www.organicukfood.com/>



Soil Association
organic symbol



EU organic logo

Organic farming in the United Kingdom is promoted by the Soil Association, which sets standards and is a certification body for farmers. Specific and detailed restrictions are set by the European Union (EU) to ensure standards are met around the continent.

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Sustainable farming

Sustainable farming allows the use of modern technologies but under the condition of the ability to maintain their populations. It is especially important in fishing, since extensive countries and corporations have put many wild fish species at risk of extinction (e.g. blue whales). Sustainable farming means that eco-friendly rules are applied in order to maintain the environment, animal welfare and quality of life are maintained, and various resources (such as water) are used efficiently.

It is worth noting that sustainable farming and intensive farming can work together to ensure the maintenance of high-yield crops, and keep soil healthy and nutritious for future generations.

Research

Visit the website <http://www.greenpeace.org/uk/campaigns/what-we-are-doing/seafood/sustainable-seafood-frequently-asked-questions> and list fish species that are endangered due to overfishing. Then research fish species which are sustainable.

Seasonal and locally produced foods

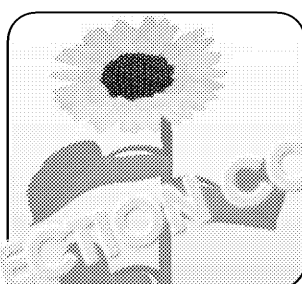
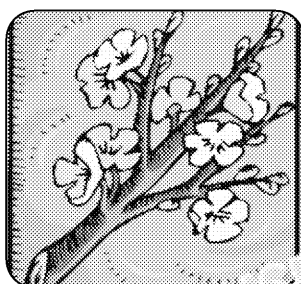
Before the development of modern technologies, people had to eat what was available in their environment. This forced them to eat only seasonally growing, **local foods** (for example, no lemons or oranges). Today, some people are turning back to the idea, claiming that it is better for the environment and health.

There are four main seasons of the year, and each can be characterised by different food products.

- In spring, most plants start to bloom and produce their first shoots. As June approaches, the first fruits become available.
- Summer is usually very rich in various fruit and vegetables, because sunlight, warmth and moisture provide them with excellent growth conditions.
- In autumn, most root vegetables are harvested. Also, while the crops last, fruit is produced for the winter.
- In winter very few plants produce any food, and, therefore, the diet is based on preserved food kept during the whole year – thus, Christmas pudding is full of dried fruit!

Did you know?

This is close to the concept of 'five flavours', which is a traditional Chinese diet based on what's locally available in each season.



Summer

Autumn

Spring
asparagus
rhubarb
leeks
cauliflowers
lettuces
kale
spring onions

Summer
peas
berries
courgettes
cucumbers
cherries
peaches
apricots

Autumn
aubergines
apples
pears
plums
pumpkins
celery
cabbages

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The development of transportation, increasing imports and new technologies have allowed people to bypass these rules. Thanks to these developments, tomatoes, for example, can be produced in polytunnels and oranges can be brought from overseas, and some fruit and vegetables (such as strawberries) are available all year long!

Seasonality applies also to non-plant foods. It may just as well be linked to fish, meat, poultry and eggs. This is based on the natural cycles of animals' lives – from birth, through growth to maturity and breeding.

Also, cheese production has, for hundreds of years, been linked to the lactation of cows and sheep produce milk between March and October only and, therefore, it is tastier then. However, intensive farming methods allow production of milk all year, so we can enjoy tasty, fresh cheese whenever we wish.

Examples of seasonal animal-based foods are shown in the table below.

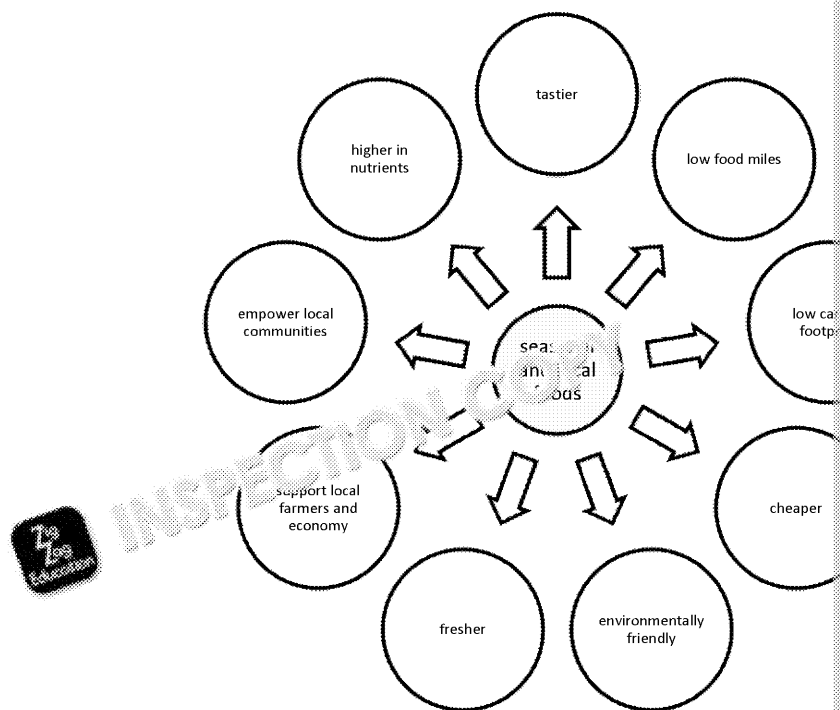
Month	Food available
January	Duck, turkey, haddock, halibut, lobster, oysters
February	Hare, partridge, venison, lemon sole, scallops, turbot
March	Mussels, oysters, salmon, mackerel
April	Lamb, wood pigeon, crab, plaice, sea trout
May	Lamb, prawns, sardines, shrimps
June	Scallops, coley, herring
July	Rabbit, pollock, whitebait
August	Beef, lamb, rabbit, venison, monkfish, pilchard
September	Beef, duck, grouse, guinea fowl, crab
October	Goose, venison, mackerel, oysters
November	Mallard, pheasant, turkey, skate, winkles
December	Goose, rabbit, turkey, venison, cod, Dover sole, queen scallop

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Advantages and disadvantages of local and seasonal foods

As with anything, seasonal and local foods have their benefits and downsides.



It is believed that **seasonal foods** are higher in nutrients – that’s because they were grown in natural conditions, with access to water, nutrient-rich soil and natural sunlight. Also, as they are produced locally and, therefore, there is no need to pick them prematurely to transport them long distances.

For this reason, the foods are fresher, because there is no need to store them for long periods of time because they don’t have to travel long distances from producer to customer.

Because the foods are often left to ripen naturally, they are higher in sugars and are therefore tastier.

Local production is also environmentally friendly because it reduces the food miles and carbon footprint (you will learn more about these later on in this chapter).

Low transport costs is a factor that affects the final price of the food, usually making it cheaper.

Buying locally also enables economic growth, supports local communities and encourages local farmers.

The disadvantages of seasonal and local food include:

- narrow choice – because only certain foods can be produced on an area of given size (due to climate and soil conditions)
- lack of diversity
- unpredictability – weather changes such as droughts and vermin may lead to lower quantities of crops, which may result in food shortage or food waste and the need for storage)
- loss of convenience – because you can eat or cook only what’s just growing or available locally, you may not have something to cook dinner (unless there are rice crops nearby)
- need for creativity – so that your meals aren’t boring (after all, you only have a couple of ingredients to use)

Research

Visit the website <http://www.eattheseasons.co.uk> to list the foods which are characteristic of the current season. Are any of them produced in your area?

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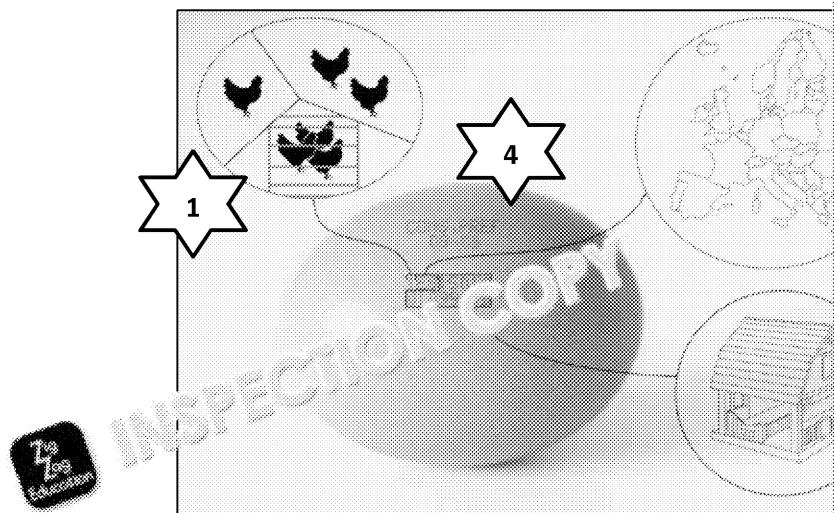
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APR

Egg production – cage, barn, free-range and organic

The way eggs are produced affects their safety and nutritional value. In the European Union, all eggs must be labelled with a stamp that contains certain information about their origin and method of production.



The stamp on the eggs has to contain the following information: 1) method of production; 2) producer's ID; 3) date mark; 4) country of origin.

- The first information in the code is **method of production**. This refers to the way the hens were reared and shows whether they were kept in cages, allowed to move around the barn or allowed outside.

Did you know?

The advocates of organic egg production claim that organic eggs are healthier, tastier, and more ethical.

The details of egg production methods are specified in the table below.

Method of production	Description
Cage	- Hens are kept in tight cages placed on top of each other - Hens cannot move around the barn - Hens often have cut wings to minimise movement - Hens may have trimmed beaks to avoid fights - The most popular method in Great Britain - Very cost-effective
Barn	- Hens can move freely around the barn - Hens can have cut wings to prevent them from flying - Hens may have trimmed beaks to avoid fights - Lighting in the barn is controlled so that hens' activity-sleep time is regulated by artificial light
Free-range	- Hens are let outside for at least part of the day - Space per bird is increased (stocking density is nine birds per square metre) - Perching space provided for each hen - Hens have access to natural sunlight for at least part of the day - Second most popular method in Great Britain
Organic	- Has to respect all criteria for free-range rearing - Birds have to be fed organic feed only

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Did you know?

In the United Kingdom, animal welfare can be ensured by following the standards of the Royal Society for the Prevention of Cruelty to Animals (RSPCA). The logo can be found on foods where animals have had a better life. This applies to meat and poultry.

The code on the label also indicates:

2. The country of origin. This is indicated by the letters following method of production and uses commonly recognised country symbols; for example, UK means United Kingdom, ES means Spain, DE stands for Germany and NL is the Netherlands.
3. The farm ID. This allows you to trace which farm produced the egg; this is especially important if food poisoning occurs, because it can help stop further spread of disease.
4. Best before date.

Some people prefer to buy eggs directly from local farmers. This may affect the safety of the eggs because they often do not perform antimicrobial tests (or don't wash the eggs for example), which puts them at risk of spreading *Salmonella*. Spreading of the disease is prevented in the UK by vaccinating hens, following the rules of the British Lion Code scheme.

Did you know?

In 2015, there were 10.02 billion eggs produced in the UK. An additional 2.1 billion were imported.

Apply

While shopping, check the labels on eggs and make notes about their origin and production method. Which ones are the most popular?

Research

Visit the website <https://www.egginfo.co.uk> and find out differences in the quality of eggs.

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Check your understanding: How far

1. Which of the following statements about organic farming is TRUE? (1 mark)
- a. It allows the use of artificial herbicides. ☐ b. It allows routine use of antibiotics. ☐
c. It allows the use of GM feed. ☐ d. None of the above. ☐

2. Which of the following is TRUE about free-range hens? (1 mark)
- a. They live in cages. ☐ b. They are allowed to roam freely. ☐
c. They live in barns. ☐ d. They only eat organic feed. ☐

3. Which of the following is TRUE? (1 mark)
- a. Locally produced foods decrease emission of greenhouse gases. ☐
b. Locally produced foods are always organic. ☐
c. Seasonal foods are often more nutritious than non-seasonal foods. ☐
d. Seasonal foods are usually less expensive than non-seasonal foods. ☐

4. State two advantages and two disadvantages of organic farming. (4 marks)

Advantage 1

Advantage 2

Disadvantage 1

Disadvantage 2

5. State two benefits of sustainable farming. (2 marks)

1.

2.

6. Evaluate the impact that farming method has on the quality and safety of food. (4 marks)

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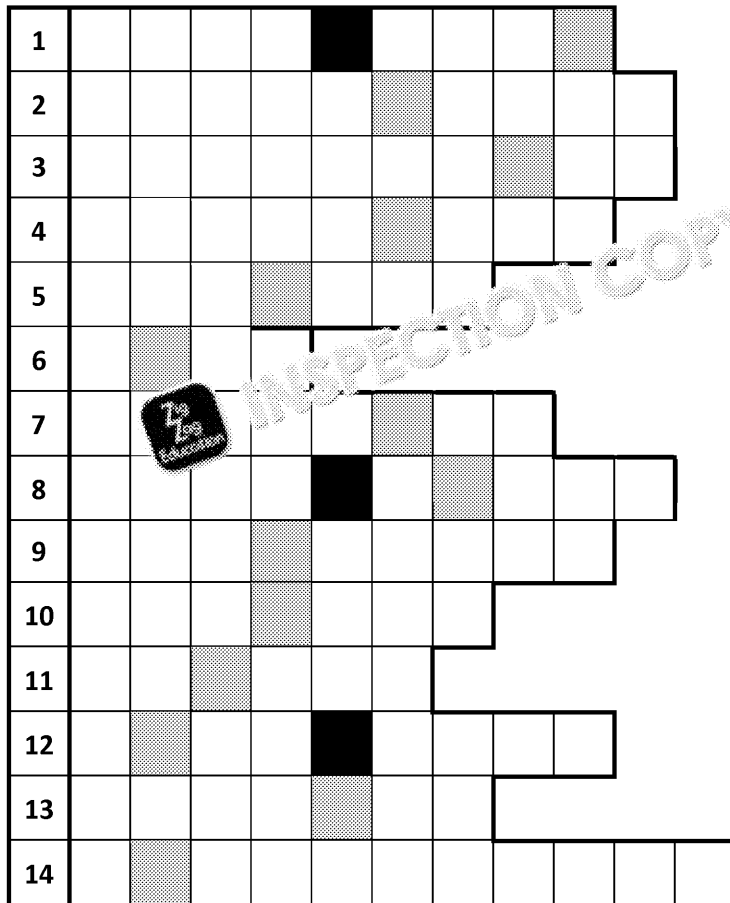
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Chapter 1: Quiz-ine

Fill in the answers to the questions below to reveal a word relevant to food provenance (the black squares are spaces between words).



1. Greasy pâté made of goose liver (4,4)
2. Growing food in this allows availability all year long (10)
3. Used to improve soil quality (10)
4. All farm animals are referred to as this (9)
5. Ingredients and foods produced without or with very little artificial substances (11)
6. Cereal grain that is most commonly used around the world (4)
7. Characteristic of a given time of year (8)
8. Farmed animals and birds which are allowed to roam outside (4-5)
9. Used to kill weeds (9)
10. The meat of a deer (7)
11. Oily fish caught for its characteristic pink flesh (7)
12. Enclosed area in which oysters and mussels can be reared (4,4)
13. Domesticated birds such as chickens and ducks are referred to as this (7)
14. Growing method in which plant roots are put directly into water (11)

The shaded squares reveal this word:

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Sustainability and security of food

Sustainability of food concerns scientists, governments and ecologists all around the world. Climate change and growing population, may affect food availability in the future. New technologies can come to the rescue, keeping the most pessimistic visions at bay.

Global warming and sustainability of food

Earth's climate changes in cycles – just like seasons. Temperatures on Earth have changed over millions of years, causing the ice to form or melt, depending on the stage of a given cycle. Before the last ice age, we experienced six glacial periods!

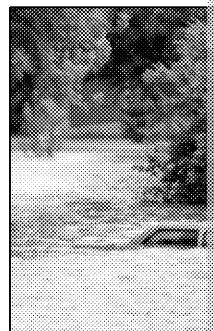
For centuries, climate change was caused by variation in Earth's orbit and in solar activity, which then determined the amount of warmth the planet received from the Sun. The Sun's rays pass through the atmosphere and are then reflected by Earth's surface. In normal conditions, the heat would spread evenly without further consequences. Unfortunately, greenhouse gases (such as carbon dioxide) create a coat around Earth's atmosphere which traps the warmth. Therefore, Earth's surface and the air around it are warming up.

The main reasons for rising carbon dioxide levels are:

- burning coal, oil and wood to obtain energy, and also for food production and transportation between countries
- deforestation to obtain fuel and land for agriculture

Global warming is dangerous. It can lead to:

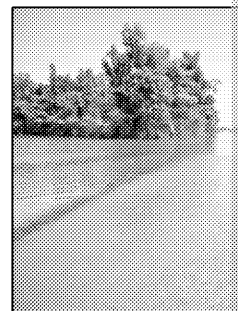
- melting of glaciers and a rise in sea levels
- a rise in global temperatures
- warming of the oceans
- extreme events such as hurricanes, intense rainfall, heatwaves, droughts and
- acidification of the oceans



Droughts and floods are both a result of climate change and have a devastating impact on the environment.



A flooded farm



A farm which is so badly flooded that it's a farm

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Food production and transportation have an enormous impact on the environment. The use of natural resources, many of which are non-renewable. The expanding industrialisation has led to a situation where there will be no resources left for the future generations to produce. The impact of climate change on food security and availability is discussed later on in this Course.

As the world population grows, more and more food has to be produced to meet the demand. Currently (March 2017) there are 7.5 billion people living on Earth, and the United Nations predicts that this will grow to 11 billion by 2100.

The more people there are, the more food is needed – but the area and resources available to produce it are limited. Food production and transportation require a lot of resources such as water and energy, and they generate a lot of waste and pollution. Intensive farming and overfishing can lead to the loss of biodiversity, species and to soil exhaustion. For these reasons the idea of **sustainable food** is becoming increasingly important. The point of sustainable food is to use the available resources only to produce food, not to overexploit them and allows them to be replenished.

The main principles of sustainable food are:

- ☐ reducing waste of food and packaging
- ☐ eating more vegetables and fruit, and less meat and dairy to limit the amount of greenhouse gases
- ☐ buying locally and seasonally to limit the carbon footprint
- ☐ choosing fair trade certified products to promote fair wages and prices
- ☐ selecting fish from sustainable resources only
- ☐ avoid or limit the consumption of sugar, salt and food additives
- ☐ growing food yourself if possible

The idea of sustainability is supported by the European Union, which created a 'Resource Efficient Europe'. The aim of the policy is to reduce waste, improve efficiency of resources and reduce consumption in order to protect the environment.

Research

Discover more about the sustainability of food at <http://ec.europa.eu/environment>

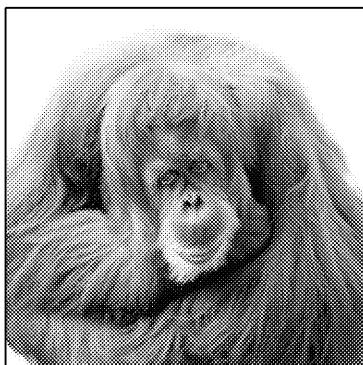
An example of how the policy is implemented is **fish farms**.

Other forms of sustainable agriculture include the use of such methods as nitrogen fixation, crop rotation, composting, green manure, soil amendment or soil steaming. They allow the maintenance of high-yield crops as well as the use of natural resources necessary for the proper growth of plants.

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Why is sustainability of resources important?



Food production has contributed to loss of biodiversity and habitats and endangered wildlife such as orangutans and Sumatran tigers.



Did you know?

Sustainability means the ability to keep harvesting or using a product without causing long-term damage or harm to the environment, the animal or to the economy or livelihood of developing countries.



A

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shop
man
pro
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Sustainability issues have surrounded the following food products:

FISH	PALM OIL	
		
Some fish stocks have become endangered through overfishing or habitat loss. Sustainable fish is fish that is caught or farmed in a way that causes minimal damage to marine environments or other wildlife. The Marine Conservation Society and Hugh Fearnley-Whittingstall campaigned for Marine Conservation Zones (also known as Marine Protected Areas) to help protect the world's most fragile marine environments from overfishing or damage. Research: Take a look at zzed.uk/8253-defra-marine to see a map of Marine Protected Areas.	Palm oil is grown in South East Asia and is found in many products, such as food, shampoo, biofuel and cosmetics. Palm oil plantations have resulted in mass deforestation of tropical forests leading to loss of biodiversity and wildlife, including the orangutan (over 80% according to the Orangutan Project). Some supermarkets state that they source palm oil from plantations which can demonstrate that they have not endangered tropical rainforests – this is referred to as <i>sustainable palm oil</i>. Research: Take a look at the Orangutan Project at zzed.uk/8253-orangutan-palm-oil	Mar ord in B the Am wild Only soyl hum feed only soyl com can mea

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Case study – sustainable fishing

Fish is a source of complete proteins, omega-3 fatty acids and vitamins A and D. Fish should, therefore, be a part of a healthy diet. Unfortunately, the growing need for them and illegal fishing have led to a situation where 90% of natural fisheries are overexploited. This is not only because a large number of fish have been caught, but also because destructive catching methods were being used. For example, bottom trawling includes dragging the fishing net along the sea floor, which disrupts the ecosystem. Another method is pair trawling, in which a fishing net is stretched between two boats. This leads to a by-catch, which means catching unwanted fish, seaweed and other sea creatures. Also, the size of fishing nets plays a role, as using openings which are too small will lead to the catching of very small fish, which won't be used for food and also won't be able to grow and rebuild the population.

For this reason, the Common Fisheries Policy was implemented. It states the way (especially in wild fisheries) to maintain a sustainable rate – this is important to avoid extinction and allow them to regenerate the population.

Sustainable fish farms should implement two general rules: ensure the health of the fish and adjust the catching method. Fish farms help to protect wild fish and other species in the oceans, while producing enough food to feed the growing population.

Fish farms allow producers to rear fish and seafood for meat, caviar, pearls, and other products.

Fish can also be sustainably obtained from wild fisheries (those naturally occurring in the wild).

There are various methods of fishing – some of them more destructive than others.

- **purse seining** means fishing with the use of a large net in which fish and other sea creatures are caught; this often leads to by-catch
- **longlining** means fishing with the use of a long line to which other lines are attached with a hook; this is not a sustainable method of fishing as it often attracts unwanted sea animals (e.g. turtles) leading to a significant by-catch
- **bottom trawling** means pulling a large net along the seabed, used to catch shellfish; this can damage the fish habitats and permanently affect the fish population
- **harpooning** in which harpoons are thrown at individual fish; this is a sustainable fishing method since only the intended fish are caught (no by-catch)
- **floating traps** in which traps and weirs are suspended in water, attracting individual fish; the fish are then trapped inside a box, but are not harmed. Once the box is removed from the water, the catch is removed and may be released back to the sea. This is a sustainable method of catching the intended fish or shellfish

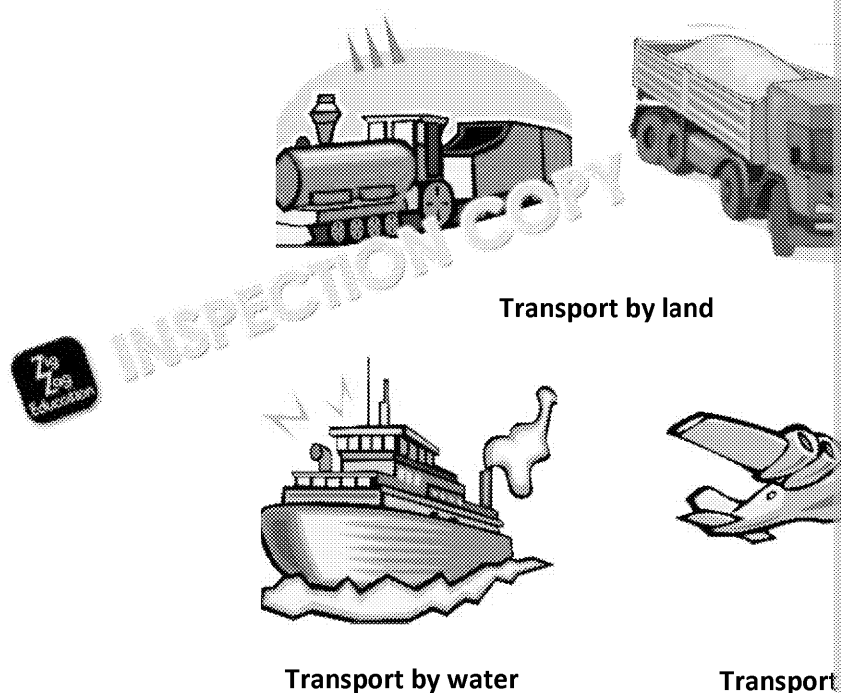
By-catch is the unwanted catch of other species of fish.

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Carbon footprint and the food miles

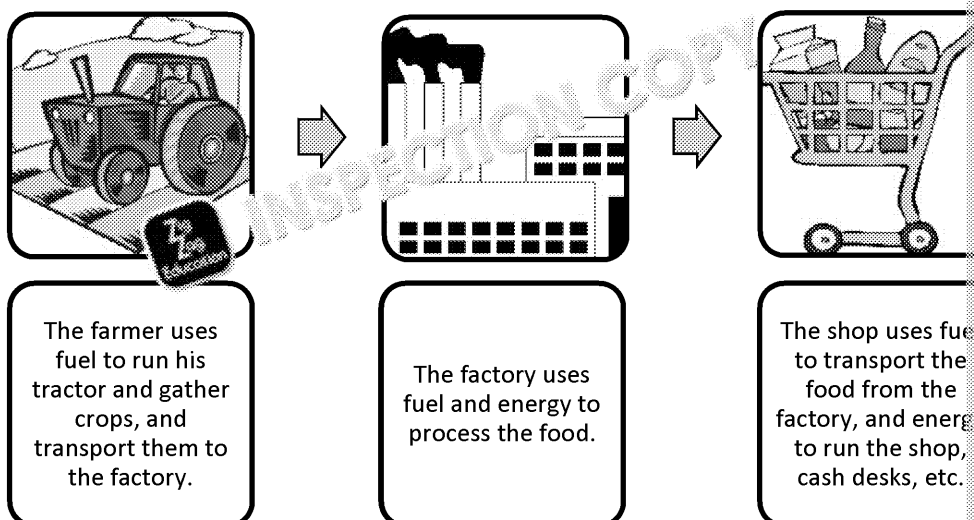
Food can be transported even from very distant countries by trains, lorries, ships and planes. All these means of transport need a lot of energy – from either carbon, petrol or wood. Combustion of these fuels produces dust, exhaust gases and carbon dioxide. They contribute to general air pollution of the air and ground (especially near main roads and motorways).



Foods and other goods are transported by different means. Which do you think produces the most carbon footprint?

An important effect of rising global transportation (and consumption of fuels) is global climate change. This is because large amounts of greenhouse gases are produced during the transport of foods. Greenhouse gases include water vapour, carbon dioxide, methane and nitrous oxide. They are produced in large amounts by households (e.g. when heating the house and using gas) and by people (e.g. buses and cars). All the greenhouse gases produced as a result of something are part of its **carbon footprint**.

Buying locally reduces the need for transportation of produce, and, therefore, is a good way to reduce your carbon footprint. It also reduces **food miles** – the distance which food has to travel.



Food miles and carbon footprint are built up all the way from the field to the shop.

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Reducing the amount of greenhouse gases produced during production and transport for saving the Earth. It can be achieved by:

- using alternative sources of energy such as wind or solar panels to run factories
- using more effective ways of transportation and improving exhaust filters in cars
- choosing local foods to reduce the need for transportation at all
- planting more trees and stopping deforestation

Research

Visit the website <http://footprint.wwf.org.uk/tips> and discuss how YOU can reduce your footprint.



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Packaging and the environment

Packaging as we know it became very popular after World War II – before that people used paper containers to carry all kinds of food. Plastic bags gained popularity in the 1950s for their durability and convenience.

Food can be packed in various types of container: bags, sacks, boxes, bottles... Food can be packed in:

- paper and/or cardboard
- plastic
- glass
- steel
- aluminium (tins and cans)
- wood (baskets and crates)

The materials can also be combined, for example, to insulate cardboard boxes so that the food inside stays fresh.

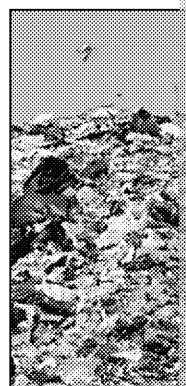
They are specifically designed to:

- protect food from external factors (such as light, oxygen, dirt or microorganisms)
- inform the consumer about the product (information)
- attract consumers to the product and tempt them to buy it (marketing)
- increase the shelf life of a given product (preservation)

How does packaging affect the environment?

Packaging has a big impact on the environment – from the moment it is produced to the time it is discarded or destroyed.

- Production of packaging – no matter what material is used – entails the use of water, electricity, detergents, labour and other resources.
- Then, the packages have to be transported to the factory, where the food is packed – that contributes to the carbon footprint.
- After the food is eaten, packages are discarded – ideally, into recycling containers. Unrecycled packaging creates pollution of air, earth and water.
- Landfills cause pollution, and require a lot of space and money to be run efficiently.
- Packaging which is not disposed of correctly can be swallowed by fish, birds etc., leading to their death.



Landfill

British people buy 22 million metric tonnes of food every year – and all that food needs to be disposed of properly, so it can be recycled or destroyed in an environmentally friendly way. This is because materials such as glass or plastic which are not recycled will take a very long time (see table on p. 29). For this reason, the government and environmental organisations strive to limit the number of plastic bags used (introducing the 5p charge in 2015 halved the number!)¹

Did you know?

In 2013, British consumers took home 7.4 billion plastic bags from supermarkets.

Source: <https://www.gov.uk/government/news/plastic-bag-numbers-rise-for-10th-year>

¹ <http://www.bbc.co.uk/news/uk-34346309>

Material	Time taken to decompose
Paper	2 weeks
Food	1-6 months
Milk cartons	3-6 months
Cigarette butts	10 years
Batteries	100 years
Aluminium cans	80 years
Nappies	250 years
Plastic bottles	450 years
Plastic bags	10-15 years
Glass	Millions of years
Styrofoam	100 years

Recycling

Recycling is a way of getting rid of waste in an eco-friendly way. To facilitate this, colour-coded bins were introduced in the United Kingdom to help people identify what litter goes where. Note that different countries (and even different city councils) can have different policies – some use more colours, some only sort waste into ‘dry’ and ‘wet’, etc.

Research

Visit the website <https://www.recyclenow.com> and create a poster in which you explain what you can recycle and how you can recycle in your area.

Typical colour of the bin	What goes into it	What happens to it
Blue	Paper, aluminium tins, metal cans, glass bottles and jars, plastic bottles, plastic food trays and yoghurt pots	The materials are recycled into new packages, etc.
Brown	Food waste, vegetable peel, egg shells, teabags, garden waste (cut grass, flowers, etc.)	This is decomposed into compost for example.
Green or grey	Plastic bags, polystyrene, light bulbs, mirrors, sanitary products, nappies	These are not recycled and have to be disposed of (e.g. burnt) or landfilled.

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² <https://www.thebalance.com/how-long-does-it-take-garbage-to-decompose-2878033>

³ <https://www.thurrock.gov.uk/household-waste-and-recycling/what-goes-in-your-bins>

Food waste

Food waste is, in general terms, all the food that is rotten, spoiled or wasted, and is thrown away. It can be created by food producers, retailers and households. Food waste is one of the major problems of rich, developed countries. In 2012, in the United Kingdom alone, the amount of food waste produced by households was about seven megatons, and by manufacturers – 3.9 megatons.⁴

Here are five reasons why food waste is wrong:

1. **Wasting food is unethical.** We live in a world of large social inequalities, where over one third of the population is obese, while another billion people suffer from famine.^{5,6}
2. **Wasting food is environmentally unfriendly.** Many resources – water, electricity – are used to produce and transport it. Not only are they used, but, in the meantime, all the resources are wasted.
3. **Wasting food is uneconomical.** Many people were involved in the process of producing the food. The World Resources Action Programme estimates that each family in the UK is wasting food worth £100 million a year.⁷
4. **Wasting food requires organisation.** After all, someone has to pick up the rubbish from your home and either recycle it or store it at a rubbish dump. That, again, contributes to the carbon footprint and increases the social cost of food waste.
5. **Wasting food creates pollution.** The food had to be produced (carbon dioxide), transported (greenhouse gases), packed (plastic) and cooked (carbon dioxide again). All the by-products of food production and consumption find their way into the environment and contribute to the overall pollution of the planet.

Did you know?

The top five wasted food items in the UK are:

- bread
- potatoes
- apples
- meat and fish meals
- vegetable meals

A number of policies were designed to help prevent food waste:

- **Recycling** – of both food and food packaging. The leftover food can be used in many ways, e.g. as animal feed.
- **First in, first out** – rotation of stock helps prevent food waste by controlling 'use by' dates.
- **Storing the food in proper conditions** – helps prevent food spoilage by either vermin or environmental factors.
- **Redistribution** – giving away anything that cannot be sold. Some of the large charities have programmes which help distribute the food to those who are in need.

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⁴ <http://www.wrap.org.uk/sites/files/wrap/UK%20Estimates%20October%2015%20%28FINAL%29.pdf>

⁵ <http://www.who.int/mediacentre/factsheets/fs311/en/>

⁶ <https://www.thelifeyoucansave.org/Causes/Hunger-and-Nutrition?gclid=CPPwk4nIvNACFUNmGw>

⁷ <https://www.lovefoodhatewaste.com/>

Food waste in food production

There are several reasons why food may be wasted before it even gets to a shop:

- **Crop failure** – poor weather conditions, drought, flood, vermin, pests – all these factors can cause a lot of food to go to waste before it is even harvested.
- **Overproduction** – sometimes good weather conditions support growth of fruit and vegetables so efficiently that too much is produced and, as a result, farmers can't sell the overabundance; in these cases food is often left in the field to rot.
- **Throwing away** – producers may choose to throw away 'ugly', misshapen fruit or vegetables; this is because, in many cases, the produce has to fulfil international standards, as otherwise it can't be sold in shops.
- **Faulty methods** – faulty methods of production, e.g. in factories, may lead to the waste of many foods.



These

Limiting food waste at these stages might not be easy, as it may require legal changes and a couple of ways which can help to limit the wastage.

- Farmers may choose to use pesticides or herbicides, or to grow foods in polytunnels to protect them from pests, vermin or weather conditions.
- Farmers can choose GM crops which are resistant to weather conditions.
- Farmers can try to sell the food more cheaply for freezing or canning.
- Factories can adjust their processing methods to minimise wastage.
- Factories can sell the food waste to produce natural fertilisers or animal feed.
- At all stages of production – when transporting, cleaning, sorting, cooking, packaging – producers can maintain proper conditions to prevent spoilage caused by microorganisms.
- Factories can use packaging to protect food from external factors – modern packaging methods, such as modified atmosphere packaging or vacuum packaging, can help to extend the shelf life of food while not affecting nutritional value.
- Producers can use preservatives – although this might be socially unacceptable, it is a proven method of extending the shelf life of food products.

Food waste in retailers

Smaller and larger shops struggle with large amounts of food which are not sold. This might be due to:

- not paying attention to date marks
- not storing the food in the correct conditions
- improper management and over-ordering

Shop managers may need to implement a couple of strategies to reduce food waste, such as:

- Daily check of date marks, especially of fresh produce – a food past its date mark cannot be sold.
- If a food is past its 'best before' date, it is usually still edible, so can be donated to food banks or even given for free to the shop workers and customers.
- Control storage conditions, both in the storeroom and in the sales hall – this applies especially to temperature and sunlight, as many foods will be packaged at this stage so will be protected from other external factors.
- Lower the price for foods which are close to their 'use by' date as they won't be safe to eat beyond that date.

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What can you do to stop wasting food?

Food waste in homes is usually caused by buying too much, cooking too much, not paying attention to date marks or improper storage conditions. Food may also be wasted due to lack of skills or knowledge; for example, when a person buys a new product and doesn't know what to cook with it or when a person can't cook and burns the meal.

Reducing food waste at home can include:

- Planning your meals and writing a shopping list – buy only the foods you need, in the amount you need. This applies especially to fresh foods, which cannot be stored for a long time.
- Using leftovers – you can use cooked vegetables to prepare a salad (or a cream soup), leftover mashed potato can be used to prepare fish cakes, and stale bread is great for a pudding or simply for breadcrumbs).
- Freezing foods that you cannot eat right away – this applies especially to meat and fish, and to cooked meals. Vegetables have to be blanched or pre-cooked before freezing.
- Serving as much as you need. If there is too little, you can always ask for an extra helping.

If your food unfortunately gets spoiled or goes rotten, don't worry – store it in a compost (or give it to someone who owns a garden).

Research

Visit the website <https://www.lovefoodhatewaste.com> and try to list five ways you may contribute towards lowering food waste.

Apply

Think of ways to reduce food waste, such as potatoes.



Things to think about

Discuss how food waste, transportation and packaging contribute to food waste.



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Impact on global markets and communities

Your food choices affect not only you and your family, but also people in other countries. Often the food we buy is often imported; for example, oranges are imported from Spain and rice from Thailand. As you pay for your shopping, the money is divided between the drivers who transported it from the factory, food factory workers and farm workers. The larger the price – so even if production of rice is very cheap, the price paid at the shop is high – the wages paid to the farmers are often very low and encourage human exploitation.

Although slavery was banned in 1833, modern societies tend to overexploit their resources – including labour – in order to produce more goods and create a bigger profit. In many countries, children are forced to work, and people are not paid fairly for their work – which leads to high poverty rates in some countries as China, Indonesia and India.⁸

Fairtrade is a global movement which helps to stop modern slavery. It has the following benefits:

- fair prices and wages for producers, farmers and farm workers – buying Fairtrade products is one way of improving their lives
- decent working conditions (such as working hours, breaks and tools)
- ends child labour and forced labour
- empowers local farmers, their families and communities – having more money allows them to make choices about their lives and send their children to school
- enables local growth and sustainability (e.g. schools and health centres can be built with money to pay for the medical care, etc.)

Fairtrade rules are designed to enhance the social, economic and environmental conditions of producers – not large intercontinental corporations.

The most popular Fairtrade products include:⁹

- bananas
- chocolate/cocoa beans
- coffee beans and tea leaves
- cotton
- sugar

Did you know?

The United Kingdom is the largest Fairtrade market in the world!

Apply

While shopping, try to find five products that come from Fairtrade producers.



Research

Research and prepare a presentation about Fairtrade standards are...

Fairtrade is also linked to sustainability of food. As the farmers and farm workers are able to produce healthy food for their families. The farm owners can also use technologies to increase the amount of food produced. Fairtrade farmers are also using environmentally friendly practices in order to use resources wisely and mitigate the impact of climate change.

Research

Watch the video at <https://www.youtube.com/watch?v=gG3fd1Jg7Jk> and discuss how it supports sustainability of food.

⁸ <http://www.worldbank.org/en/topic/poverty/overview>

⁹ <http://www.fairtrade.org.uk/en/buying-fairtrade>



Check your understanding: Sustain

1. Which of the following does NOT contribute to an increase in carbon footprint? (1 mark)
- a. using oil as fuel ☐
 - b. using carbon as fuel ☐
 - c. using wood as fuel ☐
 - d. using solar panels ☐

2. Which of the following statements is TRUE about food waste? (1 mark)
- a. The most food waste is produced by households. ☐
 - b. The most food waste is produced by restaurants. ☐
 - c. The most food waste is produced in food factories. ☐
 - d. The most food waste is produced by farmers. ☐

3. Describe what is meant by carbon footprint. (2 marks)



.....

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4. Suggest two ways in which food waste can be prevented at the stage of production.

1.

.....

2.

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5. Assess how fish farms help to ensure sustainability of resources. (4 marks)

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Food security

According to the Food and Agriculture Organization of the United Nations (FAO), at any given time and place, any person should have access to sufficient amounts of safe food. The growth of the human population means that more and more food has to be produced.

What makes food available?

- Sufficient production – means that enough food is made; intensive farming (such as GM) have made it possible, but unfortunately almost all that food stays in the fields.
- Access to retailers – means that shops or farmers are close enough for people to get food from them
- **Affordability** – means that a person has enough money to buy the food they need.

What threatens food availability?

- Climate change and the effects of global warming
- Droughts, which make growing plants impossible
- Floods, which destroy the crops
- Pollution caused by production and transportation of goods
- Insufficient land for growing food – there are more and more people to feed
- Lack of resources, such as water or fossil fuels
- Overexploitation of soil, which decreases its usefulness for growing plants
- Poverty and lack of money

In developed countries, such as the UK, there are also other factors, such as the price of the food, and lack of transportation to bring the food back home.

What does 'nutritious food' mean?

Food should not only fill you up and stop you feeling hungry – it is also a source of important macro- and microelements, which are crucial for the proper growth, development and functioning of the body. The food should, therefore, be rich in nutrients such as proteins, fats, carbohydrates, vitamins and minerals. The abundance of cheap, low-quality food in developed countries has led to the situation where 1.9 billion people worldwide are overweight or obese,¹¹ and at the same time 30% of them are undernourished.¹²

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¹⁰ http://www.fao.org/fileadmin/user_upload/sustainability/Presentations/Availability.pdf

¹¹ <http://hungerreport.org/2016/infographics-2/>

¹² <http://drhyman.com/blog/2012/02/29/how-malnutrition-causes-obesity/>

Food poverty

Food poverty means that a person or a family doesn't have enough money to buy sufficient amounts of quality (healthy and nutritious) food. In many areas, especially in developing countries, this is the cause of famine, diseases and deaths. UNICEF states that half of the deaths among children under five are caused by undernutrition.¹³ Food poverty is not restricted to poor countries only. Even rich, developed countries such as the United Kingdom struggle with the problem. According to OXFAM, 2 million British citizens are malnourished, while another 500,000 rely on food parcels from charities to feed their families.¹⁴

Effects of food poverty

Food poverty usually results in malnutrition – a condition in which the balance of a person doesn't have enough nutrients or has too much of some of them. Lack of food leads to various health issues, such as:

- hunger and/or a variable loss of body mass
- loss of muscle tissue, weakness
- lack of immunity
- vitamin and mineral deficiencies
- protein deficiency, often leading to kwashiorkor
- inability to focus and learn
- poor bone and dental health
- increased risk of heart disease, obesity and type 2 diabetes, as low-quality food is often consumed
- stress and social exclusion
- depression

...and many others. It is estimated that around half a million British citizens use food banks due to a lack of ability to put food on their table.

What can be done to make food available?

- Many international organisations, such as the Red Cross, deliver free food to war zones
- Increase salaries – although this is not easy to do, since it depends on many factors
- Decrease prices and make food more affordable for people, especially those in low-income areas, done by supporting local farmers
- Food vouchers – which are a way of helping people financially without giving them cash, as cash can be misused, because it can be spent on food only, and not on other things
- Create food banks – places where food can be given for free to those in need
- Avoid food waste – and give what you don't eat to those who might need it
- Use modern technologies, such as GM crops, to increase more efficient agriculture
- Improve storage conditions to enhance the shelf-life, e.g. by the use of modified atmosphere packaging or vacuum packaging.

Research

Read the report on

<http://www.manchesterfoodpoverty.co.uk/sites/default/files/Facts%20and%20Figures%20Report.pdf> and list the reasons and outcomes of food poverty in Greater Manchester.

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¹³ <http://data.unicef.org/topic/nutrition/malnutrition/>

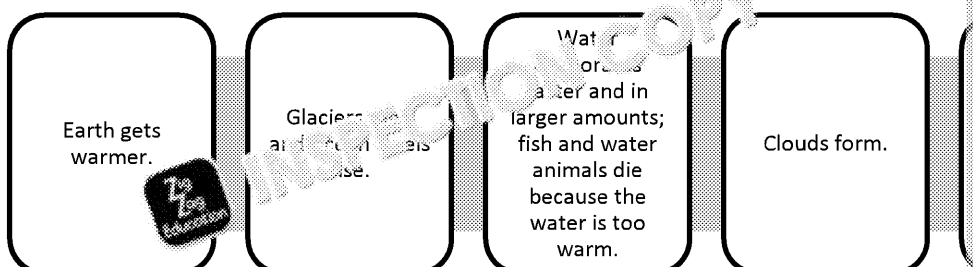
¹⁴ http://policy-practice.oxfam.org.uk/our-work/inequality/food-poverty#contentprimary_0_ctl00_1

How climate change affects food security

The effects of global warming that have been observed over the past 50 years are:

- They cause the mass extinction of many animal and plant species, as many of the new conditions (such as high temperatures or lack of water).
- They lead to the disappearance of land and whole countries under water, significant land which can be used for planting crops or grazing farm animals.
- They can cause food shortages and famine by causing crop failure (due to both drought and flooding).
- They change the pattern of the seasons, which can affect plants' life cycles and the availability of food.

How does this work?



How can we ensure food availability when facing climate change?

Climate change is a global problem. It affects individuals, communities and whole countries. Around the world are involved in the fight against carbon dioxide emissions. An example is the Paris Agreement, which obligates 197 countries to undertake certain actions to help reduce global warming. Actions have to be taken to:

- mitigate (stabilise and reduce) levels of CO₂ released into the atmosphere, e.g. by switching from fossil fuels to water or solar power, limiting transportation and using more energy-efficient buildings; limiting the use of packaging, lowering food waste, recycling and reusing goods.
- adapt to the changes that have already happened – this involves making the most of the experience, such as a prolonged summer which allows more crops to grow; using modern technologies to produce genetically modified foods, which are resistant to pests and diseases; and the use of modern storage and packaging methods to extend the shelf life of food.

Research

Visit the website <http://climate.nasa.gov> and list things you and your family can do to reduce your emission of greenhouse gases and lower your contribution towards climate change.

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Additional reading: Genetically modified foods and food security

All food comes from living organisms – plants, fungi or animals – and, therefore, each has a unique DNA code. DNA contains genes, which determine all the features of a given organism, such as its colour and nutritional value. Modification of DNA – replacing one or more of the genes – has led to the development of various plant and animal species that grow larger, are resistant to pests, and have more muscle tissue.

Why we use GM

- to increase crops and avoid food shortages
- to improve 'shelf life' in foods and lengthen storage time
- to produce biofuel
- to develop resistance to pests in plants
- to decrease the amount of herbicides and pesticides needed
- to increase the amount of eggs, milk and meat produced
- to increase immunity in animals
- to increase the amount of vitamins and other nutrients in food
- to overcome climate challenges
- to prevent malnutrition and fight off hunger
- to improve flavour, colour, appearance or size of fruit and vegetables

The experiments to design and produce GM foods started in the 1980s and, there is still debate (yet) whether they are safe and healthy to consume, because that requires long-term studies (a long time, e.g. 50 years). European Union law allows for GM crops of cotton, maize, soybean and sugar beet.

Did you know?

The so-called 'Golden Rice' was developed to prevent widespread vitamin A deficiency in some developing countries. However, it wasn't very successful at the beginning because people didn't like the unnatural-looking yellow rice!

Many people oppose GM foods because:

- there is no scientific proof that long-term use of GM food is healthy and safe
- they believe GM food increases the risk of allergies and cancer
- they may contribute to increased body mass and so to the recent growth in obesity around the world
- they may lead to antibiotic resistance
- GM seeds mix with naturally occurring plants and may cause their extinction (or reduce their numbers)
- genetic modifications often require the use of viruses or bacteria, such as *E. coli*, which can create and spread of new diseases

On the other hand, genetically modified foods have multiple advantages, and scientists are working hard to ensure the newly created species are not only environmentally friendly but also safe for consumption.

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Compared with naturally occurring plants and animals, genetically modified ones

- contain more macronutrients, such as protein, which help to alleviate hunger
- contain more polyunsaturated fatty acids, which may help to lower heart attack rates in some countries
- contain more micronutrients, necessary to prevent malnutrition
- require fewer resources, such as water, and can be grown almost everywhere in almost all weather conditions
- have a longer shelf life, so help to limit **food waste**
- be resistant to pests, so no chemicals have to be used
- produce more meat, milk or eggs, so fewer animals have to be reared and less land has to be devoted to pastures or animal farms
- be resistant to bacteria, so no antibiotics have to be used

GM advocates also claim that for these reasons, GM foods are a way of providing food security for future generations.

Research

Read about GM crops and foods at <http://www.genewatch.org/sub-568547>

- whether GM crops or animals are grown/reared in Great Britain
- what different forms of GM crops enter Europe
- whether it's easy to find GM-free products in the shops

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Check your understanding: Food

1. Which of the following statements about food poverty is UNTRUE? (1 mark)
- | | | | |
|--|--------------------------|--------------------------------------|--------------------------|
| a. It only affects people in poor countries. | ☐ | b. It also occurs in rich countries. | ☐ |
| c. It causes malnutrition. | ☐ | d. It affects food availability. | ☐ |

2. Which of the following is TRUE about GM food? (1 mark)

- | | |
|--|--------------------------|
| a. It is usually less nutritious than common food. | ☐ |
| b. It can increase the risk of food allergies. | ☐ |
| c. It supports biodiversity of species. | ☐ |
| d. GM animals are infertile. | ☐ |

3. State three advantages of using Fairtrade products. (3 marks)



4. Discuss how climate change affects food availability on Earth. (6 marks)

5. Evaluate the impact of food poverty on health. (6 marks)



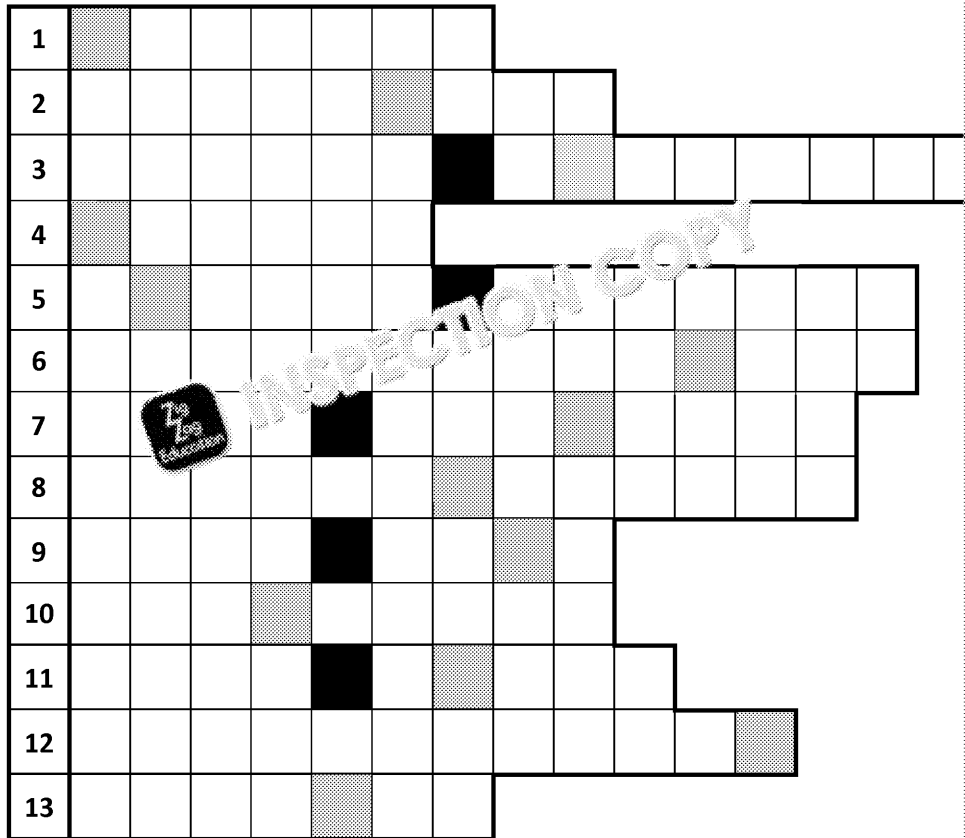
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Chapter 1: Quiz-ine

Fill in the answers to the questions below to reveal a word relevant to sustainability. Shaded squares (the black squares are spaces between words).



1. Mass of ice which melts as a result of climate change (7)
2. The practice of reusing items that would otherwise be discarded as waste (9)
3. _____ involves the greenhouse gases produced as a result of someone's actions (10)
4. The most popular Fairtrade fruit in the world. (6)
5. One of the greenhouse gases (6,7)
6. Ability to maintain the natural environment and produce goods without destroying it (10)
7. Fishing method in which a net is spread between two boats (4,8)
8. Situation where people have the purchasing power to buy a sufficient amount of goods (10)
9. Artificial tank where fish are reared for commercial purposes (4,4)
10. Metal from which tins and cans are made (9)
11. The distance travelled between the farm and the plate (5)
12. Effect of an unbalanced diet (12)
13. Lack of water leading to crop failure (7)

The shaded squares reveal the words:



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Chapter 2: British and international

Overview

In this chapter we will look at food products from British tradition and from other cuisines. We will explore different styles of cooking from different cultures and will look at the equipment and methods used to cook British and international dishes.

We will also look at the different presentation and serving styles of traditional and modern recipes.

Learning outcomes

After studying this chapter you should be able to do:

- ☐ understand and describe the distinctive features of cooking
- ☐ describe the equipment and cooking methods used in non-traditional cooking
- ☐ understand and describe how British and international cuisines have developed
- ☐ identify eating patterns and how they influence food choices
- ☐ identify different presentation and serving styles
- ☐ be able to prepare, create and adapt recipes from different cuisines
- ☐ understand how culture affects cuisine

Key Terms

Al fresco	Eating outside (e.g. picnics/barbecues)
Bento	A Japanese method of food preparation (in boxes)
Brunch	Late morning meal eaten in place of breakfast and lunch
Cuisine	A cooking style associated with a particular country or region
Culture	A way of living based on tradition
Eating patterns	A way of eating based on the culture of a country or region
Ethnicity	Relating to groups of people who belong to a specific ethnic group
Etiquette	Conforming to correct customs or behaviour
Export	To send goods to another country for sale
Garnish	A decoration or embellishment of food which can be eaten
Global	Worldwide
Immigration	Individuals or groups of people from one country moving to another country
Import	To bring goods from abroad for sale
Presentation styles	A way of showing off food in a variety of different ways
Ritual	A ceremony performed in a specific order
Scandinavian	Relating to Norway, Sweden, Denmark, Finland and Iceland
Siesta	A rest break taken in Spain during the hottest part of the day
Smorgasbord	Scandinavian buffet-style cold food meaning <i>buttered bread</i>
Sushi	A traditional Japanese food preparation method
Tagine	Earthenware dish for cooking North African spicy stews
Tapas	Traditional Spanish snacks or small meals
Traditional	Something that is long established within a country or region
Wok	Shallow frying pan associated with Chinese cooking, often used for stir-frying

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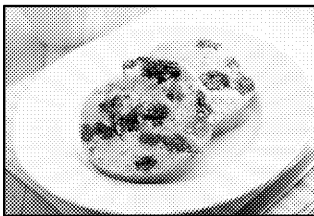
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British cuisine

The way we eat can be influenced by how we have been brought up and the traditions which we live. The type of food that is specific to a particular region or country is referred to as **cuisine**. Cuisine is a country's style based on ingredients, preparation, cooking methods and presentation/serving techniques. There are many things that affect a country's cuisine. Eating and cooking may decrease as more modern methods are embraced or when traditions affect **eating patterns**.

Typical British cuisine includes fish and chips, steak and kidney pie, shepherd's pie, apple pie, bangers and mash and regional variations such as **head-in-the-hole**, Yorkshire puddings, bubble and squeak, Cumberland and Lancashire hotpot. Traditional desserts include bread and butter pudding, spotted dick and jam roly-poly. Wales offers foods such as **barby** and Welsh rarebit and is also influenced by Italian and Mediterranean cuisines due to immigration during the eighteenth and nineteenth centuries. The East End of London is known for its **jelly eels**. Scotland is known for porridge and has its own unique food product in haggis. A traditional breakfast in Northern Ireland is the Ulster Fry and other foods typically associated with this part of the UK are soda bread and Irish stew. Cornwall is renowned for its Cornish pasties and stargazy fish pie and Derbyshire is known for Bakewell tarts.



Spotted dick pudding

The distinctive features of traditional British cuisine were one time characterised by availability and cost, with a proportion of dishes being stodgy (high fat and starchy). Due to **global** trade and **import** of exotic foods, in addition to a mix of cultures and **ethnicity**, British cuisine has evolved to include and embrace foods that were not available 40 years ago. Some traditional dishes are created through the need to reuse left-over food, such as bubble and squeak, which uses leftover vegetables.

Modern food recipes are influenced by different cultures and the availability of exotic and foreign foods. Eating outside (**al fresco**) has become more popular during the summer in the UK and barbecues have increased in popularity. The UK boasts many restaurants that offer cuisines from different countries and cultures which introduce to new or unfamiliar foods or ways of cooking.

Research

1. Look up what is included in a traditional bubble and squeak.
2. Look up the traditional method and equipment of cooking a traditional Yorkshire pudding and how it differs from making individual Yorkshire puddings.



Things to think about

Discuss one reason why, in a bubble and squeak, meat was replaced with vegetables.

Apply

List three foods that are popular now that they were 50 years ago.
Find recipes for four of these foods in this section.

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Regional variations

Cuisine in Great Britain varies depending on the region. As the climate and soil change, so do the ingredients and traditional foods. According to EU law, traditional foods can be recognised as

- **Protected Designation of Origin (PDO)** – this status is given to foods produced in a specific region with the use of traditional, recognised methods
- **Protected Geographical Indication (PGI)** – given to foods which are produced in a specific region
- **Traditional Speciality Guaranteed (TSG)** – given to foods which are made with traditional methods, but aren't linked to any specific region or area

You don't need to know these names, BUT you need to recognise traditional foods from Great Britain.

England

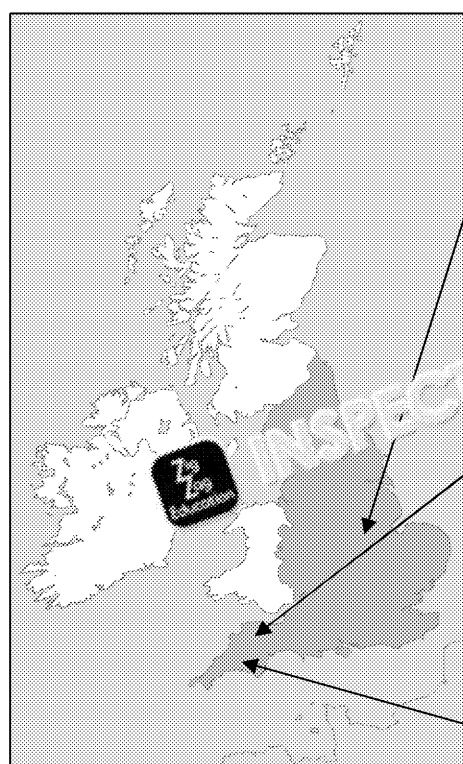
England can be divided into nine regions, each of which offers a variety of foods such as meats, cheeses, vegetables and fruit. The most popular foods include:

- | | |
|--|---------------------|
| • Cumbrian pork sausages | • Lancashire hotpot |
| • Dover sole | • Cornish pasty |
| • Cheddar, Stilton and Wensleydale cheeses | • Jellied eels |
| • English muffins | • Yorkshire pudding |
| • Eton mess | • Devonshire cream |
| • English breakfast | • Bakewell tart |

Food is an important part of English culture and is celebrated during various festivals such as the Ludlow Food Festival, the Whitstable Oyster Festival and the Taste of Cumbria Food Festival.

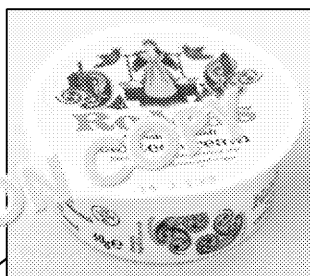
Research

Go to <http://www.ludlowfoodfestival.co.uk/> and list five traditional foods presented at this year's Ludlow Food Festival.



Did you know?

Melton Mowbray pork pies are characteristic of central England.



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Did you know?

Cornish pasties have PGI status. This means that they need to be prepared in Cornwall, but the final baking can take place anywhere.



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Wales

Traditional Welsh cuisine is hearty and filling – that’s because it evolved to fill the bellies of hard-working Welsh farmers, fishermen, miners and steel workers. When in Wales, make sure you taste these traditional foods:

- Cawl – a thick, hearty soup made of lamb and vegetables
- Welsh rarebit – spiced melted cheese on toast
- Glamorgan sausages – fully vegetarian, made from Caerphilly cheese, leek and mustard
- Leek and potato soup – the country’s most popular staple
- Welsh cakes – soft, buttery baked cakes with raisins and cinnamon
- Bara brith – dense loaf full of dried fruit and tea extract

Welsh food is known for its quality, and its export to other countries is growing. You can enjoy a variety of Welsh foods at, for example, the Anglesey Oyster Festival, which takes place in October.



Caerphilly cheese can be made from both pasteurised and unpasteurised cow's milk

Apply

Find a recipe for a traditional Welsh food, calculate its nutritional value and make it suitable for modern tastes.

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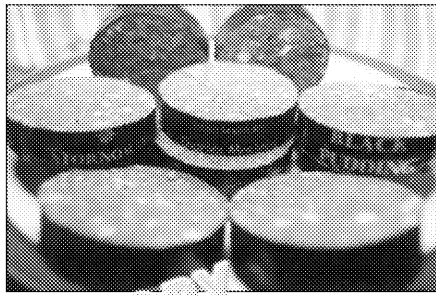


Scotland

The first thing that comes to mind when you say Scotland is probably haggis. Bingeing on haggis is a tradition in Scotland, and haggis is a pudding characteristic of this region, where it is served in a variety of ways, e.g. as a main course or a dessert.

Did you know?

Stornoway black pudding can only be produced within the area of the Isle of Lewis in the Outer Hebrides.



As Scotland is rather cold, its food has evolved to be heartening and warming. Traditional Scottish food includes:

- porridge
- Scotch haggis (made with barley, lamb, root vegetables, dried pulses and sometimes, cabbage)
- kippers (pickled and cold-smoked herring)
- kedgerree (flaked fish with rice, hard-boiled eggs and parsley)
- haggis (type of black pudding made with sheep's offal)
- Dunlop cheese
- shortbread and oatcakes
- scones
- Dundee cake

Scotland is also known internationally for its whisky.



Did you know?

Haggis is usually served with neeps and tatties (swede and potatoes). Here, it is served in a more modern way.

Research

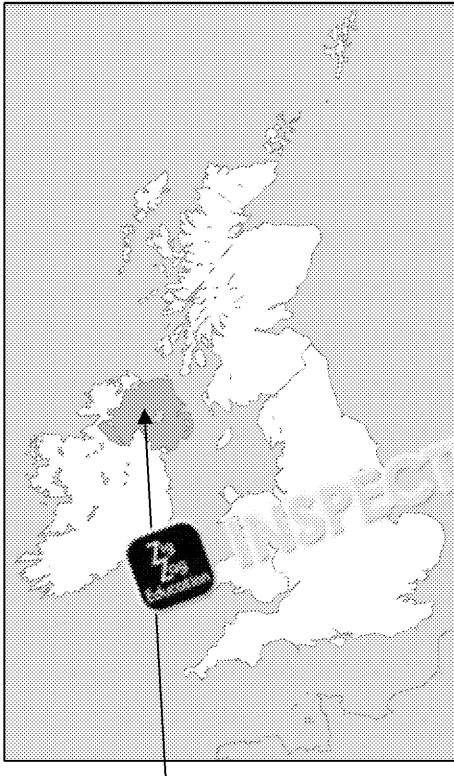
Tom Kitchin is another popular Scottish chef. His cooking is greatly inspired by his Scottish heritage. Visit <https://thekitchin.com/menus/> and find the Scottish inspirations in the menu for your region?



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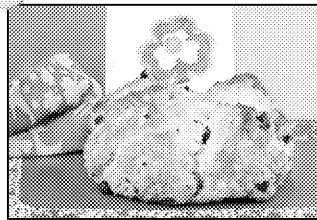


Northern Ireland



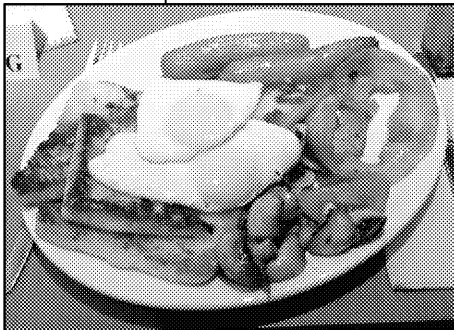
Northern Irish cuisine is a mixture of British and Irish influences. The most popular foods, you will find:

- soda bread
- Ardglass potted herring (slightly mackerel with breadcrumbs)
- boxty (potato cake made fifty-fifty with flour)
- champ (mashed potato with milk and butter)
- dulse (a snack made from seaweed)
- pasties (patties made from sausage and mince)
- steak and Guinness pie
- Irish stew made with mutton, potatoes and carrots



Did you know?

Soda bread is a traditional Irish bread made with bicarbonate of soda and no yeast.



Ulster Fry is an Irish take on a full breakfast with soda bread and potato farls

Ireland is also home to Irish whiskey (made from a blend of grains, not just potatoes).

The Irish also praise their food traditions with related events, such as Bushmills Salmon Festival and Comber Early Potato Festival.

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Check your understanding: British Food

1. Which of the following foods is a typical example of traditional UK cuisine? (1 mark)
 - a. Bangers and mash ☐
 - b. Chow mein ☐
 - c. Sushi ☐
 - d. Kebabs ☐
2. Which of the following foods has been adapted to replace meat with fish? (1 mark)
 - a. Christmas pudding ☐
 - b. Christmas cake ☐
 - c. Yule log ☐
 - d. Mince pies ☐
3. Which of the following foods is characteristic of Scotland? (1 mark)
 - a. Ardglass potted herring ☐
 - b. Stornoway black pudding ☐
 - c. Glamorgan sausage ☐
 - d. Lancashire hotpot ☐
4.  Give three ingredients characteristic of English cuisine. (3 marks)

1.

2.

3.

5. Describe two eating patterns characteristic of British cuisine. (4 marks)

1.

2.

.....

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International cuisines

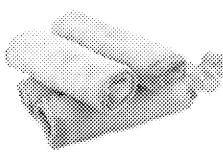
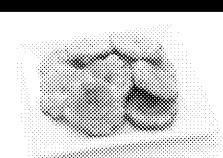
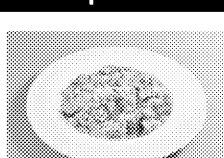
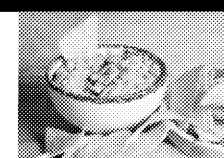
Almost every country has its own, distinguishable cuisine. The cuisines develop due to local conditions, available produce, soil quality, availability of land to grow and rear food. Cuisine is also developed in accordance with the dominant religion, e.g. in India, cuisine is influenced by Hinduism, and in Morocco by Islam. Modern cuisines are usually a medley of various influences, bringing the new foods with them and influence the locals.

Foods from various cultures

In Britain, due to global trade expansion, we sample a range of international cuisines. We can use food from other countries to describe cooking methods, particularly from France. The food from France: mayonnaise, crêpes, soufflé, hollandaise sauce, omelette, quiche, croissant, fondue, gateaux to name but a few. Some food terms refer to the cooking method or the product itself, such as *en croute* (in a crust) and *gratin* (lightly browned crust).

Other common foods found in Britain with an international origin include types of pasta, lasagne, spaghetti bolognese and pizza. The cuisine of some countries may be limited to a small area; for example **Scandinavian** countries may typically have recipes that are specific to their region. The cuisine of some countries is influenced by other **cultures** due to travelling, **importation** or **invasion** by foreign people. For example, cuisine is varied within the African continent due to variations between countries but also to the historic influence of French and Portuguese cuisines. South American cuisine is also influenced by Spanish, French and Portuguese cuisines.

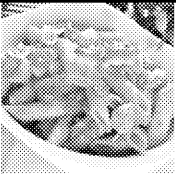
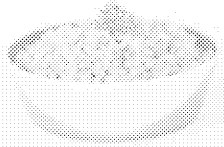
International cuisine refers to any cuisine from around the world each with its own characteristics and tastes, such as the following *typical* examples:

Chinese	Japanese	French
		
Spring rolls, sweet and sour stir-fry, noodles, chow mein	Miso, tofu, rice, wasabi, sushi	Niçoise salad, dauphine potatoes, escargot, vol-au-vents, crêpes
Caribbean	Spanish	Mexican
		
Pepperpot, seafood, plantain, rice dishes, papaya and coconut	Patatas bravas, paella, gazpacho	Enchiladas, tortillas, chiles con carne, tacos, guacamole, nachos
African	Indian	Asian (e.g. Thai)
		
Plantain, cassava, groundnut stew, couscous	Curries, biryani, tikka, dal, bhaji, dosa	Thai curry, stir-fry, rice dishes, coconut and vegetable soup

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Italian	Eastern European	South American
		
Lasagne, spaghetti bolognese, pizza, antipasto	Goulash, stew, bulgar wheat, dumplings	Quinoa, feijoada (black bean stew),



Research

Look up one traditional dish and one traditional ingredient from a cuisine you have chosen.

Apply

List three foods that are traditional to a cuisine you have chosen.

List three foods that are traditionally eaten in a region you have chosen.

Reflect

Look at the characteristics of a cuisine and its ingredients. How are they similar to other cuisines?

You may notice that some cuisines are very similar to each other, and use the same ingredients or spices. For example, the cuisine of Southern France, Italy, Greece and Morocco can be seen as similar as they all use a lot of fresh tomatoes, aubergines, courgettes, thyme, oregano, lemon, etc. This is because they are all located in the Mediterranean Sea region and enjoy the same mild climate. For this reason, cuisines of these countries can be collectively named as Mediterranean. Another example can be eastern Asia, which includes China, Japan and Korea – all of these cuisines are based on rice and use other similar ingredients.



Things to think about

Discuss why and how the cuisine of a country can change over time.



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Recipes: traditional and modern variations

In most countries there are modern variations of traditional recipes which retain elements of traditional cooking or ingredients but which better suit a modern lifestyle. In Japan, the traditional ways of taking tea are still observed in some provinces but busy lifestyles or different outlooks mean that the practice of traditional tea ceremonies is now in decline in the more modern cities, such as Tokyo. As traditions of **etiquette** and **ritual** decline, so do the associated recipes and food preparation techniques for that country.

Most modern recipe variations are created to make them more affordable, quicker to prepare and cook and use ingredients that are more readily available.

Some modern variations have different ingredients added, such as mince pies. In the Middle Ages, mince pies were made with meat rather than a filling of fruit and spices.

*Christmas
are made
rather than*

In some cases, recipes are influenced by ethical, moral or health concerns. For example, where recipes call for a non-sustainable product, where recipes call for a high fat content, variations may be made by using similar

Research

Look up a traditional British recipe that could still be prepared and cooked today with available ingredients.

Apply

List one traditional modern variation



Things to think about

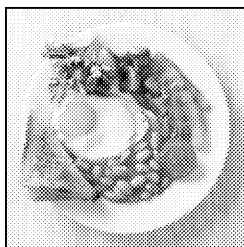
Discuss why a traditional recipe may need to be adapted to meet modern needs.

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Eating patterns

Eating patterns can influence what type of food we eat. For example, typical traditions may include eating a roast dinner on Sundays consisting of beef or other meat with vegetables and a full English breakfast which may consist of bacon, sausages, eggs, beans, mushrooms and bread. Other typical British traditions may include afternoon tea, dinner, supper.

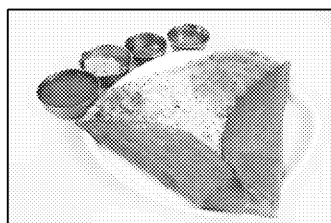


Although a full English breakfast is still consumed regularly in the UK, some people prefer a lighter more healthy breakfast. For some people their eating patterns and food choices are governed by time and a busy schedule and for others it may be cost or health or ethical concerns.

Modern ways of living and working have affected the way some people eat, for religious and ethical concerns. Traditional eating patterns are influenced by different ethnic groups, introducing new foods and ways of cooking, more information about healthy living and different ways of working. In Spain a traditional part of the working day is the hottest part of the day between 2pm and 4pm, where workers may visit a restaurant (take a later siesta) or take a rest. With air conditioning and the need to keep up with businesses do not keep with the tradition but prefer to work throughout the day. Proposals to end the working day at 6pm instead of 7pm may mean that there is a risk the tradition may die out eventually. A typical and traditional way of eating in Spain is to share dishes or snacks from which people can share.

Eating patterns are often influenced by religion and culture. In traditional Japan, eating was observed and the preparation and cooking were incorporated into a special ritual. Modern living and working mean that there may not be enough time to devote to traditional eating. However, some customs do still exist and small lacquered boxes containing portions of food (called **bento** boxes) which can be bought as takeaways or prepared for lunch.

A traditional Indian breakfast differs greatly from a typical UK breakfast and may include dosas (thin pancakes made with lentils with a spicy filling). An American breakfast may include pancakes with syrup and sometimes fruit. Nowadays, due to time constraints and convenience, breakfast may consist of toast and cereal.



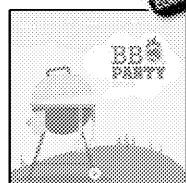
Example of a traditional Indian breakfast



Example of Spanish tapas

Research

Look up the difference between brunch and lunch.



Barbecues and picnics have become more popular in the UK. Eating outside is referred to as *al fresco* dining.

Apply

List one real breakfast is

Things to think about

Discuss why eating patterns may differ from country to country.

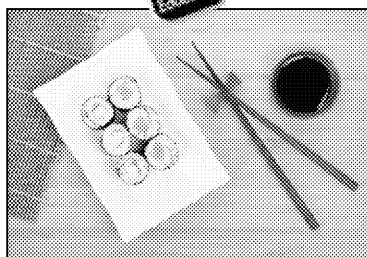
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Presentation styles

Presentation styles can affect how we view food and can help to make it more appealing or appear more appetising. In some cases, the presentation of food may be unappetising and discourage consumption. Food in restaurants is presented to embellish and show off the food and make it look more creative and colourful, sometimes with **garnishes** of flower petals. Some garnishes may be for decorative purposes only while traditional garnishes such as salad vegetables can be consumed (the rule is, you shouldn't put anything inedible on the plate).

In Japan, presentation is important when providing food. **Sushi** is a type of food preparation consisting of vinegared rice with seafood or meat and/or vegetables and sometimes fruit. Sushi is usually presented in the form of small balls or rolls. The way that sushi is prepared and presented is considered an important aspect of the dish. It is served with condiments such as soy sauce, wasabi or pickled ginger. Although most people use chopsticks it is acceptable to eat sushi with (washed) hands and some Japanese restaurants provide cloths to ensure hands are clean before and after eating.



Sushi are small rolls or balls of food usually presented with sauces, such as ginger, wasabi or soy and eaten with chopsticks or with clean hands

A traditional Scandinavian **smorgasbord** consists of open sandwiches which can

Equipment and cooking methods

Equipment and cooking methods vary depending on the dishes being created and the methods of the country of origin; some recipes call for specific cooking equipment.

Preparation

Equipment, tools and utensils that may be used for food preparation include:

Colanders, slicers, mixers, blenders, graters, strainers, mixing bowls, mincers, garlic mashers and peelers, measuring cups, scales for measuring, cutting boards, measuring spoons, whisks, shears, cheese slicers, mortars and pestles for grinding spices, and meat tenderisers for tenderising meat.

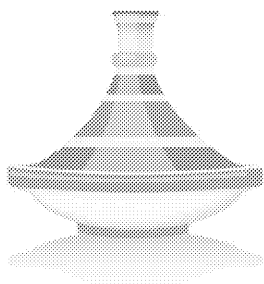
Cooking

Equipment and tools which may be used for cooking include:

- barbecue for outdoor dining
- **tagine** dish – an earthenware dish with a conical lid (used for slow cooking North African tagines)
- baking oven and grill
- earthenware pizza oven
- skillet – frying, sautéing and browning
- griddle or flat iron baking plate
- frying pan
- air fryer – fries food without the need for oil or fat
- **wok** – a large pan used in Chinese cooking for stir fries, steaming, poaching and deep frying
- sauté pans – to lightly fry in a little oil
- soup and sauce pans
- casserole dish – for slow cooked stews
- ramekin dish – a small dish for cooking and serving a helping of food
- baking trays – for tarts, pies, puddings and roast potatoes
- stockpots – for boiling stock

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Tagines are used in traditional North African (e.g. Moroccan) cooking



Woks are used in traditional Chinese and other Asian cooking

Skills



1. Look up a recipe for a traditional jam roly-poly pudding and try to prepare it.
2. Prepare and cook falafels using traditional methods and cooking equipment.
3. Prepare guacamole and present it Mexican style.
4. Prepare a Japanese bento using traditional methods and cooking techniques.



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- | Cheese | Country |
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Chapter 2: Quiz-ine

Fill in the answers to the questions below to reveal a word relevant to cuisine in the shaded squares (spaces are spaces between words).

1									
2									
3									
4									
5									
6									
7									
8									
9									
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11									
12									
13									

- This is made from chickpeas, olive oil and garlic and is associated with Middle East cuisine (5)
- Traditional dessert made of whipped cream, crushed meringue and strawberries (6)
- Stuffed pancakes served as a part of an Indian breakfast (5)
- Large sausage made from sheep's offal (6)
- These utensils are traditionally used in Asia to eat meals in place of a knife and fork (4)
- Welsh national vegetable (4)
- Where clotted cream and pasties come from (8)
- Salade niçoise originates from which country? (6)
- A range of open sandwiches served in a buffet, characteristic of Sweden (11)
- Blue mould cheese made in England (7)
- This French word means *pastry crust* (2,6)
- Chow mein is a dish from which country? (5)
- Layered Italian dish made from sheets of pasta, béchamel sauce, tomato sauce (8)

The shaded squares reveal this word:

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Chapter 3: Food manufact

Overview

In this chapter you will learn what primary and secondary processes the food has to go through before finding its way to your plate. You will also learn how the processing of food affects its nutritional value and sensory features. Finally, you will learn about how modern technologies support food production and human health. You will also learn what additives are used for, and their advantages and disadvantages.

Learning outcomes

After studying this chapter you should be able to do the following:

- ☐ describe the difference between primary and secondary processes
- ☐ distinguish between processed and unprocessed foods
- ☐ explain how processing affects the nutritional value of food
- ☐ explain the need for food fortification
- ☐ explain how M foods affect health

Key Terms

Additives	Artificial or natural substances that do not usually occur in foods but are added to enhance their features or shelf life
Antioxidant	Chemical which can prevent oxidation by donating electrons to free radicals
Atherosclerosis	Condition in which cholesterol plaque builds up and accumulates in the arteries, leading to narrow and stiffen
Bran	Outer layer of a grain
Cholesterol	Fatty substance necessary for building cell membranes, and producing steroid hormones, transported in the blood by lipoproteins
Coagulation	A process by which proteins aggregate together and form lumps, e.g. curdling of milk to form cheese
Curd	Coagulated milk, a stage in cheese production
Enriching	Addition of vitamins and minerals to foods which lost their nutrients during processing
Fermentation	A process in which sugar is turned into lactic acid or alcohol; typically involving bacteria and yeast
Fortification	A process in which vitamins and minerals are added to foods to improve their nutritional value
Homogenisation	The process of breaking down fat molecules to make them smaller and more evenly distributed throughout the mixture
Irradiation	The application of ionizing radiation to food products in order to kill bacteria, microorganisms and insects.
Lactose	Milk sugar
Lipoproteins	Molecules built of protein and fat, responsible for transporting lipids in the blood
Pasteurisation	A process in which product is heated to 72 °C to kill harmful bacteria
Phytosterol	Chemical derived from plants, which helps to lower blood cholesterol and reduce the risk of atherosclerosis
Prebiotic	Naturally occurring substance or chemical which supports the growth of beneficial bacteria
Primary processing	All actions applied to food that do not change its features or nutritional value significantly
Probiotic	Beneficial bacteria species that are beneficial for health
Rennet	An enzyme found in calves' stomachs, used in cheese production to coagulate milk
Secondary processing	Actions applied to food which change its features significantly, e.g. cooking, baking, frying, etc.
Sterilisation	A process in which a food is heated to high temperatures (over 121 °C) to kill bacteria and spores and enhance shelf life
Trans fats	Harmful fats generated as an effect of prolonged heating of unsaturated fats
Whey	A milky liquid by-product of cheese production

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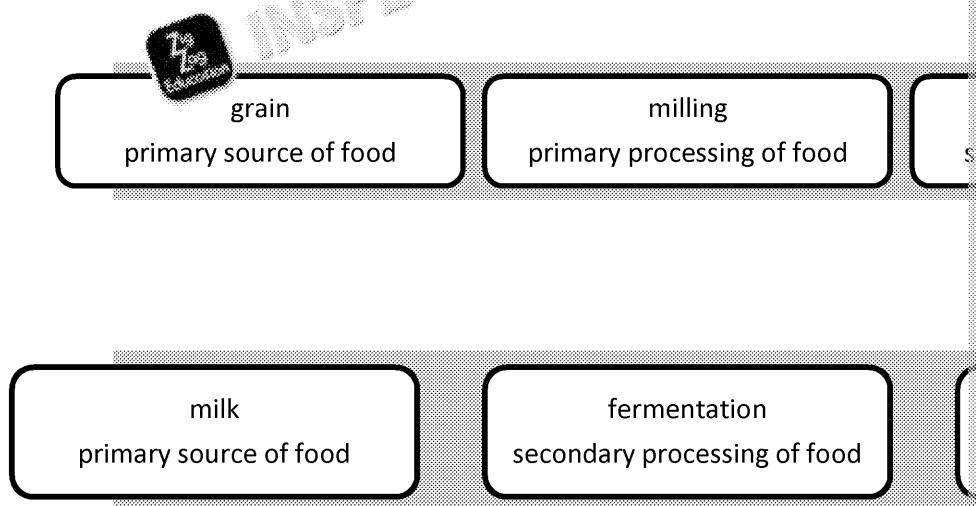


Food processing

Food production is the process of growing crops and rearing animals, and then creating appetising meals. Many raw products are edible, but still have to go through some processing before they can be actually eaten; for example, strawberries have to be washed and potentially sliced. Food is processed to ensure it's safe to eat, lengthen its shelf life, maintain its nutritional value, use, and assure its variety and affordability. Food processing includes two main stages:

1. **Primary processing**, which makes the food usable
2. **Secondary processing**, to make food more convenient to use and lengthen its shelf life

The foods in their natural state are called primary sources of food – they include grains and eggs in their natural, raw state. If they are processed in any way, they are called secondary sources. You can see examples of primary and secondary sources of food on the diagram below.



Before the food is processed, it needs to be grown/reared/caught, harvested and then transported to a factory.

Point of origin

Point of origin indicates where food comes from, as this is important for its nutritional value. For example, carrot is a staple food widely used in British cuisine. It can be grown both conventionally and organically. If the latter occurs, you can assume that the carrot contains fewer pesticides and is healthier. There are also foods which cannot be grown in the UK for various reasons (e.g. average temperature, moisture, type of soil). These foods are then imported to the UK. The origin has to be clearly shown on the label. The produce is then harvested, picked or collected. Grains are then harvested, picked or collected (many farms have their own silos in which to store grains) or transported to a place of storage.

Transport

Depending on the distance, the produce is most often transported from the farm to a mill or a factory, where the food is processed. Livestock (e.g. pigs or cows) are transported to slaughterhouses in trailers. Once the food is processed, it is shipped to wholesalers. Fresh produce, such as milk, is often transported by refrigerated trucks to maintain its quality.

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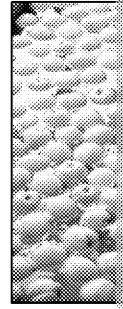


Primary processing of plant-derived foods

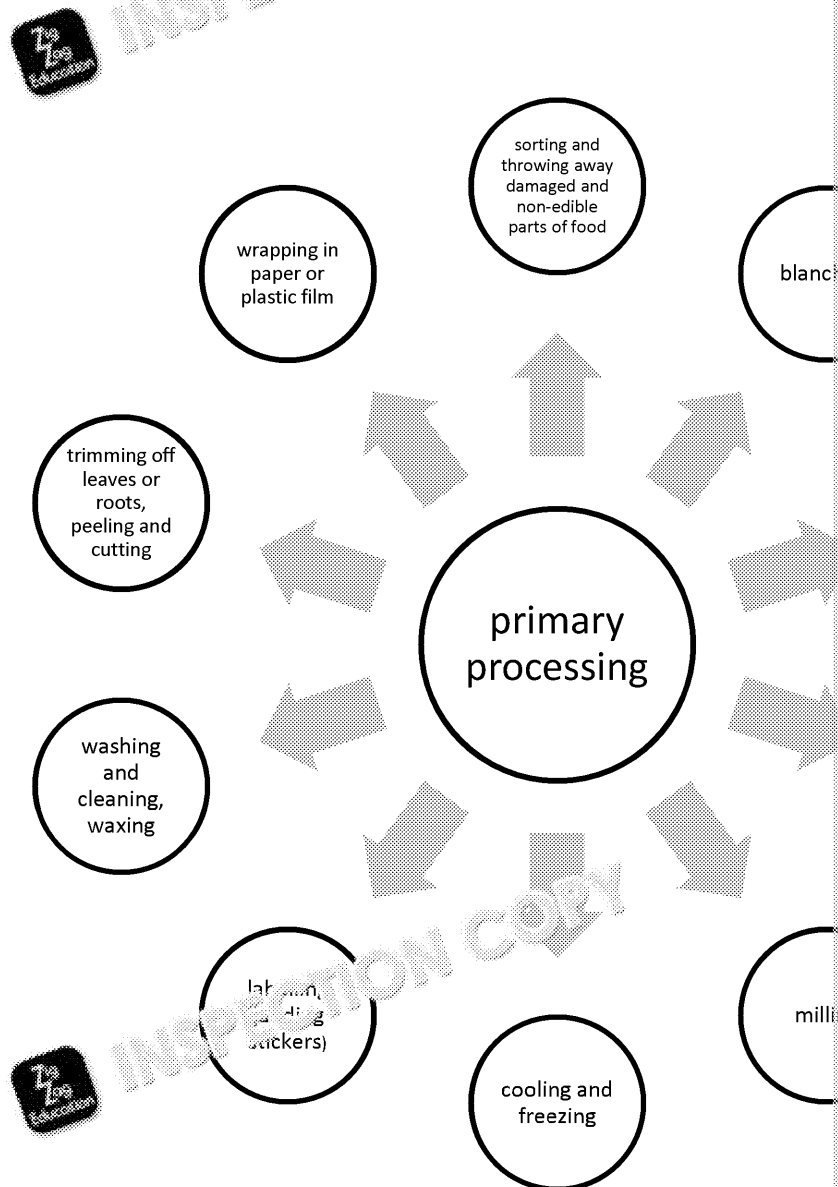
Primary processing of food consists of all actions taken to make raw produce ready to use or eat, and usually does not affect the features of nutritional value of food products in a significant way.

That includes actions taken after the produce has been harvested or picked, such as washing, peeling, trimming, slicing, bagging, labelling and many other actions taken to make sure the plant-derived food products can be eaten or used for further processing.

Primary processed fruit and vegetables are usually sold raw, dried or frozen, either the primary processes applied to plant-derived foods are shown in the diagram below



Apples are packed in boxes



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The first few steps of primary processing are pretty straightforward – the food has to be washed, cleaned, sorted and inspected. It is then washed again and sand, trimmed to remove inedible parts, and sorted to separate it from misshapen or damaged items. It can be either prepared for sale (e.g. by waxing and adding stickers) or processed further. It can then be stored, either in a convenient or safer to use. These stages could include one or more of the following:

Blanching is the process in which fruit or vegetables are immersed into boiling water (for a short time, usually around two minutes) and then plunged into ice-cold water. The process is mainly used for vegetables and fruits that would otherwise be susceptible to enzymatic browning, such as apples or potatoes. Blanching is used to preserve some fruit and vegetables before freezing. Blanching prevents the food from becoming discoloured and preserves its nutritional value.

Cooling includes refrigeration and freezing foods – all the way from the factory to the consumer. The main purpose of this is to slow down the growth of microorganisms which could spoil the food, and to preserve its nutritional value.

Drying is a process in which most of the water in food is evaporated at high temperature. Lack of water makes food less prone to microorganism growth, and therefore, extends its shelf life. Drying can be applied to foods that are resistant to heat, and helps obtain such products as powdered milk, cereals, potato flakes and powdered soups.

Accelerated freeze-drying (lyophilisation) helps to extend the shelf life of food by removing almost all of the water from it, while maintaining its taste. In this technique, food is first frozen (e.g. in liquid nitrogen) and only then is water removed from it under low pressure (usually in vacuum). The effect is a powder or granules – like instant coffee. Freeze-drying is also used to dry herbs and fruit. Drying and freeze-drying may lose some soluble vitamins in the final product, as they may be evaporated together with water.

Storing the food usually means keeping it in coolers, fridges, freezers or other kinds of storage. The food must be kept for a prolonged period of time. Storage conditions are very important and have to be controlled to ensure the quality of the product. During storage, the proper temperature, lighting, air quality and protection from pests must be ensured, as otherwise the food could be spoiled and lose its nutritional value, as well as its taste.

Chilling means that the food is cooled to below 5 °C. In the food industry, it is important to be carried out as quickly as possible, as this shortens the risk of bacterial growth and food spoilage.

In *blast chilling*, the food is cooled to below 3 °C in a maximum of 90 minutes. Blast chillers are used to cool down hot, cooked food – you cannot use a fridge for this as it would increase the internal temperature of the fridge and overburden its cooling system, putting other foods in it at risk. Once cooled, the food can be stored safely in a fridge for no more than five days.

Freezing means chilling the food to below -18 °C. Freezing enables the formation of ice crystals. The smaller the crystals, the smoother the texture of the food. Freezing slows down the growth of microorganisms by slowing down the rate of chemical reactions, and prevents the food from becoming discoloured. Various methods of industrial freezing include:

- **air-blast freezing** – in this method, air at a temperature of -30 °C is blown over the food. This method requires a lot of time and allows the growth of large ice crystals, which may damage the food. A form of air-blast chilling is *fluidised bed*, in which food travels on long conveyor belts and is blown from the bottom so that the food is suspended upon it; this shortens the time required to maintain the quality of food
- **contact freezing** – food is placed between two cold metal plates and frozen between them
- **immersion freezing** – food is immersed in a low-temperature brine or other fluid
- **cryogenic freezing** – food passes through a long channel where it is cooled by liquid nitrogen or carbon dioxide

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All of these methods can also be combined.

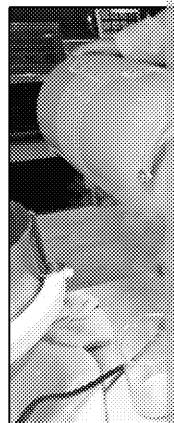
Once the food is frozen, it needs to be stored in a freezer. Domestic freezers are usually set at -18°C , while industrial freezers can be set as low as -84°C (in freezers cooled with liquid nitrogen, the temperature can be as low as -184°C !).

Remember that both fresh and cooked foods can be frozen!

Primary processing also includes **milling** – turning grains into flour, which then can be used to make other foods during secondary processing – refining of sugar or extraction of corn kernels from the cob.

Apply

Research why brine is used for immediate freezing.



The process of using liquid nitrogen is so fast that you don't have time to feel the cold. It has a very low boiling point.

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How is flour made?

Flour is a powder obtained as a result of milling grains, such as wheat, barley, rye.

Contains mostly starch and is the main ingredient of flour

Endosperm

Brush



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Germ

Provides nutrients, such as vitamins and minerals, to the growing plant, and adds nutritional value to flour

Bran

The outer shell of the grain which protects it from environmental factors, and accumulates fibre and group B vitamins

After the grains have been harvested, they are sieved to separate dirt, stones, little pieces of metal and other possible contaminants. That stage is called 'purification'.

After the grain has been purified, it is washed in warm water and dried in a centrifuge. This usually increases the amount of water in the grain and makes it easier to peel.

Afterwards, the grain is ground – it goes through breaker rolls, which open it and separate the **bran**. As a result, a 'first break flour', semolina and large pieces of wheat grain are produced.

The 'first break flour' is then removed, and semolina and large pieces of wheat grain are rolled repeatedly a few times (usually up to five) to produce fine flour.

After each reduction roll, the flour goes through metal sieves, which sort the final product into different grades. If the flour is not separated, it is called wholemeal.

Since most of the micronutrients in grains are located close to the bran, white wheat flour is fairly poor in them, and, therefore, is obligatorily fortified in iron, thiamine, nicotinic acid (a form of niacin) and calcium carbonate (or another form of calcium).

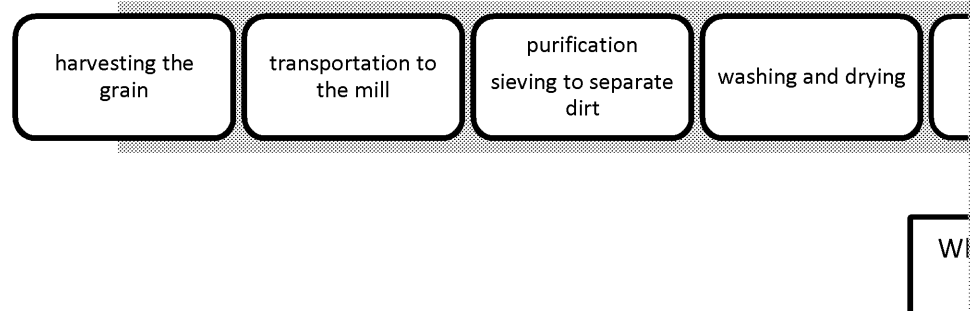
The germ that's left from milling can be used to produce wholemeal flour, bran cereals, animal feed or even edible plates!

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The main stages of flour production are presented in the diagram below.



There are many varieties of flour available on the market – many of them are made from other kinds of flour. They differ in gluten content, protein content and use.

Type of flour	Description and use
Strong flour	As it is high in gluten, it is best for making bread
Weak flour	Low in gluten, it is best for shortcrust and in baking (biscuits, cakes, scones, doughnuts)
Self-raising flour	Contains a raising agent, so can be used for scones and biscuits
Wholemeal flour	High in fibre; usually added to bread to improve texture
Semolina	Coarse flour used to make pasta
Gluten-free flour (e.g. cornstarch)	As it has no gluten, it is not ideal for making bread and crumbly) but can be used as a thickener for soups and free pasta
Rye flour	High in gluten; can be used to prepare a sourdough

How is sugar made?

Sugar is a sweet, crystalline substance obtained from sugar cane and sugar beets. The process of sugar production can be adjusted in order to produce different types of sugar, e.g. crystal sugar, caster sugar, icing sugar and brown sugar. The sugar consumed in Europe and the USA comes mostly from sugar beets – however, only 20% of the world's sugar is made from beets.

So, how is sugar made?

1. Sugar beet harvest season begins in mid-September – this is when you can spot long chains of lorries full of beets going to factories around the country.
2. There, beets are washed clean from soil and sliced into thin strips.
3. The strips of beet are then mixed with hot water to remove the sucrose from the beets.
4. The mixture is then filtered and heated to thicken it and turn it into a syrup.
5. Afterwards, factory workers add sugar crystals to the syrup – the sucrose from the syrup will attach to the crystals and grow larger, which makes them easier to extract.
6. Sugar crystals are then dried, and eventually processed further (e.g. bleached) to produce different types of sugar. The remaining thick syrup with sugar crystals removed is known as molasses.

As you know, sugar consumption in a healthy, balanced diet should be limited. For those who choose to use sugar alternatives, such as stevia or xylitol, which are sweet substances derived from the stevia plant and birch tree juice, respectively.

Research

Visit <http://www.sucrose.com/learn.html> and list the countries where sugar is produced.

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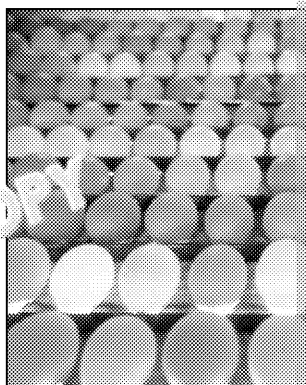


Primary processing of animal-derived foods

Primary processing of animal foods includes all actions taken to prepare the reared animals for further processing, such as draining blood from killed animals, skinning, removing the carcasses (which can also be left whole), plucking feathers, filleting, or removing bones. For raw animal foods edible, eggs are washed (and labelled) and milk is pasteurised.



Feathers are plucked and chicken is portioned



Eggs are washed and sorted through quality control and packaging

Primary processing of milk

After the milk has been collected from cows, it is transported to dairy factories, where it can be **pasteurised**, **sterilised**, **homogenised** and even turned into other products such as yoghurt or cheese.

1. **Pasteurisation** of milk is a process in which the milk is heated to 72 °C for 15 seconds and then cooled. This process kills harmful bacteria and extends shelf life. It doesn't usually affect nutritional value or any other features of the milk.
2. Ultra-high temperature (UHT) processing of milk is a process in which milk is quickly heated to 135 °C for one second and immediately cooled. As a result, all the bacteria are killed (including the good ones) and the milk can be stored at ambient temperature. Since the process is very short, it doesn't affect the features of milk in a significant way.
3. Milk is an emulsion in which fat molecules and other nutrients are suspended. To prevent them from separating, milk has to go through **homogenisation**. Homogenisation is done by applying pressure through tiny openings. Consequently, fat molecules become very small and form a stable, creamy mixture, ready to drink or use. Homogenisation doesn't affect the nutritional value but can improve its colour since fat molecules are dispersed more evenly in the milk, so it reflects light more efficiently (thus, milk can look whiter).
4. **Sterilisation** is a process designed to kill all microorganisms present in raw milk. It is usually heated to 110 °C for 30 minutes. Sterilisation inactivates enzymes and damages cell membranes. High temperature also causes complex reactions to happen between molecules of proteins and lipids. As a result, brown pigments and aromatic agents are produced. Therefore, sterilised milk has a different flavour, colour and texture. Also, the temperature and length of sterilisation will affect the nutritional value of B vitamins in milk.
5. Milk can also be microfiltered. During microfiltration, milk passes under low pressure through fine membranes, which collect bacteria and some fat. For that reason, microfiltered milk has a lower amount of fat in milk in order to obtain semi-skimmed or skimmed milk. Semi-skimmed milk can be poorer in fat-soluble vitamins, since they are removed, together with the fat. This can also change the flavour of the milk, which may become more watery and provide less creaminess than whole milk. Microfiltration helps to extend milk's shelf life by up to 45 days.

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Depending on the amount of fat in milk, it can be labelled blue (full fat) green (semi-skimmed) or white (skimmed).

Research

Visit the website www.bbc.co.uk/programmes/articles/xF8zVbpw have-the-most-surprising-facts-about-our-favourite-foods to discover more about the foods we eat and consumed in Great Britain.

Primary processing of meat

Meat is obtained from the muscle tissue of animals, such as cows, lambs, pigs and is made up of:

- two types of proteins (myosin and actin) which make the muscle fibres and enable them to contract and stretch; during cooking, the protein in meat will denature, and the fibres of a piece of meat to become smaller and leak some meat juice.
- connective tissue (made of collagen and elastin) which surrounds the fibres and attaches it to the bones, forming tendons
 - When the meat is cooked, the collagen dissolves and softens, and can be extracted and used to set savoury and sweet dishes.
 - The elastin builds mainly the tendons and ligaments which join the bones, and usually remains tough even after cooking.
- fatty tissue, which is located both in the muscle structure (intramuscular fat, a type of invisible fat) and around it (visible fat); during cooking, the fat will melt and make the meat more juicy.

After the animal has been killed, it has to be shaved or plucked, skinned and divided into portions (the cuts can differ between countries).

The animals are cut into various pieces depending on the muscle structure and position. Tender parts, such as sirloin, are low in connective tissue and usually require a short cooking time (they can be used for steaks). Tougher cuts are high in connective tissue and require long cooking times. Parts, such as the hocks and trotters of a pig, are very high in elastin, and can be used to make a savoury jelly made with meat and vegetables). The less-popular cuts, such as the mince, are used to make various kinds of sausages.

To find out more about the different cuts of beef, pork and lamb, and their culinary uses, visit the website.

After being killed, the body of an animal goes through many chemical changes. To improve the tenderness of the meat, it can be hung. Hanging requires low temperature and a certain length of time (at least seven days for red meat, around two days for poultry). During this time, the proteins in the meat relax and are partially broken down by the enzymes present in the meat, making it softer and easier to digest. Also, during that time, certain aromatic compounds in the meat become dark red.

Other primary processes applied to meat can include:

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Chilling	Usually applied to separate cuts, which can be then shipped to stores
Freezing	To extend shelf life
Mincing	To improve the texture, especially of very tough meat cuts Minced meat can be sold, or can be used in the factory to make products

Primary processing of fish

The primary processes applied to fish differ depending on various factors, such as:

- whether the fish is to be sold fresh, frozen, smoked, or canned
- whether the fish is to be sold whole, in fillets, or in pieces

For fish classification, read Chapter 1.

The muscles of fish are built from fibres separated by connective tissue built of collagen are rich in water. It softens and dissolves quickly during cooking – for this reason cooking time is short. Collagen from the connective tissue and bones releases some gelatin to prepare aspic.

The primary processing related to fish usually involves:

- trimming – removing the fins
- cleaning – removing dirt and sand
- removing scales
- cutting – usually into fillets (tender meat blocks with no bones) or steaks (cheeks) (which may be used to prepare fish preserves or sold in packets for preparation)
- chilling or freezing – depending whether the fish is to be sold fresh or frozen



Fresh salmon prepared to be frozen in the factory

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Check your understanding

Primary processing of food

1. Primary processing does not include...? (1 mark)
 - a. trimming off leaves ☐
 - b. milling flour ☐
 - c. cheese production ☐
 - d. milk pasteurisation ☐
2. Which statement is TRUE about primary processing of food? (1 mark)
 - a. it is only applied to plant foods ☐
 - b. it is only applied to animal foods ☐
 - c. in primary processing, foods are cooled ☐
 - d. none of the above ☐
3. The correct temperature for freezing is...? (1 mark)
 - a. below 10 °C ☐
 - b. below 5 °C ☐
 - c. below 0 °C ☐
 - d. -18 °C ☐
4. Explain how flour type affects bread quality. (4 marks)

.....

.....

.....

.....

.....

5. Describe the following processes applied to milk. (6 marks)

Pasteurisation	
Sterilisation	
Ultra heat treatment	

6. Explain how milling of wheat affects its nutritional value. (2 marks)

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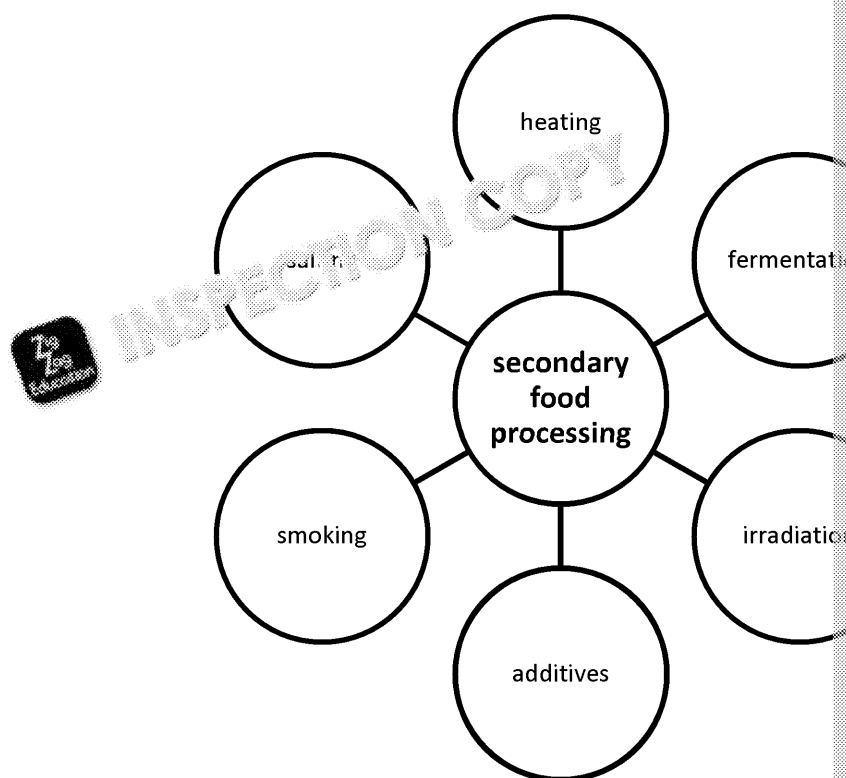
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Secondary processing of food

Secondary processing of food allows it to be used to make new products, which are different from the ingredients they were made from. This may be turning flour and eggs into a cake or turning milk into yoghurt.

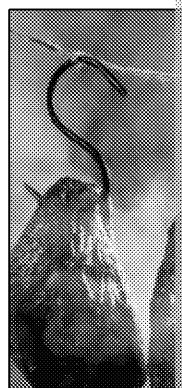
The main methods of secondary food processing include:



Heating is about cooking food in order to kill pathogenic microbes, changing its texture and making it more convenient and appealing to consumers. Heating increases the shelf life of food. If the package remains closed. Heating also includes **pasteurisation** and **sterilisation** of milk and meat and vegetable preserves.

Salting usually is applied to meats and fish. This is a very old technique, which was used to preserve the food before fridges were invented. Salting changes the structure of the food and significantly extends the shelf life. An example of a salted food is beef jerky.

Smoking is a process applied mainly to cheese, fish and meats. It is carried out in specially designed smoking chambers. Smoke preserves the food and changes its flavour, so it is important to use the right kind of wood (e.g. oak, beech, alder or maple, with addition of other kinds of wood (such as juniper), herbs and vegetables (such as garlic) to alter the flavour and texture of the desired product. Smoking can be conducted in cold temperatures (around 30 °C) or in warm conditions (up to 90 °C), and usually takes from a couple of hours to as much as a month.



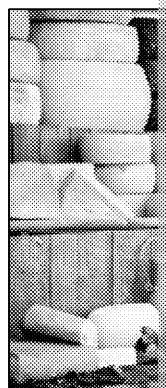
Ham and salt

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Fermentation is a process in which microorganisms – such as bacteria, mould or yeast – turn sugars into carbon dioxide and other substances, such as lactic acid or alcohol. Fermentation is used to obtain yoghurt, kefir, cheese, wine, beer, bread, and even cold cuts such as salami.

Another way of preserving the nutritional value of foods and extending their shelf life is **irradiation**. In this process, ionising radiation is applied to foods in order to kill harmful bacteria and reduce the need to use preservatives. The World Health Organization states that such foods as raw chicken, cocoa beans, dates, mango, papaya, potatoes, onion, legumes, spices, strawberries, raw fish, fish preserves and grains can be irradiated without harm, although countries can state their own law in the matter. In the UK, irradiation of seven food groups is legal, and includes meat, vegetables, cereals, bulbs and tubers and shellfish, and poultry products are mandatory to include proper information on the packaging ingredients and their use.



Cheese is

The addition of food **additives** changes the flavour, colour, and/or texture of food, and extends its shelf life. This will be discussed in more detail later.

Apply

using

Examples of secondary processing

In the previous section we discussed how wheat is processed to obtain flour. From flour, many other products, such as bread, pasta, cakes, shortbread, pizza, sauces, waffles

How pasta is made from wheat

The basic recipe for pasta includes flour and warm water. To change the flavour, eggs, spices and colourants (natural or artificial) can be also added. First, flour is mixed with other ingredients are added (such as eggs, colourants and herbs). Once the dough is formed, it is pressed between large cylinders, changing the dough into a thin sheet, which is then cut into pasta shapes. The pasta is then dried to kill microorganisms and pasteurise the dough. Afterwards, the sheet can be cut into various shapes. Pasta can then be cooked, refrigerated, frozen or dried.



A pasta machine can be used for both pressing the dough and cutting it – and the width of the sheet can be adjusted.

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How bread is made from wheat

Bread, in many different forms, is known in various countries all around the world. Bread is most popular in many countries such as Great Britain or the USA, more so than other breads from different cuisines, such as naan bread from India or South American bread.

The main ingredients of bread include flour, water and salt. Depending on the type of bread, it can be sourdough or yeast.

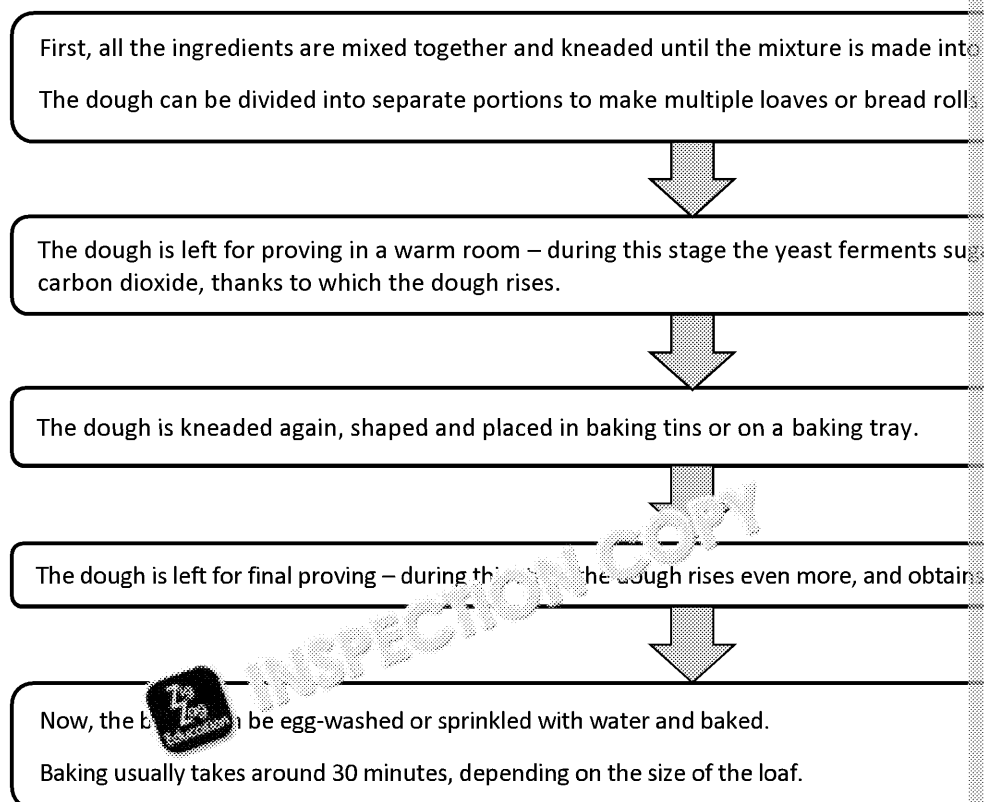
Flour is necessary to make the structure and bulk of the bread. When the flour is mixed with water, it forms gluten. Gluten has the form of a net, which creates the structure of the bread. The quality of the flour plays a vital role in the final texture and taste of the bread.

Water helps to develop gluten in the dough.

Salt is used for many reasons. It improves the flavour of the bread, strengthens the gluten, slows down the growth of microorganisms and prevents the dough from overgrowing. Since it competes with sugars from flour for water, it also helps to make the brown crust during baking, as the sugars caramelize.

The last ingredient – either sourdough or yeast – is used in bread as a leavening agent. With the warmth, water and food (sugar), the microorganisms ferment the sugar and produce carbon dioxide, which expands and rises, and is trapped in the gluten net, which helps to obtain the final shape of the bread.

The stages of bread making are shown in the diagram below.



Various producers may also choose to add:

- seeds, nuts, herbs or spices – to improve the taste, aroma and nutritional value of the bread; they can be both added to the dough and sprinkled on top
- vinegar – to preserve the bread and extend its shelf life
- vegetable fat – to make the dough lighter due to aeration and to extend the shelf life

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How yoghurt is made from milk

Yoghurt is a result of milk **fermentation**, conducted by the **probiotic** bacteria. During the process, **lactose** is turned into lactic acid. Depending on the species of bacteria and fat content in the milk, the yoghurt will be thicker or more liquid, and will have a tangy or more delicate flavour. Ready-to-eat yoghurt should contain live bacteria, which are advantageous for health.

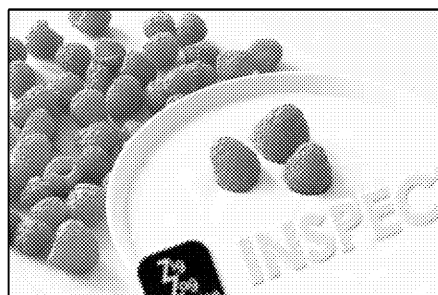
First, milk has to be **pasteurised** to kill all the harmful bacteria and protect it from spoilage. It is also filtered and **homogenised**, to obtain a smooth texture. It is then stirred into the milk, which then spends some time in warm conditions – around 40 °C – to grow and process the sugar to produce lactic acid. Since acid causes proteins to coagulate, the yoghurt is much thicker than milk and has a sour taste.

Once the yoghurt is set, various **additives** may be added to it – most popular yoghurts contain fruits or jams, cereals, flavours, coffee extracts or toffee sauce.

There are various types of yoghurt available, depending on the quality of ingredients and the details of the production process.

Yoghurt type	Description
Natural full-fat yoghurt	- Made of whole milk with the use of probiotic bacteria - The most basic type of yoghurt - Creamy and tangy
Low-fat yoghurt	- Made of semi-skimmed or skimmed milk - Usually runnier than full-fat yoghurt - Can contain starch, gelatine or other thickening agents
Greek yoghurt	- Thick and creamy - High in fat Whey is drained off during production
Live yoghurt (bio yoghurt)	- Less acidic than 'normal' yoghurt - Contains various bacteria types to support the digestive system

Yoghurt is a source of **probiotic** bacteria and high biological value proteins. Since it can also be considered as part of a diet for lactose-intolerant people.



Did you know?

Probiotic bacteria are beneficial for health

- They limit the growth of pathogenic bacteria
- They boost the immune system
- They regulate bowel movements
- They help fight off diarrhoea and constipation
- They improve ingestion of macronutrients
- They produce vitamins!

Apply

You can make a yoghurt yourself!

1. Heat up 1 litre of milk until it reaches 80 °C.
2. Cool it down to 42 °C.
3. Add 60 g of natural yoghurt with live bacteria (check the label!) and stir.
4. Keep the container in warm conditions for a couple of hours.
5. Once the yoghurt is ready, put it in the fridge and eat within a few days!

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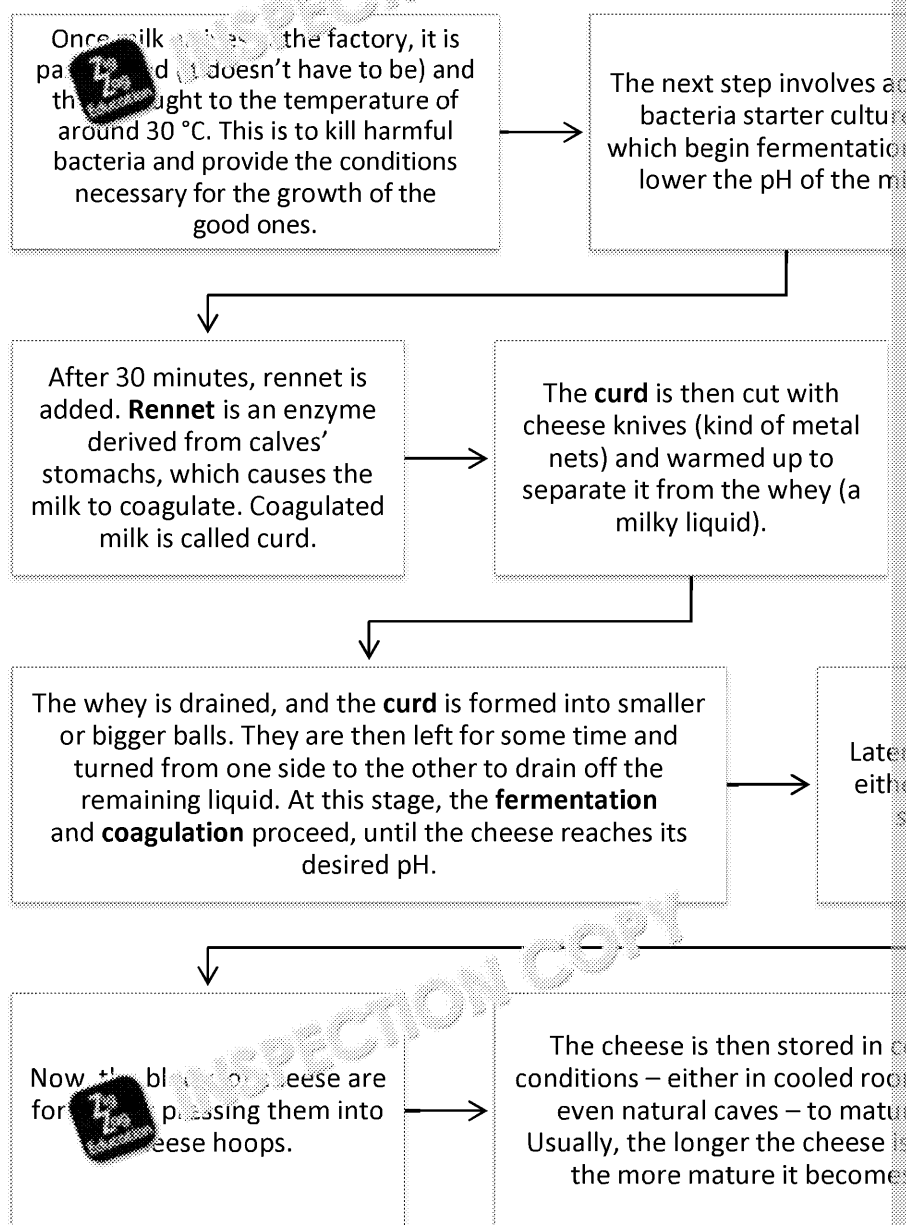


How cheese is made from milk

Cheese is a nutrient-rich product made of milk. Its look, flavour, smell, nutritional value and other features depend on many factors, such as:

- what kind of milk was used to make the cheese
- what type of coagulant was used to process the milk (bacteria, mould, rennet...)
- whether any additives were added, such as herbs or leaves
- how long the cheese was processed
- what the processing conditions were
- and even what the cow (or sheep, or goat, or buffalo...) ate

Cheese can be made from either raw or pasteurised milk, and that also affects its features. Milk in large factories is always pasteurised, but the milk in small factories may not have to be.



There are many various types of cheese – soft, firm, hard, fresh and smoked. The texture or have big holes inside. All these features depend on the bacteria species sometimes mould such as *Penicillium* is added too (usually to obtain blue- or green-veined cheese). Bacteria in milk include *Lactococcus*, *Lactobacillus*, *Streptococcus*, *Propionobacterium* and

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Cheese is an important source of calcium, phosphorus, proteins, fats and fat-soluble vitamins. It is an important part of cuisines in various countries all around the world.

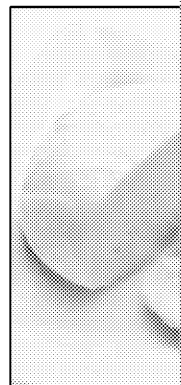
Since the **lactose** in it is usually processed by the microorganisms, it can also be eaten by lactose-intolerant people.

Apply

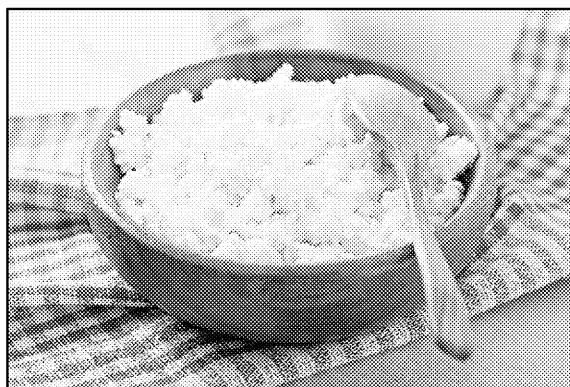
How
Can
Cook



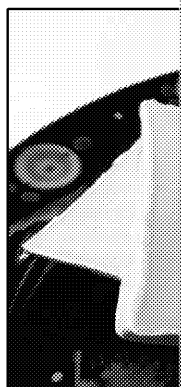
Various types of cheese



Mozzarella is



Cottage cheese can be eaten on toast, in pancakes, or can be used to make a cheesecake



*The white skin
to*

Research

Learn more about cheese at

<http://www.britishcheese.com/downloads>



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Secondary processing of fruit (e.g. jams)

Fruit is produced by bushes and trees and is designed to protect the seeds and provide them with nutrients until the time the seed can be planted and grown into another bush or tree. For that reason, they are full of micro- and macronutrients. Since fresh fruit is available for a short time only (usually from early spring to autumn), people have learnt to make fruit preserves, which can be stored for a later use. Fruit is used to make:

- marmalade
- chutney
- fruit butter
- confiture
- jam
- sauce
- dried fruit
- fruit curd
- frozen fruit
- candied fruit
- compote
- wine
- and many other products

The final product – again – depends on the quality and quantity of ingredients used, the method and length of cooking, and the additives, such as sugar, cloves, lemon juice or gelling agents.

Jam, fruit butter and confiture are made from whole or cut fruit, while jelly is made from fruit juice. Fruit butter is usually made from thick (not watery) fruit such as apples, and confiture is usually made from cherries, and jam can be made from soft fruit such as raspberries or strawberries.

The process of making jam is shown in the diagram below.

- 1
 - wash, cut or crush the fruit
 - fruit such as quinces, apples, gooseberries and currants are high in water, acid and pectin, which are important for jam making
- 2
 - add water
 - this is important, especially if fruit used has a low water content (e.g. plums), as water helps to cook the fruit and ensure proper texture
- 3
 - add acid, e.g. lemon juice
 - acid helps to release pectin from the fruit cells, and this helps to thicken and set the mixture
- 4
 - add sugar
 - sugar acts as a preservative in jam
 - special jam sugar contains also pectin and acid, which help to thicken and set the mixture
- 5
 - simmer
 - the jam needs to be clear and very hot before being poured into jars
- 6
 - pour into jars
 - sterilising the jars and lids in boiling water helps to ensure that no microorganisms (bacteria) are present
 - pour the hot jam into clean, sterile jars and close with a clean lid
 - closing the jar immediately helps to create a vacuum inside the jar, so the shelf life is extended

Marmalade is kind of a jam made from citrus juice, fruit and peel. For this reason, it is popular in regions where citrus fruits are grown, such as Portugal or Spain.

Some fruit, such as oranges or apples, can also be juiced. When making a juice, fruit is pressed through sieves to remove the solid bits. The juice can then be pasteurised, and additives may be added to it, e.g. vitamin C to prevent oxidation, or sugar to improve taste. Since fruit juice is usually very low in dietary fibre, it is recommended to limit its consumption to 150 ml per day.

Certain fruits are very rich in pectin. This natural gelling agent helps to turn fruit products into a jelly. To make a jelly, you need to crush and cook the fruit (you can add sugar then), and then sieve to remove any solid bits. If fruit such as blackcurrants are used, the juice will turn into a jelly when cooled. To make jelly from low-pectin fruit, such as strawberries, you need to add a gelling agent to the strained syrup.

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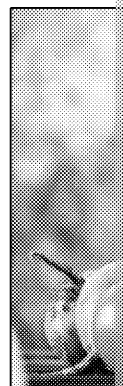


Secondary processing of vegetables

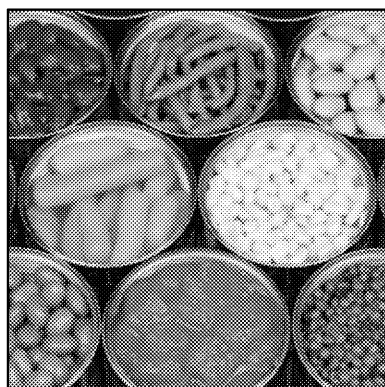
Vegetable preserves are indispensable, especially during long winter months, when fresh vegetables are not available. Secondary processing of vegetables may include such processes as cooking, freezing and pickling.

Cooking of vegetables softens the fibre in them and helps to gelatinise the starch, making them more palatable and tender. Cooking allows us to obtain a wide range of food products, from steamed vegetables to soups. However, the cooking method, the nutritional value of cooked vegetables may be preserved (e.g. steaming), lost (boiling and draining especially decrease the amount of water-soluble vitamins) or increased (e.g. in deep-frying the amount of fat rises dramatically).

Juicing is applied to many vegetables, such as carrots, beetroots and tomatoes. The juice can be pressed from both cooked and raw vegetables. It can also have all the bits filtered out to make it more palatable. The most popular vegetables used for juicing include tomatoes and carrots. In recent years, food processors and blenders have become very popular, which has increased the number of people making their own juices at home from various ingredients, such as kale, cucumber, celery and beetroot. Juicing can lower the amount of fibre if the bits are removed from the juice, and can speed up enzymatic browning of the juice. For this reason, commercially available juices are often pasteurised or contain preservatives. Juices can also be evaporated to obtain concentrates (which will lower the amount of water-soluble vitamins in them).



Vegetable juicing



The most popular canned vegetables include peas, sweetcorn, beans and tomatoes

Canning is a fairly cheap and effective way of preserving vegetables (and other foods) for a long time. It was a product of the Industrial Revolution – they were first developed in the beginning of the nineteenth century.

Today, canning is used to preserve all types of food, including milk, beverages, etc. However, it is only applied to foods that are processed (cooked, cut, minced or prepared in some way).

Once the food has been cooked, it is poured into a can and sealed with a metal lid. The can is then sterilised by steam, which lowers the pressure inside the can and makes the cans airtight.

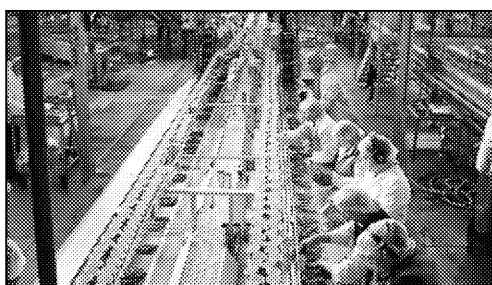
Despite the name, canning can be applied to any material which can be boiled and sealed, such as glass jars and plastic bottles. The process of canning can greatly affect the nutritional value and sensory characteristics of food:

- some fruit and vegetables become too soft, or even mushy
- acidic foods, such as chopped tomatoes and citrus fruit, may react with the metal can. A protective plastic layer has to be added inside of the can
- some vitamins may become damaged
- as many canned fruits are covered with syrup, their sugar content and calories are increased
- as many canned vegetables are covered with brine, their salt content greatly increases

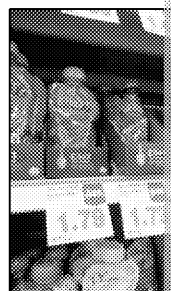
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Canning greatly extends the shelf life of food as the seal prevents it from exposure to air. The process of canning with hot water kills all remaining microorganisms in the food. Canned foods are safe to eat – but there are cases when the canned food has still been edible long after the 'best before' date has expired.



Workers putting food into cans before they are filled with brine and sealed.



Pouches of vegetables undergo a process.

Remember that the liquid should be drained from canned foods once opened – exposure to air can lead to the growth of microorganisms and the transmission of harmful substances from the packaging.

Apply

List foods which can and cannot be canned.



Apply

Think about cans a suitable packaging for...

Pickling can be done with the use of brine (solution of water and salt) or vinegar. Pickled vegetables will have different nutritional values compared to fresh ones, depending on the ingredients used. Vegetables pickled in brine often undergo bacterial fermentation, which makes them high in **probiotic** bacteria – an example of such a product is sauerkraut.

Secondary processing of meat

Fresh meat is considered a perishable food. This means that it has to be packaged, cooked or preserved in another way to maintain its taste, appearance and safety. Meat can include steps such as hanging (when the meat is left to mature) and smoking.

During curing, pieces of meat (usually small cuts such as a joint, but sometimes large pieces) are flavoured with a mixture of salt, nitrites and sugar. The meat can be immersed in a brine solution or can be rubbed or injected into it. Various chemical reactions which take place during curing affect the texture, colour and nutritional value of the meat.

Research

Research the function of nitrite when curing meat.

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Check your understanding

Secondary processing of food

1. Secondary processing does not include... (1 mark)
 - a. smoking ☐
 - b. jam making ☐
 - c. cheese production ☐
 - d. milk sterilisation ☐
2. Processing of foods extends shelf life because... (1 mark)
 - a. it kills microorganisms ☐
 - b. it reduces the number of microorganisms ☐
 - c. preservatives are added ☐
 - d. all of the above ☐
3. A by-product of cheese production is called... (1 mark)
 - a. curd ☐
 - b. whey ☐
 - c. cheese ☐
 - d. rennet ☐
4. Identify one function of the following ingredients in cheese production.

Probiotic bacteria	
Rennet	

5. Explain why blast chilling has to take less than 90 minutes. (2 marks)

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6. Describe three reasons why food is processed. (6 marks)

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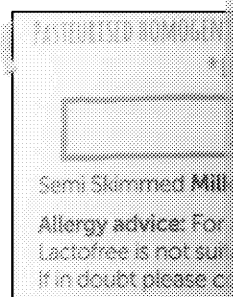


How processing affects the nutritional value of food

The choice of preparation and cooking methods is important in maintaining the nutritional value of food. Some of the processes are beneficial, others lead to vitamin and mineral loss.

Primary processing of foods usually doesn't change the structure of a given food.

- Milling wheat leads to vitamin and mineral loss because the inside of the grain is removed. Most of the vitamins in grains are located close to the bran, so they are lost. To avoid this is to either choose wholemeal flour or fortify the plain white flour.
- Another example of how primary processing affects food is sterilisation of milk. Sterilisation is conducted under very high temperatures, which kill all the bacteria and spores in the milk. During this process, proteins begin to denature and if the milk is heated for too long, the Maillard reaction can occur. The Maillard reaction is a process between particles of sugar and protein. As a result, so-called *Amadori* compounds are created. The Maillard reaction can, therefore, change the colour, smell and flavour of milk. The same process occurs when sugar is removed to make **lactose-free** milk.
- Also, cutting fruit and vegetables to make them more convenient for consumption leads to a loss of nutritional value because of oxygen exposure, which accelerates the rate of oxidation and nutrient loss.



Lactase enzymes break down molecules of lactose, which improves the nutritional value of lactose-free milk.

Secondary processing of foods includes the use of very high and very low temperatures, which significantly affects the nutritional value of foods. Water-soluble vitamins are very easily lost. They are washed out of food. Also, skimming milk (or removing fat from other products) removes fat-soluble vitamins in it. The loss of certain micronutrients due to various processing methods is shown below.

Vitamin or mineral	Freezing	Drying	Cooking	Congelation
Vitamin A	5%	50%	25%	
Vitamin C	30%	80%	50%	
Vitamin B1	5%	30%	55%	
Vitamin B2	-	10%	25%	
Folic acid	5%	50%	70%	
Vitamin B12	-	-	45%	
Calcium	5%	5%	20%	
Iron	-	-	35%	
Magnesium	-	-	25%	
Sodium	-	-	25%	

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How does secondary processing affect the nutritional value of food?

- Prolonged heating, especially at very high temperatures (such as in **deep frying**) creates **trans fats**. Trans fats are a form of unsaturated fats, which are very harmful for health. Consumption can increase the risk of atherosclerosis (blocking of veins and arteries) and coronary heart disease, heart attack and stroke.

Research

Read the document at <https://www.bda.uk.com/foodfacts/TransFats.pdf> and identify foods which usually contain trans fats.

- **Curing** of meat extends its shelf life and helps to inhibit bacterial growth, but increases the amount of sodium in the ready product. For this reason, consumption should be limited, especially when struggling with hypertension.
- Processing of meat involves **smoking**, can introduce harmful substances into the food, which is associated with a higher risk of developing bowel cancer. Hot dogs, bacon, sausages are high in fat and sodium.
- **Grilling** can lead to a change in the nutritional value of foods; first, because of the loss of fat, second, because during grilling carcinogenic substances are released. This may increase the risk of cancer – especially bowel cancer. There is also a positive aspect to grilling – it allows food to melt and allows it to drip off, so the final product provides fewer calories.
- Depending on the method used, **drying** and **freeze-drying** can affect the nutritional value by reducing the amount of water-soluble vitamins. Also, some vitamin A is lost when exposed to the sun (vitamin A is extremely sensitive to light). Nevertheless, they remove moisture, inhibit the growth of microorganisms and thereby reduce the risk of food poisoning and food spoilage.

Interestingly, **irradiation** is believed not to affect the nutritional value of foods; however, food processed with this method must be labelled in a suitable way.

Other methods, such as the use of modified atmosphere packaging, help to preserve food as they limit oxygen exposure and prevent oxidation.



Things to think about

Discuss how primary and secondary food processing affects the nutritional value of food. Consider ways of preventing this.

How does secondary processing affect the sensory characteristics of food?

Again, this depends on the type of process used. For example, fermentation turns milk into cheese (change in texture, and colour); curing tenderises meat and also preserves its pink colour (change in texture, aroma and taste); baking causes a sponge-like, open texture and creates a golden-brown, crunchy crust (change in texture and taste).

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Check your understanding: How processing affects the nutritional value of food

1. Which of the following is UNTRUE about pasteurisation? (1 mark)
 - a. It is applied to milk.
 - b. It can be applied to solid foods.
 - c. It can be applied to non-food products.
 - d. It is performed at low temperatures.
2. Which of the following statements is UNTRUE about sterilisation? (1 mark)
 - a. It can cause colour change in milk.
 - b. It is carried out at high temperatures.
 - c. It kills all bacteria and spores.
 - d. It is carried out at low temperatures.
3. Which of the following reduces the amount of fat-soluble vitamins in food?

☐ a. Steaming	☐ b. Drying
☐ c. Frying	☐ d. Smoking

4. Identify two negative effects of secondary processing of meat. (2 marks)

1.

2.

5. Evaluate how canning affects the sensory value and nutritional value of food.

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6. Why is brine a suitable liquid for use in immersion freezing? (2 marks)

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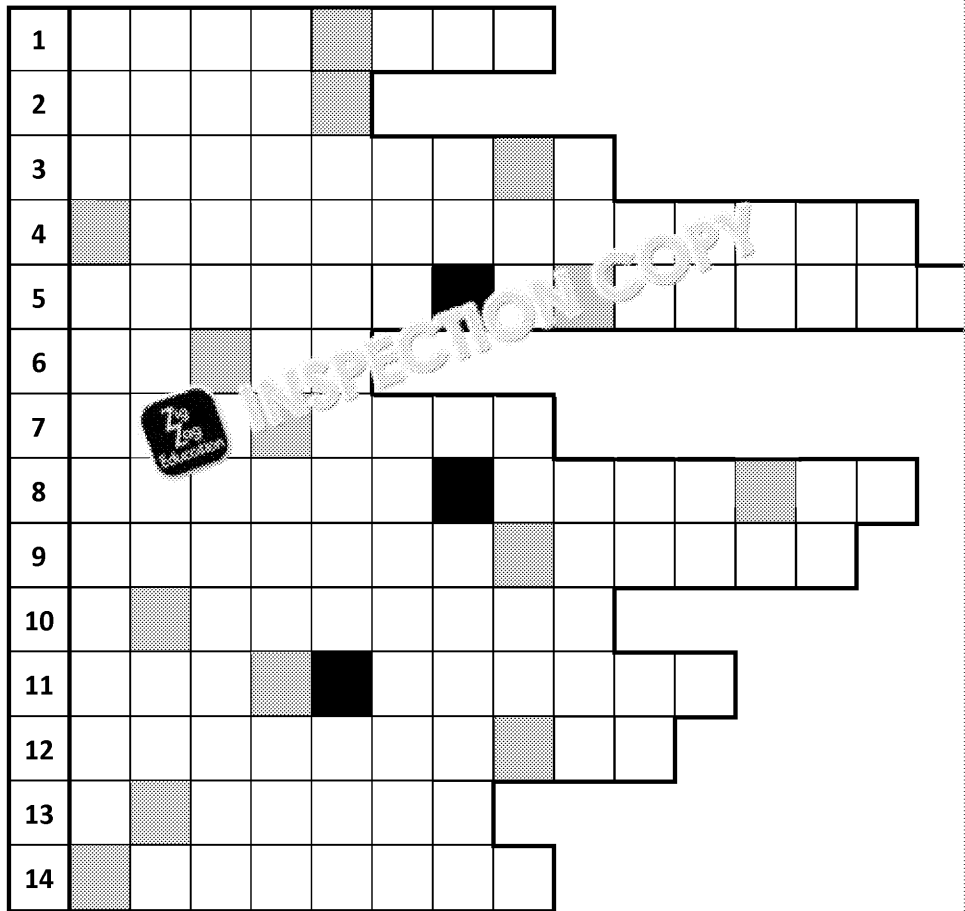
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Chapter 3: Quiz-ine

Fill in the answers to the questions below and then use the letters from the shaded squares relevant to food processing.



1. Coarse flour used to produce pasta (8)
2. Fruit preserve made from fruit juice and gelatine (5)
3. The process stopped by removal of oxygen in CAP (9)
4. Heating raw milk to 72 °C (14)
5. The chemical name for kitchen salt (6,8)
6. Solution of water and salt (5)
7. Type of protein in meat which dissolves during cooking (8)
8. Preservation method in which all air is removed (6,7)
9. Process applied to food to kill all bacteria and spores (4)
10. Preserve made from citrus fruit (9)
11. Date mark used on canned foods (4,6)
12. Heat transfer method used in cooking freezing (10)
13. Dairy product made with use of probiotic bacteria (7)
14. Liquid used in cryogenic freezing (8)

The shaded squares reveal this word:

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Technological developments which health and food production

Processing of foods leads to (sometimes significant) changes in their nutritional value and quality. Low intake of vitamins and minerals, along with high intake of calories, can lead to diet-related diseases, such as anaemia, atherosclerosis, and beriberi. For that reason, in many countries in the world vitamins and minerals are added to foods to increase their nutritional value and reduce the risk of such diseases.

Modern technologies also allow further changes in the structure and nutritional value of foods. Some changes are used to improve the palatability and safety of the food, while others aim to reduce foods' impact on health.

Technological developments supporting better health

Fortification of food

Fortification of foods is a process in which certain vitamins and/or minerals are added in order to:

- increase its nutritional value
- restore its nutritional value which has been lost during processing
- make it more suitable for certain consumer groups (e.g. children)
- prevent diseases caused by lack of these vitamins and minerals

According to the Food and Agriculture Organization of the United Nations (FAO), 'fortification' is applied to foods whether or not they contain a given micronutrient, while foods that have lost their nutritional value during processing are 'enriched'.

There are two important rules about food fortification:

1. Fortification cannot be applied to unprocessed foods.
2. If micronutrients are added, it is obligatory to list the amount on the label.

Foods can be fortified obligatorily or voluntarily.

ENERGY
FAT
of which
CARBOHYDRATE
of which
FIBRE
PROTEIN
SALT
VITAMIN
THIAMINE
RIBOFLAVIN
NIACIN
VITAMIN B6
FOLIC ACID
VITAMIN C
MINERAL
IRON

The amount of
thiamine

Mandatory fortification	Voluntary fortification
Wheat flour and bread iron, vitamin B1, niacin, calcium and folic acid	Bread Calcium, iron, vitamin B1, niacin, folic acid
Fat spread (margarine) vitamin A and D	Fat spread (margarine) vitamin A and D
Skimmed and skimmed milk Vitamin A	Whole milk and other milk products Vitamin A

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¹⁵ <https://www.food.gov.uk/sites/default/files/multimedia/pdfs/breadflourguide.pdf>

¹⁶ <https://www.food.gov.uk/sites/default/files/multimedia/pdfs/yellowfatguidance0610.pdf>

Advantages of fortification

INGREDIENTS

Fortified Wheat Flour (**Wheat** Flour, Calcium Carbonate, Iron, Niacin, Thiamin), Water, Yeast, Salt, Rapeseed Oil, Emulsifiers; Mono- and Diglycerides of Fatty Acids, Mono- Di-Acetyl Tartaric Acid Esters of Mono- and Diglycerides of Fatty Acids, **Soya** Flour, Preservative; Calcium Propionate, Flour Treatment Agent; Ascorbic Acid.

For allergens, including cereals containing gluten, see ingredients in **bold**.

Bread is a staple food fortified by law

Did you know?

In some countries it is mandatory to fortify salt with iodine to prevent thyroid gland diseases.



Tropical
sweet
Ingr
Water
(Orange
Lulo)
Mango
Flavour
Sweet
V
A la

Apply

Find five products in your home that have been fortified. Which micronutrients do they contain? Was this mandatory or voluntary fortification?

Disadvantages of fortification

Although generally beneficial, fortification can have its downsides. The disadvantages are:

- Products fortified with calcium might not be suitable for people suffering from kidney disease.
- Products fortified with iodine might not be beneficial for those suffering from thyroid disease.
- As manufacturers often add vitamins and minerals to breakfast cereals, cereals, and other products, they might make them seem healthier and more appealing; in fact, they are often loaded with sugar (and often salt), and their consumption should be limited. The health benefits of fortified foods are usually lower than the advantages, as they might contribute to the obesity and tooth decay.
- Some substances, such as iron, can also affect the taste and appearance of the food.
- Iron interacts with vitamin A and iodine. For this reason the addition of these nutrients to fortified foods should be carefully monitored.
- Some nutrients may interact with each other, making it difficult to calculate the amount of each nutrient that should be added. For example, calcium limits iron absorption, while vitamin C increases iron absorption.
- In many cases, food fortification may also be a costly process, and in effect the cost of the nutrients may be borne by those who need them the most (e.g. people who do not eat a balanced diet based on fresh produce).

Ingredients Cereal Grains (Whole Grain **Wheat** Flour (32.5%), Rice Flour), Sugar, Glucose Syrup, Vitamins and Minerals (Calcium, Niacin, Pantothenic Acid, Iron, Vitamin B1, Vitamin B6, Vitamin B12, Vitamin C, Vitamin E, Vitamin K, Vitamin A, Vitamin D, Vitamin F, Vitamin G, Vitamin H, Vitamin I, Vitamin J, Vitamin K, Vitamin L, Vitamin M, Vitamin N, Vitamin O, Vitamin P, Vitamin Q, Vitamin R, Vitamin S, Vitamin T, Vitamin U, Vitamin V, Vitamin W, Vitamin X, Vitamin Y, Vitamin Z, Vitamin AA, Vitamin AB, Vitamin AC, Vitamin AD, Vitamin AE, Vitamin AF, Vitamin AG, Vitamin AH, Vitamin AI, Vitamin AJ, Vitamin AK, Vitamin AL, Vitamin AM, Vitamin AN, Vitamin AO, Vitamin AP, Vitamin AQ, Vitamin AR, Vitamin AS, Vitamin AT, Vitamin AU, Vitamin AV, Vitamin AW, Vitamin AX, Vitamin AY, Vitamin AZ, Vitamin BA, Vitamin BB, Vitamin BC, Vitamin BD, Vitamin BE, Vitamin BF, Vitamin BG, Vitamin BH, Vitamin BI, Vitamin BJ, Vitamin BK, Vitamin BL, Vitamin BM, Vitamin BN, Vitamin BO, Vitamin BP, Vitamin BQ, Vitamin BR, Vitamin BS, Vitamin BT, Vitamin BU, Vitamin BV, Vitamin BW, Vitamin BX, Vitamin BY, Vitamin BZ, Vitamin CA, Vitamin CB, Vitamin CC, Vitamin CD, Vitamin CE, Vitamin CF, Vitamin CG, Vitamin CH, Vitamin CI, Vitamin CJ, Vitamin CK, Vitamin CL, Vitamin CM, Vitamin CN, Vitamin CO, Vitamin CP, Vitamin CQ, Vitamin CR, Vitamin CS, Vitamin CT, Vitamin CU, Vitamin CV, Vitamin CW, Vitamin CX, Vitamin CY, Vitamin CZ, Vitamin DA, Vitamin DB, Vitamin DC, Vitamin DD, Vitamin DE, Vitamin DF, Vitamin DG, Vitamin DH, Vitamin DI, Vitamin DJ, Vitamin DK, Vitamin DL, Vitamin DM, Vitamin DN, Vitamin DO, Vitamin DP, Vitamin DQ, Vitamin DR, Vitamin DS, Vitamin DT, Vitamin DU, Vitamin DV, Vitamin DW, Vitamin DX, Vitamin DY, Vitamin DZ, Vitamin EA, Vitamin EB, Vitamin EC, Vitamin ED, Vitamin EE, Vitamin EF, Vitamin EG, Vitamin EH, Vitamin EI, Vitamin EJ, Vitamin EK, Vitamin EL, Vitamin EM, Vitamin EN, Vitamin EO, Vitamin EP, Vitamin EQ, Vitamin ER, Vitamin ES, Vitamin ET, Vitamin EU, Vitamin EV, Vitamin EW, Vitamin EX, Vitamin EY, Vitamin EZ, Vitamin FA, Vitamin FB, Vitamin FC, Vitamin FD, Vitamin FE, Vitamin FF, Vitamin FG, Vitamin FH, Vitamin FI, Vitamin FJ, Vitamin FK, Vitamin FL, Vitamin FM, Vitamin FN, Vitamin FO, Vitamin FP, Vitamin FQ, Vitamin FR, Vitamin FS, Vitamin FT, Vitamin FU, Vitamin FV, Vitamin FW, Vitamin FX, Vitamin FY, Vitamin FZ, Vitamin GA, Vitamin GB, Vitamin GC, Vitamin GD, Vitamin GE, Vitamin GF, Vitamin GG, Vitamin GH, Vitamin GI, Vitamin GJ, Vitamin GK, Vitamin GL, Vitamin GM, Vitamin GN, Vitamin GO, Vitamin GP, Vitamin GQ, Vitamin GR, Vitamin GS, Vitamin GT, Vitamin GU, Vitamin GV, Vitamin GW, Vitamin GX, Vitamin GY, Vitamin GZ, Vitamin HA, Vitamin HB, Vitamin HC, Vitamin HD, Vitamin HE, Vitamin HF, Vitamin HG, Vitamin HH, Vitamin HI, Vitamin HJ, Vitamin HK, Vitamin HL, Vitamin HM, Vitamin HN, Vitamin HO, Vitamin HP, Vitamin HQ, Vitamin HR, Vitamin HS, Vitamin HT, Vitamin HU, Vitamin HV, Vitamin HW, Vitamin HX, Vitamin HY, Vitamin HZ, Vitamin IA, Vitamin IB, Vitamin IC, Vitamin ID, Vitamin IE, Vitamin IF, Vitamin IG, Vitamin IH, Vitamin II, Vitamin IJ, Vitamin IK, Vitamin IL, Vitamin IM, Vitamin IN, Vitamin IO, Vitamin IP, Vitamin IQ, Vitamin IR, Vitamin IS, Vitamin IT, Vitamin IU, Vitamin IV, Vitamin IW, Vitamin IX, Vitamin IY, Vitamin IZ, Vitamin JA, Vitamin JB, Vitamin JC, Vitamin JD, Vitamin JE, Vitamin JF, Vitamin JG, Vitamin JH, Vitamin JI, Vitamin JJ, Vitamin JK, Vitamin JL, Vitamin JM, Vitamin JN, Vitamin JO, Vitamin JP, Vitamin JQ, Vitamin JR, Vitamin JS, Vitamin JT, Vitamin JU, Vitamin JV, Vitamin JW, Vitamin JX, Vitamin JY, Vitamin JZ, Vitamin KA, Vitamin KB, Vitamin KC, Vitamin KD, Vitamin KE, Vitamin KF, Vitamin KG, Vitamin KH, Vitamin KI, Vitamin KJ, Vitamin KK, Vitamin KL, Vitamin KM, Vitamin KN, Vitamin KO, Vitamin KP, Vitamin KQ, Vitamin KR, Vitamin KS, Vitamin KT, Vitamin KU, Vitamin KV, Vitamin KW, Vitamin KX, Vitamin KY, Vitamin KZ, Vitamin LA, Vitamin LB, Vitamin LC, Vitamin LD, Vitamin LE, Vitamin LF, Vitamin LG, Vitamin LH, Vitamin LI, Vitamin LJ, Vitamin LK, Vitamin LL, Vitamin LM, Vitamin LN, Vitamin LO, Vitamin LP, Vitamin LQ, Vitamin LR, Vitamin LS, Vitamin LT, Vitamin LU, Vitamin LV, Vitamin LW, Vitamin LX, Vitamin LY, Vitamin LZ, Vitamin MA, Vitamin MB, Vitamin MC, Vitamin MD, Vitamin ME, Vitamin MF, Vitamin MG, Vitamin MH, Vitamin MI, Vitamin MJ, Vitamin MK, Vitamin ML, Vitamin MM, Vitamin MN, Vitamin MO, Vitamin MP, Vitamin MQ, Vitamin MR, Vitamin MS, Vitamin MT, Vitamin MU, Vitamin MV, Vitamin MW, Vitamin MX, Vitamin MY, Vitamin MZ, Vitamin NA, Vitamin NB, Vitamin NC, Vitamin ND, Vitamin NE, Vitamin NF, Vitamin NG, Vitamin NH, Vitamin NI, Vitamin NJ, Vitamin NK, Vitamin NL, Vitamin NM, Vitamin NN, Vitamin NO, Vitamin NP, Vitamin NQ, Vitamin NR, Vitamin NS, Vitamin NT, Vitamin NU, Vitamin NV, Vitamin NW, Vitamin NX, Vitamin NY, Vitamin NZ, Vitamin OA, Vitamin OB, Vitamin OC, Vitamin OD, Vitamin OE, Vitamin OF, Vitamin OG, Vitamin OH, Vitamin OI, Vitamin OJ, Vitamin OK, Vitamin OL, Vitamin OM, Vitamin ON, Vitamin OO, Vitamin OP, Vitamin OQ, Vitamin OR, Vitamin OS, Vitamin OT, Vitamin OU, Vitamin OV, Vitamin OW, Vitamin OX, Vitamin OY, Vitamin OZ, Vitamin PA, Vitamin PB, Vitamin PC, Vitamin PD, Vitamin PE, Vitamin PF, Vitamin PG, Vitamin PH, Vitamin PI, Vitamin PJ, Vitamin PK, Vitamin PL, Vitamin PM, Vitamin PN, Vitamin PO, Vitamin PP, Vitamin PQ, Vitamin PR, Vitamin PS, Vitamin PT, Vitamin PU, Vitamin PV, Vitamin PW, Vitamin PX, Vitamin PY, Vitamin PZ, Vitamin QA, Vitamin QB, Vitamin QC, Vitamin QD, Vitamin QE, Vitamin QF, Vitamin QG, Vitamin QH, Vitamin QI, Vitamin QJ, Vitamin QK, Vitamin QL, Vitamin QM, Vitamin QN, Vitamin QO, Vitamin QP, Vitamin QQ, Vitamin QR, Vitamin QS, Vitamin QT, Vitamin QU, Vitamin QV, Vitamin QW, Vitamin QX, Vitamin QY, Vitamin QZ, Vitamin RA, Vitamin RB, Vitamin RC, Vitamin RD, Vitamin RE, Vitamin RF, Vitamin RG, Vitamin RH, Vitamin RI, Vitamin RJ, Vitamin RK, Vitamin RL, Vitamin RM, Vitamin RN, Vitamin RO, Vitamin RP, Vitamin RQ, Vitamin RR, Vitamin RS, Vitamin RT, Vitamin RU, Vitamin RV, Vitamin RW, Vitamin RX, Vitamin RY, Vitamin RZ, Vitamin SA, Vitamin SB, Vitamin SC, Vitamin SD, Vitamin SE, Vitamin SF, Vitamin SG, Vitamin SH, Vitamin SI, Vitamin SJ, Vitamin SK, Vitamin SL, Vitamin SM, Vitamin SN, Vitamin SO, Vitamin SP, Vitamin SQ, Vitamin SR, Vitamin SS, Vitamin ST, Vitamin SU, Vitamin SV, Vitamin SW, Vitamin SX, Vitamin SY, Vitamin SZ, Vitamin TA, Vitamin TB, Vitamin TC, Vitamin TD, Vitamin TE, Vitamin TF, Vitamin TG, Vitamin TH, Vitamin TI, Vitamin TJ, Vitamin TK, Vitamin TL, Vitamin TM, Vitamin TN, Vitamin TO, Vitamin TP, Vitamin TQ, Vitamin TR, Vitamin TS, Vitamin TT, Vitamin TU, Vitamin TV, Vitamin TW, Vitamin TX, Vitamin TY, Vitamin TZ, Vitamin UA, Vitamin UB, Vitamin UC, Vitamin UD, Vitamin UE, Vitamin UF, Vitamin UG, Vitamin UH, Vitamin UI, Vitamin UJ, Vitamin UK, Vitamin UL, Vitamin UM, Vitamin UN, Vitamin UO, Vitamin UP, Vitamin UQ, Vitamin UR, Vitamin US, Vitamin UT, Vitamin UY, Vitamin UZ, Vitamin VA, Vitamin VB, Vitamin VC, Vitamin VD, Vitamin VE, Vitamin VF, Vitamin VG, Vitamin VH, Vitamin VI, Vitamin VJ, Vitamin VK, Vitamin VL, Vitamin VM, Vitamin VN, Vitamin VO, Vitamin VP, Vitamin VQ, Vitamin VR, Vitamin VS, Vitamin VT, Vitamin VY, Vitamin VZ, Vitamin WA, Vitamin WB, Vitamin WC, Vitamin WD, Vitamin WE, Vitamin WF, Vitamin WG, Vitamin WH, Vitamin WI, Vitamin WJ, Vitamin WK, Vitamin WL, Vitamin WM, Vitamin WN, Vitamin WO, Vitamin WP, Vitamin WQ, Vitamin WR, Vitamin WS, Vitamin WT, Vitamin WY, Vitamin WZ, Vitamin XA, Vitamin XB, Vitamin XC, Vitamin XD, Vitamin XE, Vitamin XF, Vitamin XG, Vitamin XH, Vitamin XI, Vitamin XJ, Vitamin XK, Vitamin XL, Vitamin XM, Vitamin XN, Vitamin XO, Vitamin XP, Vitamin XQ, Vitamin XR, Vitamin XS, Vitamin XT, Vitamin XU, Vitamin XV, Vitamin XW, Vitamin XX, Vitamin XY, Vitamin XZ, Vitamin YA, Vitamin YB, Vitamin YC, Vitamin YD, Vitamin YE, Vitamin YF, Vitamin YG, Vitamin YH, Vitamin YI, Vitamin YJ, Vitamin YK, Vitamin YL, Vitamin YM, Vitamin YN, Vitamin YO, Vitamin YP, Vitamin YQ, Vitamin YR, Vitamin YS, Vitamin YT, Vitamin YU, Vitamin YV, Vitamin YW, Vitamin YX, Vitamin YY, Vitamin YZ, Vitamin ZA, Vitamin ZB, Vitamin ZC, Vitamin ZD, Vitamin ZE, Vitamin ZF, Vitamin ZG, Vitamin ZH, Vitamin ZI, Vitamin ZJ, Vitamin ZK, Vitamin ZL, Vitamin ZM, Vitamin ZN, Vitamin ZO, Vitamin ZP, Vitamin ZQ, Vitamin ZR, Vitamin ZS, Vitamin ZT, Vitamin ZU, Vitamin ZV, Vitamin ZW, Vitamin ZX, Vitamin ZY, Vitamin ZZ.

ALLERGY ADVICE: For allergens, including cereals containing gluten, see ingredients in **bold**. May also contain **Milk**, **Peanuts** and other **Nuts**.

These cereals may seem healthy, but in fact they are full of sugar and salt.

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New and emerging foods

When talking about new trends in food production, it is worth mentioning functional foods. Functional foods are products which:

- provide extra health benefits (beyond their normal nutritional value)
- are similar in appearance to conventional food (so, for example, pills and capsules do not count)
- can be consumed as part of a healthy, balanced diet

Functional foods are usually labelled with a *health claim* on the package, so that consumers can identify them. Functional foods include those which are designed to improve cardiovascular health, improve digestion.



This beverage is an example of a functional food, since it provides high levels of vitamin E and vitamin C. Moreover, it is low in sugar. The beverage is thought to be designed for athletes to quickly restore their vitamin levels lost through sweating.

Probiotics

Probiotics are the 'good' bacteria living in the human body. They live mainly in the large intestine. In the body, they have multiple functions:

- improve immunity by fighting off the 'bad' bacteria in the intestine
- improve digestion by breaking down some dietary fibre
- produce short fatty acids, which can be used by our bodies as an extra source of energy
- produce vitamins, such as vitamins K, B12, B1 and B2
- increase absorption of iron, calcium and magnesium
- prevent and help cure diarrhoea
- maintain the proper pH of the skin and vagina
- help to maintain healthy body weight

Did you know?

Probiotic bacteria are found in around 2 kg of weight!

Probiotic bacteria are often used in the production of food products such as yoghurt and probiotic beverages (e.g. Yakult®, Actimel™), sauerkraut and gherkins.



Things to think about

Discuss why a doctor may prescribe you probiotic supplements after an illness.



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Prebiotics

Prebiotics are indigestible substances which support the growth of probiotic bacteria. They include dietary fibre, inulin and fructo-oligosaccharides. Prebiotics are naturally found in many foods.

Prebiotics support the proper performance of the intestines, improve calcium absorption, lower cholesterol levels and boost immunity. Studies show that they might also be helpful in the prevention of cancer and alleviation of irritable bowel syndrome.

Foods rich in prebiotics include:

- leek, onion, garlic and asparagus
- chicory
- oats and wheat
- soybeans
- bananas
- artichokes

This is a prebiotic product.

Apply



Read the labels of five different yoghurts and list the bacteria species used in their production.

Research

Try to find out why inulin may be beneficial (aside from improving their nutrition).

Phytosterols

Cholesterol is a fatty substance necessary to build cell membranes, bile acid and some hormones. It is transported in the blood by lipoproteins.

Low-density lipoproteins (LDL) transport fat from the liver to the cells; they increase the levels of blood cholesterol and are, therefore, called 'bad'.

High-density lipoproteins (HDL) transport fat from the blood to the liver, where it is stored or removed from the body; they reduce the amount of cholesterol and fat in the blood and are, therefore, called 'good'.

High levels of LDL cholesterol are linked to increased risk of cardiovascular disease, heart attack, hypertension and stroke.

Did you know?

Natural vegetable oils do not contain any cholesterol!



To prevent these, especially among the young, spreads are produced. They are usually made from rapeseed oil, sunflower oil and olive oil. They contain plant sterols or stanols. Also, special care is taken to ensure that no trans fats are released during production.

Studies have shown that an intake of 1.5 - 2.4 g of these substances lowers the levels of blood cholesterol and therefore reduces the risk of death from heart attack.



The producers of such spreads have also introduced other products containing sterols and stanols. These include milk drinks and yoghurt.

Such products are especially beneficial for people at risk of overweight, obesity, high blood pressure and high blood cholesterol levels. These conditions often occur together.

35% low fat vegetable spread

Ingredients: Water, vegetable oil (rapeseed, palm, rapeseed), plant sterol esters, salt (1%), emulsifiers (mono- and diglycerides), potassium sorbate, citric acid, flavour.

A daily consumption of 1.5 - 2.4g per person as part of a healthy diet and lifestyle has been shown to lower blood cholesterol and reduce the development of coronary heart disease. This product is not intended for people who do not need to improve more than one to reduce cholesterol levels. Not suitable for special dietary needs. Not suitable for women and children under 5. This product is not intended for people who do not need to control their blood cholesterol levels.

Low-fat vegetable spread health claims

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Genetically modified foods and their impact on health

The development of modern technologies has allowed scientists to manipulate the DNA of living organisms, such as viruses, bacteria, plants and animals. There is a strong correlation between diet, nutrition and health, and it is no surprise that genetically modified foods also have an impact on human health.

Introducing new genes to DNA or removing faulty ones has many advantages for human health and well-being.

- The food is more nutritious – in fact, crops can produce more vitamins and fatty acids, thanks to which the food we eat (cereals, vegetables, fruit, eggs) contains more nutrients
- Higher nutrient content can help to combat malnutrition and cure the effects, especially in poorer countries
- High-yield crops can help to fight off hunger, as more food can be produced on the same area of land

Genetically modified organisms have been in use since the 1980s. During this time, many people have raised concerns about using them – due to both the environmental and health-related problems they may pose. Currently, there is no sufficient data to prove or disprove how GM foods affect the health, but the main arguments include:

- Higher incidence of allergies – this is usually linked to GM soybeans, which cause many more allergic reactions than non-modified crops
- Fear of new diseases, which can be caused by creating new bacteria species that are resistant to all known antibiotics
- A belief that GM foods contribute to the growing rates of obesity in developed countries, such as the USA
- A belief that GM foods increase the risk of cancer in those eating them



Maize is one of the most common GM crops.

In Great Britain, it is obligatory to state that a food contains GM ingredients if the percentage is higher than 0.9%.

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Check your understanding

Technological developments supporting

1. Which of the following is TRUE? (1 mark)

- a. All cholesterol is harmful. ☐
- b. Plant sterols decrease LDL level in blood. ☐
- c. Plant sterols decrease HDL level in blood. ☐
- d. Cholesterol level is not important for health. ☐

2. Probiotics occur in largest amount in... (1 mark)

- a. the large intestine ☐
- b. the small intestine ☐
- c. the stomach ☐
- d. the mouth ☐

3. Which of the following statements about food fortification is UNTRUE? (1 mark)

- a. Fortification increases the nutritional value of food.
- b. Fortification restores the nutritional value in processed foods.
- c. Fortification is used to prevent certain diseases.
- d. It is unhealthy to eat fortified products.

4. List two foods which are fortified by law and state one nutrient which

Fortified food	Nutrient

5. Explain the need for mandatory fortification of milk. (2 marks)

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6. Evaluate the advantages and disadvantages of using genetically modified (7 marks)

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Technological developments supporting food production

Food production can sometimes involve very complex processes, which couldn't be done without the use of modern technologies. In this chapter we will discuss how computers can be used to help food producers. Producers may choose to use food additives.

Computer-aided manufacturing

The production of large amounts of food would not be possible without the use of computers. Computer-aided design (CAD) and computer-aided manufacturing (CAM). Small producers and managers can also benefit from their use.

In fact, computers can be used at the stage of designing a food product. CAD is used to:

- design the packaging
- calculate the shelf life of the food, so that suitable date marks are printed on the packaging
- calculate the amount of ingredients to scale up production
- calculate the cost of production
- calculate the nutritional value of the food
- compare the new product with existing foods
- compare the results of sensory tasting to check which version of the newly designed food is best, etc.

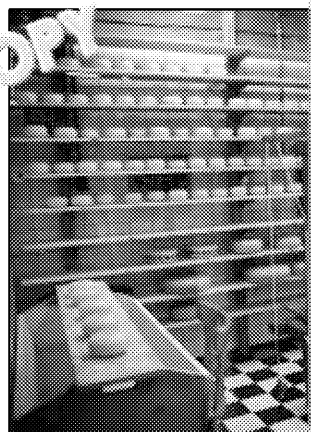
Once the product is approved for production, computers are used to facilitate and speed up the process. CAM is then used to:

- weigh or measure out the ingredients and add them into the batch at a given rate
- control the time and speed of mixing or kneading
- control the temperature, e.g. when making beer or yoghurt
- monitor the water content of the food, e.g. grains before milling
- divide the batch into portions
- control the time and temperature of further processes, such as baking or freezing
- assemble the product, e.g. slices of sponge, jam and cream
- detect faulty products and remove them from the production line
- package the food
- detect metal, glass or other impurities in the food

Computers can also be used during storage of the food to control the temperature and the amount of oxygen.



In this factory almost all processes are computerised



In this storage room, air temperature and humidity are controlled by computers to ensure the quality of the food

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Computers can also be used in other branches of the food industry, e.g. to design workflow is possible, or storage rooms so that they are properly ventilated and pr

Computers also help to control the supply chain, so that storage rotation is ensured kept at all stages. They also facilitate logistics and help to adjust the transport rou



Things to think about

Discuss how a small local restaurant can use CAD/CAM.

Food additives

There are various additives added to food, and their use is strictly regulated by EU Union law. The use of them has to be clearly stated on the food label, together with function and E number.

Food additives are grouped by their function in the food.

The safety of additives is assessed by European Food Safety Authority, which states whether a given additive can be used in food and in what amount. However, the remains controversial.

One of the most controversial food additives is aspartame. It is a very sweet, low-calorie substitute for sugar. Since its discovery in the 1980s, it has been believed to cause brain tumours and cancer. However, the most recent study shows no link between aspartame intake and such diseases, and, therefore, it is considered safe to consume. However, since it is broken down to phenylalanine in the body, it cannot be eaten by people suffering from PKU (*phenylketonuria*).

Use of additives can be harmful to people suffering from food allergies, such as sulphite allergy. Sulphites are commonly used in dried fruits and many other products, so it is important to read the label carefully when buying foods.

Did you know

Phenylketonuria is a genetic condition in which one of the amino acids, phenylalanine – cannot be broken down and used or removed from the body. It accumulates in the blood and can cause brain damage. People with phenylketonuria need to avoid high-protein foods for the rest of their lifetime.

Cereal (41 %) and milk chocolate chip (5 %) bar half covered with milk chocolate (20 %)

Ingredients: **Oat** flakes (21 %), invert sugar syrup, sugar, glucose syrup, **wheat** flour, vegetable fats (palm, shea), rice flour, cocoa butter, cocoa mass, honey (2 %), dried skimmed **milk**, **wheat** bran, dried whey (from **milk**), dried whole **milk**, humectant (glycerol), **milk** fat, emulsifier (E471, E472), preservative (E200), extract, natural flavourings, E471, E472, E473, E474, E475, E476, E477, E478, E479, E480, E481, E482, E483, E484, E485, E486, E487, E488, E489, E490, E491, E492, E493, E494, E495, E496, E497, E498, E499, E500, E501, E502, E503, E504, E505, E506, E507, E508, E509, E510, E511, E512, E513, E514, E515, E516, E517, E518, E519, E520, E521, E522, E523, E524, E525, E526, E527, E528, E529, E530, E531, E532, E533, E534, E535, E536, E537, E538, E539, E540, E541, E542, E543, E544, E545, E546, E547, E548, E549, E550, E551, E552, E553, E554, E555, E556, E557, E558, E559, E560, E561, E562, E563, E564, E565, E566, E567, E568, E569, E570, E571, E572, E573, E574, 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Advantages and disadvantages of food additives

Group	Function/Advantage	Disadvantage
Colourants	- Enhance the colour - Change the colour - Make food more appealing - Make food more appetising - Improve appearance of food - Some of them are natural	- Can be used to hide poor quality of ingredients - Can increase consumption, leading to obesity - Tartrazine is linked to lethal asthma attacks and other allergic reactions, such as skin rashes, throat tumours and - Some of them are artificial
Emulsifiers, stabilisers, gelling agents and thickeners	- Prevent mixtures from separating - Keep emulsions and other mixtures stable - Prevent crystallisation of mixtures	- Can be used to hide poor quality of ingredients - Can damage the lining of the intestines, and cause bloating and flatulence - Some emulsifiers are linked to causing <i>leaky gut syndrome</i>
Flavour enhancers and sweeteners	- Substitute for sugar - Have a lower calorific value than sugar - Enhance the flavour - Change the flavour - Add new flavour to a food - Make food more appealing and appetising	- May increase consumption, leading to obesity - MSG can cause allergic symptoms such as itching or sweating - Aspartame is a source of phenylalanine, so can't be eaten by people suffering from phenylketonuria
Preservatives and antioxidants	- Enhance shelf life - Prevent bacterial growth - Prevent growth of moulds and yeast - Prevent food spoilage - Lower food waste	- Sulphites can cause allergic reactions, including anaphylactic shock - Nitrates used in cold cuts can cause stomach cancer - Benzoates can cause asthma, skin rashes and other allergic reactions - Sodium benzoate can cause dermatitis (skin inflammation)

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Ingredients: Sugar, Glucose Syrup, Flavourings & Colours May Contain **E102, E110, E122, E124, E142, E155, E157**. **Some additives in BOLD, may have an adverse effect on activity and attention.**
MOWBRAY Confectionery, Blackpool FY3 7UN ENGLAND

Where can we find additives?

Additives cannot be added to foods which are labelled as 'natural', and artificial additives cannot be added to foods labelled as 'organic'.

Nevertheless, manufacturers can choose what substances they want to add to their products.

So where are they used most often?

- Colourants usually make their way into beverages, fruit yoghurts, lollipops, ice-lollies and condiments
- Sweeteners, such as glucose syrup, are added to cereals and cereal bars, sweets and candies, ice creams, and even sauces and condiments
- Monosodium glutamate is added to savoury foods, such as instant soups and sauces, potato crisps and meat substitutes
- Sodium nitrite is added to cured meats and meat preserves
- Aspartame and other sugar substitutes are often found in low-sugar, 'light' foods and drinks

Some additives cause allergic reactions in children.

E110, E102, E122, E124, E129

Apply

While shopping, try to find five products that contain different additives, and explain why they are used.



UHT unsweetened soya drink

vitamin B12, riboflavin and vitamin E

Ingredients

Water, Soya Bean (5%), Tricalcium phosphate (Gellan Gum), Vitamin B12, Riboflavin

This soya drink is made with the use of natural ingredients and is also enriched with calcium and vitamins.

INGREDIENTS: Sea salt, vegetable oils (palm oil*, sunflower oil*), glucose syrup*, sugar*, vegetables* (6%) (onions*, celery*, carrots*, parsnips*, tomatoes*), maize starch*, yeast extract, concentrated vegetable juice* (1%) (celery*, carrots*, onions*), herbs* (containing celery* leaves), caramelised sugar*, spices*. *Certified organic

These organic stock cubes are made with the use of organic maize starch, which works as a filler / bulking agent

Research

Research different additives to find out their uses.

Things to think about

Discuss the reasons food producers might want to avoid the use of additives.

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Check your understanding: Technology developments which support healthy food production

1. Which statement about food additives is TRUE? (1 mark)
- a. They increase nutritional value of food. ☐ b. They prevent food from becoming stale. ☐
 c. They can cause health issues. ☐ d. Their use is increasing. ☐

2. Common problems linked to food additives include... (1 mark)
- a. allergies ☐
 b. nervous system disorders ☐
 c. asthma ☐
 d. all of the above ☐

3. Classify the additives listed in the table according to the function they perform.

Sodium glutamate	
Tartrazine	
Aspartame	
Sulphur dioxide	
Lecithin	

4. Suggest two ways in which CAM can be used during the production of food.

1.

 2.

5. Discuss the benefits of using CAD when designing a low-sugar food product.

-

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1. Sweetener which can be broken down into phenylalanine (9)
2. Emulsifier naturally present in egg yolk (8)
3. Natural colourant derived from tomatoes (8)
4. Flour made from this cereal is fortified by law (5)
5. May occur if the blood vessels in your brain are blocked by cholesterol plaques (10)
6. Function of sulphites in food (12)
7. Dairy product made with the use of probiotic bacteria (7)
8. Iron is added to flour to prevent this health condition (7)
9. Another name for a vegetable fat spread (9)
10. Probiotics and prebiotics are referred to as this (10)
11. Probiotic bacteria species which produces lactic acid (13)

The shaded squares reveal this version

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Chapter 1: Food provenance

The origins of food: where food comes from

Things to think about (p. 6)

PRO: allows producers to grow foods over large areas; allows the foods to grow in natural sunlight and with microorganisms and insects that improve growth (such as bees)

ANTI: vermin; floods and droughts; unpredictability; need to use pesticides; contamination

Check your understanding

1) d 2) d 3) b (1 mark for each correct, max. 3 marks)

4) Any two from: (1 mark for each correct, max. 2 marks)

- wild boar
- deer
- fish, such as salmon or trout
- shellfish, such as oysters
- ducks and geese
- pheasants
- or any other suitable answer

5) Any two from: (1 mark for each reason and 1 mark for a relevant explanation, max. 2 marks)

- **reason:** helps to prevent and avoid overfishing of natural fisheries
explanation: thanks to fish farms there is an abundance of fish on the market, so there is no need to fish in the natural fisheries
- **reason:** helps to preserve natural habitats
explanation: fish were obtained with the use of destructive methods, such as dynamite, so fish farms, there is no need for such practices
- **reason:** helps to preserve naturally occurring species and support biodiversity
explanation: fish farms raise species which are most valuable from the natural fisheries, so thanks to them the natural fisheries are preserved, and various species can be farmed in the environment, as the food chain is not disturbed
- **reason:** prevents extinction of wild fish species
explanation: some fishing methods could lead to by-catch (involuntary catch), so thanks to fish farms there is no need for such practices any more, and fishing methods can be used to prevent by-catch of too small fish
- **reason:** helps to provide sufficient amount of food (meat) for the growing population
explanation: fish farms are very effective at producing large numbers of fish, so thanks to modern technologies and the use of specialised feed and hormones
- **reason:** also provides caviar and other products
explanation: by-products of rearing fish may be used for animal feed or for other products
- **reason:** used to produce animal feed
explanation: (as above)
- or any other suitable answer

6) Indicative content:

Advantages: (1 mark for each correct answer, max. 3 marks)

- suitable for growing tropical plants, which need warmth to grow
- protection from weather factors, such as strong wind or heavy rainfall
- protection from vermin
- protection from frost
- protection from chemicals, e.g. in acid rain or from car exhaust
- enables long harvest season
- helps to control the quality of food, e.g. in terms of minerals or heavy metals
- shortens the growth cycle, so plants can be harvested a few times a year
- allows producers to grow species which would not otherwise grow in a given area

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Disadvantages: (1 mark for each correct, max. 3 marks)

- requires large water supply
- poor ventilation increases risk of fungal growth
- polytunnels can become damaged and may need to be repaired, which is costly
- they are best located in a sheltered site as strong winds could blow them away
- provides limited space, so only limited crops can be produced

Positive value of the polytunnels over growing foods in the fields or orchards: (1 mark)

- polytunnels help to control the amount of food produced, increasing food availability
- polytunnels allow food to be grown all year long, enabling availability of varied foods

thanks to this, people may follow a varied, balanced, plant-based diet all year round

Other suitable answers may be accepted.

How food is grown, reared or caught

Check your understanding

1) d 2) b 3) c (1 mark for each correct, max. 3 marks)

4) Advantages: (1 mark for each correct, max. 2 marks)

- fewer pesticides are used, so the food produced is healthier
- no GM seeds or feed are used, so the consumer doesn't have to worry about them
- antibiotics are only used when necessary, so the meat should be free from them
- does not occur
- high social acceptability helps to increase demand/sales
- supports soil quality and natural methods of fighting off pests and vermin

Disadvantages: (1 mark for each correct, max. 2 marks)

- higher costs as organic feed and fertilisers are more expensive than artificial ones
- necessity to obey very strict law
- as fewer pesticides are used, the plants are more susceptible to pests, and this can reduce yield
- natural fertilisers may be less effective than artificial ones, so the plants produce less
- often more land is needed to produce the same amount of food as would be produced by artificial methods
- organic farming is not capable of producing enough food for the growing population
- the only way of producing food

Other suitable answers may be accepted.

5) Any two from: (1 mark for each correct, max. 2 marks)

- supports biodiversity
- supports responsible use of natural resources, such as water
- prevents animal and plant species extinction
- provides sufficient amount of food without damaging the natural environment
- limits waste and pollution
- or any other suitable answer

6) Any three from: (2 marks for each well-explained point, max. 6 marks)

- quality of the soil (amount of nutrients available) affects the quality of vegetables which are grown in it; plants grown in soil of poor quality will have fewer nutrients
- quality of the soil also has an effect on the quality of meat from animals which eat the plants, as the plants themselves will have a better or lower nutrient content
- intensive farming methods may introduce pesticides and other chemicals into the food, which can cause allergic reactions and poisoning
- intensive farming methods may introduce antibiotics into the food, which can cause allergic reactions and increases the risk of antibiotic resistance
- eggs from hens which are fed industrial feed can have altered nutritional value with omega-3 fatty acids, carotenes and other substances
- the quality of organically produced eggs and meat cannot be controlled in the same way as industrial products
- organically grown and reared foods have fewer pesticides, and, therefore, are healthier

Other suitable answers may be accepted.

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Quiz-ine

- | | |
|---------------|-----------------|
| 1. Foie gras | 8. Free range |
| 2. Polytunnel | 9. Herbicide |
| 3. Fertiliser | 10. Venison |
| 4. Livestock | 11. Salmon |
| 5. Organic | 12. Fish farm |
| 6. Rice | 13. Poultry |
| 7. Seasonal | 14. Hydroponics |

The shaded squares reveal this word: **sustainability**

Sustainability of food

Things to think about: (example argument, 32)

- Food production: use of water, fossil fuels, fertilisers; transportation to factories
- Transportation: use of fossil fuels; food miles
- Food waste: use of resources (water, fossil fuels, fertilisers) to produce and transport, collect, store and safely dispose of the waste
- Packaging: use of water, fossil fuels, natural resources; transportation to factories
- It all creates food miles and carbon footprint. The more greenhouse gases are produced, the more increased amount of carbon dioxide in the air accumulates and traps warmth which causes global warming. Therefore, the air and Earth's surface heat up. Water in oceans evaporates faster. More storms are caused. People suffer from either drought or floods. Foods shortages occur. People die of famine.

Check your understanding

- 1) d 2) a (1 mark for each correct, max. 2 marks)
- 3) 2 marks for a detailed description, 1 mark for a basic description.
Indicative content:
- Carbon footprint is the amount of carbon dioxide (and other greenhouse gases) released from production, processing, transporting, consumption and disposal of goods, e.g. food.
 - The sum of all carbon dioxide emissions released into the atmosphere in a given period.
 - Indicator used to measure the effect human activities have on the environment.
 - Accept other suitable answers.
- 4) Any two from: (1 mark for each correct, max. 2 marks)
- use of pesticides and herbicides can help to prevent crop failure, and damage to crops by pests and vermin
 - GM crops are more resistant to weather conditions, so could prevent crop failure
 - overabundance of food could be sold for a lower price, e.g. for canning or freezing
 - storing food in proper conditions, e.g. in coolers, can help to keep it fresh for longer
 - in factories, specially adjusted packaging methods can help to preserve food for longer
 - factories can adjust their production methods so that no produce is wasted, e.g. leftover pulp and skins can be used for other purposes
 - or any other suitable answer
- 5) Any four from: (1 mark for each correct statement, max. 4 marks)
- Fish farms are artificial fisheries in which chosen species of fish, crustaceans and shellfish are raised. There is no need to obtain them from natural fisheries.
 - Fish farms prevent overfishing of natural fisheries, support biodiversity and protect habitats.
 - Fish farms also prevent by-catch, as only the fish of specific species and size are caught.
 - Fish farms use natural resources, such as water, responsibly, and dispose of waste in a controllable way. This means that only as much as necessary is needed, and water (and other resources) are cleaned/purified on site or disposed of in a controlled way (not polluting the environment, for example).
 - Fish farms help to prevent pollution and damage to the natural environment.
- Other suitable answers may be accepted.

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Food security

Check your understanding

- 1) a 2) b (1 mark for each correct, max. 2 marks)
- 3) Any three from: (1 mark for each correct, max. 3 marks)
- ensures fair wages and prices for the food producers and farmers
 - enables decent working conditions and rights for the workers
 - ends child labour and forced labour
 - empowers local farmers
 - enables local growth and sustainability
 - supports education and access to health facilities
- Other suitable answers may be accepted.
- 4) Any three from: (2 marks for each well-explained point, max. 6 marks)
- Climate change causes the average temperature on Earth to rise. Many plants and animals cannot survive new temperature conditions, and, therefore, die and become endangered/extinct.
 - The increased temperature causes faster evaporation of water reservoirs, so droughts in some regions of the world. Drought makes growing plants impossible for people, or for animals (e.g. cattle).
 - As water evaporates, it accumulates in the higher layers of the atmosphere, which can cause flooding in other areas of the world. Floods damage crops and infrastructure, so people or feed for animals.
 - Climate change also causes sea levels to rise, and, therefore, large areas of land are lost. There is less land available on which to grow food or rear animals.
- Other suitable answers may be accepted.
- 5) Any three from: (2 marks for a well-explained point, max. 6 marks)
- Food poverty may lead to weight loss as people may not eat enough food and/or nutrients to maintain a healthy body weight; weight loss may also be caused by loss of muscle mass as protein is provided to support it, and loss of bone tissue, as not enough nutrients are provided for bone density.
 - Food poverty may lead to weight gain as cheaper foods often provide empty calories, but provide no nutrients; this may further lead to cardiovascular diseases and other conditions.
 - Food poverty may cause bone and teeth problems due to insufficient consumption of calcium and vitamin D-rich products, especially oily fish.
 - Food poverty may cause lack of immunity as there will not be enough protein and other nutrients to protect the body from bacteria; other nutrients may also be lacking.
 - Food poverty may cause brain dysfunction, such as an inability to focus and learn, due to lack of glucose and nutrients.
- Other suitable answers may be accepted.

Quiz-time

- | | |
|---------------------|------------------|
| 1. Glacier | 9. Fish farm |
| 2. Recycling | 10. Aluminium |
| 3. Carbon footprint | 11. Food miles |
| 4. Banana | 12. Malnutrition |
| 5. Carbon dioxide | 13. Drought |
| 6. Sustainable | |
| 7. Fair trade | |

The shaded squares reveal these words: **global warming**

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Chapter 2: British and international

British cuisine

Things to think about (p. 43)

After World War II there was a period of rationing due to food shortages. This meant households were only allowed restricted amounts. To combat this restriction, recipes used more readily available ingredients.

Check your understanding

1) a 2) d 3) b (1 mark for each correct, max. 3 marks)

4) Any three from: (1 mark for each correct, max. 3 marks)

- pork
- corned beef
- crab
- cockles
- Devonshire
- Cheddar cheese
- cauliflower
- sprouts
- cabbage
- rhubarb
- strawberries
- Any other suitable example

Do NOT accept examples of foods or dishes, e.g. beef casserole, cauliflower cheese

5) Any two from: (1 mark for identifying an eating pattern and 1 mark for a correct

- **brunch** – a meal eaten in the late morning / at noon in place of breakfast and lunch
- **elevenses** – small snacks (e.g. biscuits) and a cup of tea or coffee, eaten around 11am
- **lunch** – a meal eaten around midday, usually consisting of light foods such as sandwiches and potato crisps
- **afternoon tea** – a meal eaten in the early afternoon (usually around 4pm), consisting of a selection of sandwiches, cakes and scones
- **dinner** – the main meal of the day, usually served hot, eaten in the evening
- **supper** – a meal eaten in the late evening, often instead of dinner

Other suitable answers may be accepted.

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International cuisines

Things to think about (p. 50)

A country's cuisine can change over time due to travel, export and trade, immigration, also be influenced by the resources available and weather conditions or natural events like flooding. It can also be influenced by war and by embargoes imposed by other countries.

Things to think about (p. 51)

Traditional recipes may be adapted to suit availability of ingredients, health, or ethical or sustainability concerns.

Things to think about (p. 52)

Eating patterns can differ between countries according to lifestyle and culture. They vary by day (Spain traditionally has a siesta from 2pm to 4pm), the weather (heat), availability of ingredients, traditional ways of cooking and eating, religion and local customs.

Check your understanding:

1) b 2) d 3) 1 mark for each correct, max. 3 marks)

4) 1 mark for each correct row, max. 3 marks

Only one type of cheese for each country is required.
Other suitable answers may be accepted.

Cheese	Country
Stilton, Wensleydale, Suffolk Gold, Cheddar, Dunlop, Caerphilly, Red Leicester, Double Gloucester	UK
Brie, Camembert, Comte, tomme, reblochon, Morbier, Livarot, Saint-Nectaire	France
Parmesan, mozzarella, ricotta, Gorgonzola, pecorino, fontina, mascarpone, taleggio	Italy
Emmental, Gruyère, Appenzeller, raclette	Switzerland
Gouda, Maasdam, Leyden, Leerdammer	The Netherlands

5) Any three from: (2 marks for each well-explained point, max. 6 marks)

- climate (weather conditions, average temperature, rainfall) determines when the time at which meals are eaten, e.g. in Spain, dinner is eaten late as it may be hot
- soil quality (acidic, neutral, alkaline) determines what can be grown and reared
- religion (Islam, Hinduism, Buddhism, Judaism, Sikhism, Rastafarianism)
- migration (e.g. from India to the UK)
- lifestyle (applies to modern cuisines; people tend to choose less time-consuming patterns)
- market development (helps to import new foods from abroad)

Other suitable answers may be accepted.

Quiz-time

- | | |
|---------------|----------------|
| 1. Hummus | 8. France |
| 2. Eton mess | 9. Smorgasbord |
| 3. Dosas | 10. Stilton |
| 4. Haggis | 11. En croute |
| 5. Chopsticks | 12. China |
| 6. Leek | 13. Lasagne |
| 7. Cornwall | |

The shaded squares reveal this word: **Mediterranean**

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Chapter 3: Food manufacture

Primary processing of food

Check your understanding

1) c 2) d 3) b (1 mark for each correct, max. 3 marks)

4) Any two from: (2 marks for a well-explained point, max. 4 marks)

- Flour which is high in gluten will produce better quality bread. This is because of the structure which traps carbon dioxide produced by the yeast and, therefore, the texture of the bread. Examples include rye flour and strong wheat flour.
- Low-gluten flour is less able to hold a large amount of gas inside, and so the bread is smaller in size, as it won't be able to prove properly. Examples of this is plain wheat flour.
- Gluten-free flour will produce a tough, dense bread as it will be able to hold the gas in, but only, and the bread will lack the soft, spongy texture. Examples include rice flour.
- Self-raising flour, although it contains gluten and extra raising agent, may not be the best choice as the chemical raising agent in it might affect the final taste.

5) 2 marks for a detailed description, 1 mark for a basic description (max. 6 marks)

Pasteurisation	• temperature: 72 °C • time: 15 seconds • helps to kill harmful bacteria, but not spores • doesn't affect the nutritional value of milk
Sterilisation	• temperature: 110 °C • time: 30 minutes • kills all bacteria and spores • affects the nutritional value of milk • can lead to changes in taste, aroma and appearance
Ultra heat treatment	• temperature: 135 °C • time: 1–4 seconds • kills all bacteria and spores • extends the shelf life significantly

Other suitable answers may be accepted.

6) 2 marks for a well-explained point, 1 mark for a basic description (max. 2 marks)

Indicative content:

- During milling, grain is first washed in warm water and then dried – this causes a loss of water-soluble vitamins.
- Once the grain is ground, it is separated into the inside part, which contains the endosperm, and the outside part (bran). Each of these parts has a different nutritional content and therefore affects its nutritional value as well.
- The flour is then sieved to remove the bran – this lowers the amount of mineral and dietary fibre in the flour.
- If the flour is bleached, its surface is oxidised which also causes a loss of nutrients.

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Secondary processing of food

Check your understanding

1) d 2) d 3) b (1 mark for each correct, max. 3 marks)

4) 1 mark for each correct function, max. 2 marks
Only one function of each ingredient is required.

Probiotic bacteria	- process lactose in milk - produce lactic acid - lower pH of milk - increase acidity - begin the process of protein denaturation and coagulation
Rennet	- coagulates the protein in milk - is responsible for the final texture of mature cheeses

5) 2 marks for a detailed description, 1 mark for a basic description (max. 2 marks)
Indicative content:

- Blast chilling means that the food is cooled quickly from over 70 °C to less than 5 °C.
- During the process, the food goes through danger zone temperatures (5–63 °C).
- Blast chilling shortens the time food spends in the danger zone temperature.
- Blast chilling shortens the time during which bacteria and other microorganisms can grow.

Other suitable answers may be accepted.

6) Any three from: (1 mark for each reason identified, 1 mark for a relevant description)

- reason:** to increase variety in the diet
description: we can enjoy foods that are fresh, canned, frozen, pickled, dried, etc.
- reason:** to improve the texture of food
description: curing helps to tenderise meat, baking helps to obtain the soft texture of bread, cooking causes eggs to set, fermentation turns liquid milk into thick curd.
- reason:** to improve the appearance of food
description: curing helps to preserve the pink colour of the meat, baking helps to brown the surface of food.
- reason:** to improve the taste
description: for example, salting and smoking help to obtain the desired flavour.
- reason:** to preserve the food
description: processing helps to extend the shelf life of food, e.g. by killing microorganisms, sterilisation, or by removing water from food so that bacteria do not have the conditions for growth.

Other suitable answers may be accepted.

How processing affects the nutritional value of food

Things to think about (p. 79)

- Primary and secondary processing decrease the nutritional value of foods. Processing such as freezing, cooking, draining and reheating decrease the amount of vitamins and minerals. In these processes happens through: contact with oxygen (oxidation), dissolving in water, and solution in which the food is cooked and incorporated, and breakdown caused by high temperatures.
- Also, oxygen is harmful to food and leads to oxidation. It causes rancidification of fats and enzymatic browning of vegetables and fruits, such as bananas.

To prevent nutrient loss:

- Fresh foods should be sold whole, not cut.
- Foods should be stored in dry, dark conditions to protect them from moisture and light.
- Foods should be stored at correct temperatures to prevent bacterial growth.
- Cooked foods should not be drained, if possible.
- Cooking techniques should be chosen carefully, e.g. steaming instead of boiling.
- The time and temperature of cooking should be adjusted and shortened where possible.
- Raw fruit and vegetables should be eaten more often.

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Check your understanding

1) c 2) b 3) a (1 mark for each correct, max. 3 marks)

4) Any two from: (1 mark for each correct, max. 2 marks)

- smoking of meat increases the amount of carcinogens in it, increasing the risk of cancer
 - curing meat introduces nitrites, which can cause stomach cancer
 - curing meat increases the amount of salt in it, increasing the risk of hypertension
- Other suitable answers may be accepted.

5) 2 marks for each well-explained point, max. 6 marks

Any three from:

- During canning, food is often sterilised. Sterilisation kills all bacteria and so increases the shelf life of the food.
- The high temperatures applied during sterilisation can affect the appearance of food (for example, some vegetables may become mushy while others can lose their colour and become dull green).
- The high temperature of sterilisation also causes loss of vitamins, especially vitamin C.
- During canning, vegetables are often immersed in brine, which increases their water content and their sugar content and calorific value.
- The liquid in which food is preserved (e.g. brine, syrup, water) can sometimes cause various chemical reactions to happen (especially after the food is opened, it may oxidise, and, therefore, nutritional value may be lost. Also, the sensory properties may change, especially the taste and aroma).
- As the cans are sealed, they are airtight and the food has no contact with the air, which helps to preserve the nutritional value of vegetables, as it prevents oxidation.

Other suitable answers may be accepted.

6) 2 marks for a detailed explanation, 1 mark for a basic explanation, max. 2 marks

Indicative content:

- Brine is a solution of water and salt (sodium chloride).
- Water freezes at 0 °C degrees.
- Freezing temperature of brine is much lower and can be set at -21 °C.
- Consequently, brine stays liquid at freezing temperatures for food (-18 °C) and so preserves the food.

Quiz-time

- | | |
|--------------------|-------------------|
| 1. Semolina | 8. Vacuum packing |
| 2. Jelly | 9. Sterilisation |
| 3. Oxidation | 10. Marmalade |
| 4. Pasteurisation | 11. Best before |
| 5. Sodium chloride | 12. Conduction |
| 6. Brine | 13. Yoghurt |
| 7. Collagen | 14. Nitrogen |

The shaded squares reveal this word: **lyophilisation**

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Technological developments supporting better health

Things to think about (p. 84)

Antibiotics are very strong drugs which have the ability to kill bacteria. When taking (disease-causing) bacteria and the good bacteria living in your gut. Probiotic supplements have finished your course of antibiotics to restore the good gut flora and improve your health.

Check your understanding

1) b 2) a 3) d (1 mark for each correct, max. 3 marks)

4) 1 mark for each food identified and 1 mark for a correct nutrient, max. 4 marks
Only one nutrient needs to be stated for each food product.

Fortified food	Nutrient
Wheat flour / bread	Calcium, iron, thiamine
Vegetable-fat spreads	Vitamin A, vitamin D
Semi-skimmed milk and skimmed milk	Vitamin D

5) 2 marks for a detailed explanation, 1 mark for a basic explanation (max. 2 marks)
Indicate the nutrient:

- Only semi-skimmed milk and skimmed milk have to be fortified
- Mandatory fortification of milk with vitamin A
- Vitamin A is fat-soluble
- Vitamin A level in semi-skimmed milk and skimmed milk is reduced because of the removal of fat.

6) **Advantages:** (1 mark for each correct, max. 3 marks)

- GM foods can be higher in vitamins. For example, Golden Rice is very rich in vitamin A and is used in the prevention of vitamin A deficiencies, especially in poorer countries.
- GM foods can be higher in omega-3 fatty acids. As such, they can be used to improve heart health.
- GM plants produce a higher yield of crops, and, therefore, can be used to produce more food to distribute.
- GM food can be higher in antioxidants, and, therefore, can be used in the prevention of chronic diseases.
- GM foods are higher in nutrients, and, therefore, help to prevent malnutrition.
- GM food can be higher in protein, and, therefore, can be used to prevent protein deficiency.

Disadvantages: (1 mark for each correct, max. 3 marks)

- GM foods are made with the use of bacteria. This can lead to the spreading of antibiotic resistance.
- GM foods are linked to an increased risk of developing food allergies.
- GM foods have unknown long-term effects and should be introduced into a diet with caution and a reaction to them.
- GM foods are associated with higher prevalence of obesity in developed countries and other diet-related diseases, such as type 2 diabetes, heart attack and stroke.
- GM foods can result in antibiotic resistance in animals and the people who eat them.

1 mark for a final conclusion (max. 1 mark), for example:

- *The benefits of GM foods for health outweigh their potential negative effects, and should be used to improve public health.*

or

- *There is insufficient scientific evidence to prove the safety of GM foods for health, and they should be strictly controlled in interventions aiming to improve public health.*

Other suitable answers may be accepted.

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Technological developments supporting food production

Things to think about (p. 89)

A small local restaurant can use CAD and CAM in many ways. The manager may decide to ask local citizens to check whether a newly designed product will be acceptable. Computer can be used to find food substitutes, e.g. when wanting to produce a gluten-free cake. They are also helpful in understanding the nutritional value of food, which might be especially important for those customers who have specific dietary needs. Smart devices can also be used to control the temperature of food during preparation, cooking, and storage, which is especially important as cooked food has to reach a certain temperature before it can be safely consumed. Scales can be used to weigh ingredients, and spreadsheets can help to calculate the cost of production.

Things to think about (p. 91)

The use of food additives is controversial and not always acceptable to the consumers. Some people avoid using food additives, especially when they wish to produce organic foods, but others use them to create products as 'eco', 'bio', 'natural', etc. Lack of additives can help consumers to view a food as more natural, which can boost sales and trust in the brand.

Check your understanding

1) c 2) d (1 mark for each correct, max. 2 marks)

3) 1 mark for each correct, max. 5 marks

Monosodium glutamate	Flavour enhancer / flavour
Tartrazine	Colourant
Aspartame	Sweetener
Sulphur dioxide	Preservative
Lecithin	Emulsifier

4) Any two from: (1 mark for each correct, max. 2 marks)

- electronic, computer-controlled scales can be used to weigh the ingredients and other ingredients
- electronic thermometers can be used to control the temperature of the water and the room in which the dough is being left to prove
- computers can also control the time and speed of kneading the dough, as well as the amount of yeast applied to it so that carbon dioxide is not knocked out of it
- moistness of the dough can be measured to make sure the bread will always have a consistent consistency
- computers can measure the time of proving
- computers are used to control and maintain a stable temperature and consistent humidity of the oven
- the time of cooling is controlled to make sure the bread is totally cooled before it is packed
- Any other suitable answer

5) Any four from: (1 mark for each correct, max. 4 marks)

- computer programmes can be used to calculate the nutritional value of the product, such as the amount of sugar
- it can be used to research sugar substitutes and calculate the ratio of ingredients needed to make a sweeter than sugar and, therefore, less sugar needed
- it can be used to redesign and improve the ratio of other ingredients, such as the amount of yeast
- it can be used to identify potential target groups who would benefit from a product, such as the elderly
- it can be used to compare the results of sensory tests and create charts, star diagrams, etc.
- it can be used to research other similar products to assess how big the competition of success are
- computers help to scale up the ingredients so that large amounts of the product can be produced
- computers can also be used to calculate the cost of production and set a price for the product
- computers can be used to assess the mould-free shelf life of the food – in low humidity, as sugar works as a preservative

Other suitable answers may be accepted.

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Quiz-ine

- | | |
|-----------------|-------------------|
| 1. Aspartame | 7. Yoghurt |
| 2. Lecithin | 8. Anaemia |
| 3. Lycopene | 9. Margarine |
| 4. Wheat | 10. Synbiotics |
| 5. Stroke | 11. Lactobacillus |
| 6. Preservative | |

The shaded squares reveal this word: **phytosterol**

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