



# Living things: Human body

Most young children imagine that their body is a kind of skin bag that holds food, blood and waste. Stomachs are commonly imagined to be large, low-slung containers, often with two exits, corresponding to the double functions of lavatories. But children will also have connected the stomach with the breaking down of food and they may sense that it is transferred somewhere else in the body. The word 'diet', however, is almost always associated with weight loss, and not with the balanced intake of foods that should characterise healthy eating.

We need a range of foods for healthy living. These can be provided from a variety of sources, and commonly include carbohydrates for energy, fats for both energy and general body functions, proteins for growth and repair, and small amounts of vitamins and minerals for general health and resistance to disease. We can obtain these foods from many different sources, including plants and animals; a balanced diet provides them in the right quantities.

A balanced diet and regular exercise are essential for health. There are few intrinsically good or bad foods or means of exercise; we all need to develop a lifestyle that suits our individual needs. There are many definitions and measures of fitness. Some individuals are on special diets for cultural or religious reasons, have medical problems, or difficulties like obesity.

Most people are aware of the major food groups, and the importance and characteristics of each. Packaged foods are clearly labelled and ingredients identified. Food habits are formed before school, and for primary children these are likely to reflect family values and parental choice, as well as children's own decisions.



# Lesson 1: Food and nutrition

## Lesson preparation

### Objectives

- 🕒 explain what is meant by nutrient, and describe how plants and animals obtain the nutrients they need
- 🕒 list the five main nutrients the human body needs and explain their role in the diet
- 🕒 explain the importance of fibre (roughage) in the diet

### Science skills

classifying

### Equipment

**Warm up:** a meal

**Extension:** research facilities

### Key words

**carbohydrates:** starch, glucose, sucrose and foods containing these nutrients; the substances in sugary and starchy foods that give us energy

**fats:** the main nutrients in fatty foods such as butter and lard; eating fats gives us energy, but eating too much fatty food makes us fat

**fibre:** tough indigestible parts of food; fibre aids digestion by bulking up the faeces so they pass easily through the body

**minerals:** pure non-living substances; a substance that living things need in small amounts to grow well

**nutrients:** substances the body needs to grow, maintain and repair itself

**proteins:** the nutrients needed for growth and repair; the substances in foods such as fish, nuts and beans that help to build and repair our bodies

**vitamins:** essential substances that we require in small quantities for health; fresh fruit and vegetables contain vitamins

### Background information

Advice on healthy eating seems to vary week by week. But some facts are unchanging: we need to eat to fuel, maintain, repair and (when young) grow our bodies; we need a balanced diet for health; too much food, especially carbohydrates and fats, can be stored in the body and will lead to increased weight and possibly obesity.

Most foods contain more than one nutrient, and many contain quite a range, so it is difficult to condemn any food as being unhealthy. No food is of itself harmful; it is the excess that can damage your health. Some nutrients, for example minerals and vitamins, are only needed in extremely small quantities, and any excess is excreted.

Note that students commonly relate the word diet to a weight-reducing regime; in science, a diet describes the range of foods eaten by an animal or human.



## Lesson plan

### Warm up

Bring in a meal for the students to name and analyse. You might choose a healthy meal or one that is deliberately unhealthy or possibly one of each.

Ask the students to tell you the foods you have in the meal. *Which are energy foods? Which are foods that will help to maintain and repair my body? Which contain important nutrients to keep me healthy?*

*Does it contain energy foods? Does it contain proteins? Does it contain the small amount of fat which I need? Do you think it contains vitamins and minerals? Foods should contain fibre or roughage which helps to push the food through the gut. Do you think this meal contains roughage?*

Ask the students to work in groups to plan a meal that contains all the food groups.

### Activity 1 p11

Ask the students to record a food diary for one day. Ask them to record all that they ate and drank from breakfast one morning to breakfast the next. They should group them into food from plants and food from animals.

They could also look for examples of food to provide carbohydrates, proteins, fats, vitamins, minerals and fibre. *Are there examples of all of these?*

Ask the students to work in groups and examine each other's food diaries. They can make suggestions to ensure that all the food groups are represented in at least some of the meals eaten during the day.

### Activity 2 p13

#### Answers

- 1 carbohydrates: provide energy
- 2 proteins: help the body to grow and repair
- 3 fats: build and maintain body parts and provide energy
- 4 vitamins: special substances that cannot be made by the body
- 5 minerals: build bones, carry oxygen in the blood and control blood pressure
- 6 fibre: bulks up waste

### Extension

Ask the students to explore the diets of different animals and find out the proportions of different nutrients that animals eat. They may find some surprises; for example many carnivores are able to make their own vitamin C. This compensates for the fact that they do not eat fresh fruit and vegetables.

Babies and older people may have different nutritional requirements; work together to plan a healthy diet for different age groups.

### Concluding the lesson p13

#### What you have learnt answers

Our food gives us the different nutrients our bodies need to stay healthy and grow. We need carbohydrates for energy, and proteins for growth and repair. We need some fats for making and maintaining body parts, but not too many. To stay healthy we also need vitamins and minerals in small quantities. These substances perform special tasks in the body. Fibre does not give us nutrition, but it helps waste pass easily through the body.



### Check your progress answers

- 1 A nutrient is any substance that provides essential nourishment to maintain life. Accept any five.
- 2 Fibre bulks up food, making it easier for food to pass through and out of the gut.
- 3 carbohydrates for energy; proteins for growth and maintenance; vitamins.

## After the lesson

### Workbook p4–5

#### Answers

- 1 plants: rice, fruit, oil, tomatoes, bread  
animals: eggs, butter, meat, cheese
- 2 minerals; carbohydrates; fats; proteins; vitamins
- 3 **a** carbohydrates **b** proteins **c** fats **d** vitamins **e** minerals
- 4 **a** to carry oxygen in the blood **b** to build bones **c** to control blood pressure. (Students do their own research on minerals.)
- 5 **a** plants **b** animals **c** digestion **d** fibre

# Lesson 2: Food groups

## Lesson preparation

### Objectives

- ☉ identify the main food groups provided by common foods
- ☉ name foods that provide vitamins and minerals in the diet
- ☉ know how to test for two food types

### Science skills

classifying

### Equipment

**Warm up:** a selection of different foods

**Extension:** research facilities

### Key words

**butter:** solid fat separated from milk

**food tests:** chemical and physical tests that identify the food groups different foods contain

**meat:** the flesh of animals

**nutrients:** substances the body needs to grow, maintain and repair itself

**starchy:** describes foods that are mainly starch

**sweet:** one of the four basic tastes; sugar is sweet



## Background information

Staple foods – bread, cereals, rice and roots – contain starch, which is a carbohydrate, the stored form of sugar. Some sweet foods, including sugar and honey, contain carbohydrates too. Meat is not the only source of protein: fish, beans and pulses, eggs, dairy products, seeds and nuts all contain a proportion of protein. We all need a small amount of fat: butter, margarine, groundnuts, animal and plant oils and fatty meats contain high proportions of fat. They can often be recognised because oils and fats produce a translucent spot on paper.

Many foods contain essential vitamins, and a varied diet should provide all that we need.

## Lesson plan

### Warm up

It is important to emphasise that most foods contain more than one food group. It is very easy to believe that, for example, meat is solely a protein food, whereas it contains other food groups and a number of essential vitamins. Introduce some simple foods, for example, an egg, a green vegetable, rice, fruit. Ask the students what food groups they contain.

*Why should I eat this egg? Will it give me energy? Will it help me to maintain and repair my body? Does it contain any vitamins and minerals?*

*This green vegetable looks healthy. What food groups does it contain? Does it contain any vitamins and minerals?*

*Rice is an energy food. Does it contain any other food groups? Do you think it contains any vitamins?*

*I know I should eat lots of fruit to stay healthy. So fruit contains some important vitamins. But does it contain any other food groups? Which ones?*

### Activity 1 p14

Students complete their own nutrients diagram, putting the food pictured in the correct circle. Point out that some of the foods will go in the areas where the circles overlap.

### Activity 2 p15

Explore the table with the class, and ask them to ensure that they are regularly eating at least one food that contains each of the essential vitamins.

### Extension

Ask students to explore animal diet; the book describes the diet of the giant panda, which can only eat bamboo shoots, and the koala bear, which only eats eucalyptus leaves. Ask them to find other examples; and to explain why the dependence on a single food source like this puts the animal at risk of extinction. Ask groups of students to research one vitamin; and to present their findings to the rest of the class. *What is unique about Vitamin D? It is one vitamin that we can manufacture for ourselves by the effect of sunlight on our skin.*

### Concluding the lesson p16

#### What you have learnt answers

Food contain different nutrients. Sweet and starchy foods are rich in carbohydrates. Dairy foods, nuts, beans, fish and meat are good sources of protein. Oil, margarine and butter are fatty foods. We can use food tests to identify the different nutrients that a food contains.





### Check your progress answers

- 1 Any appropriate food. Remember that few foods are 'purely' one nutrient.
- 2 Vitamin C is essential to maintain connective tissue: skin, blood vessels and gums. Without it you are in danger of an illness called scurvy.

## After the lesson

### Workbook p6

#### Answers

- 1 a protein b carbohydrate c fat
- 2 a false b true c false d false
- 3 a A & C b A & B
- 4 this question is ideal for homework and needs 24 hours' notice for accurate completion.

# Lesson 3: A balanced diet

## Lesson preparation

### Objectives

- 🕒 explain what is meant by a balanced diet
- 🕒 plan a menu to provide a balanced diet that includes all the important food groups
- 🕒 describe the importance of water in the diet

### Science skills

identifying

### Equipment

**Warm up:** a food processor, a cucumber or squash

**Extension:** research facilities

### Key words

**balanced diet:** a diet with the correct quantities and proportions of different food groups; a diet with the right mixture of different nutrients to keep the body healthy

**dehydrated:** lacking in water; describes a living thing that has lost water from its body

### Background information

A balanced diet provides the correct mix of nutrients to keep the body in good health. The balance will vary with the age of the person, and there is also some variation across different cultures. Although it is commonly agreed that carbohydrate, protein, fats, vitamins, water, minerals and fibre are all essential for a balanced diet, there is some disagreement about how much of each type any person needs. It is important



to remember that most students do not have control over the diet they eat; it is their parents and guardians who determine whether their diet is balanced or not.

Water is essential to health. It makes up 60–70% of the human body or about 40 litres of an adult, of which 25 are inside the cells and 15 outside. A loss of 8–10 litres may cause death. We lose about 1.5 litres a day through breathing, perspiration and excretion. Much of this is replaced by the food we eat as well as what we drink.

## Lesson plan

### Warm up

Remind the students about the variety of foods and their sources. Ask them to tell you about the food they ate the previous day.

*Did you eat a range of different foods? Did you eat food that was high in protein? Did you eat food that was high in carbohydrates?*

*Who rides a bike? What do you call it when you keep the bike upright? You don't fall left and you don't fall right. So we call that balanced. We call a good healthy diet a balanced diet too. Not too much, and not too little.*

Most of the water that we need is contained in our food. Demonstrate this to the students with a food processor. Take a food that is high in water content, such as cucumber or squash, and liquidise it in a food processor to demonstrate how much of it is water. Once the cell structure is broken down, the water is released and it is possible to see that many foods are high in water content.

### Activity 1 p17

Students make a list of the food they ate the previous day and identify the different food groups.

#### Answers

- a** fruit **b** carbohydrate **c** vegetables, fats, carbohydrates, protein  
**c** contains all nutrients.

### Activity 2 p18

Students are asked to plan meals for the next three days which include all the major food groups, to produce a balanced diet. This may be a theoretical exercise, since what they eat will be chosen by their parents or guardians, but it's still possible to think about how the diet should be balanced.

### Activity 3 p19

Balance the water content of food against water loss. A misunderstanding about the importance of taking in at least 2 litres of water a day overall led to a belief that people should drink 2 litres of water in addition to the water that they take in from other sources.

#### Answers

- 1** drinks, moist food and breaking down food in the body
- 2** urine, sweat, breathing out, faeces
- 3** yes, because the water intake is the same as the water losses



## Extension

Explore the importance of water to the body. Students might look at waterborne disease in Third World countries. Four-fifths of all illness in these countries is caused by waterborne diseases with diarrhoea being the leading cause of childhood death. Malaria, carried by mosquitoes dependent on stagnant water for breeding, affects 400 million people every year and kills 5 million.

Some groups might look at polluted water in industrialised nations, and whether dumping of waste of all kinds causes a range of diseases from headaches to cancer.

## Concluding the lesson p19

### What you have learnt answers

A balanced diet provides the correct mixture of nutrients to keep the body in good health. We should eat from each of the five nutrients every day. Fresh fruit and vegetables are an important part of a balanced diet. Water is an essential part of the diet. If you do not replace water lost through urination, sweating and other routes, the body becomes dehydrated.

### Check your progress answers

- 1 A balanced diet provides the correct mix of nutrients to keep the body in good health.
- 2 Accept any correct answers.
- 3 Water is needed for health and body functions.

## After the lesson

### Workbook p7–8

#### Answers

- 1 We must eat a mixture of different foods to stay healthy. A balanced diet contains proteins, carbohydrates, vitamins, minerals and some fat.
- 2 Example answer: bread: carbohydrates; fruit: vitamins and minerals; milk, protein, vitamins, minerals and fats; rice: carbohydrates; green beans: vitamins and minerals; potatoes: carbohydrates
- 3 **a** urine **b** sweat **c** breathing out **d** faeces
- 4 **a** Person A **b** Person B **c** Person A's water losses are greater than their intake; Person B's are balanced.

# Lesson 4: Food and energy

## Lesson preparation

### Objectives

- investigate the energy content of foods
- state (in Calories) the normal energy needs of the human body
- interpret the nutritional information provided by the labels on packaged foods





## Science skills

measuring

## Equipment

**Warm up:** a chocolate bar

**Activity 1** food samples, kitchen tongs, a candle, a metal tray filled with sand

**Extension:** food labels of ordinary and low-fat foods

## Key words

**Calorie:** a unit used to measure the energy in food

**calorimeter:** an instrument for measuring the quantity of heat (released by burning food for example)

**energy:** something has energy when it can do work or cause change

**food label:** a label on a packaged food item that lists information about its energy and nutrient content

## Background information

All food contains Calories. Calories are a way of measuring the energy from the food you eat. In scientific terms, a Calorie is the amount of heat you would need to raise the temperature of 1 litre of water by one degree Celsius. Theoretically, if you set fire to a piece of food that had 5 Calories in it, and held a litre of water over the flame, the water will be 5°C hotter by the time the food finished burning.

Some foods have more Calories than others. For example, you get about the same number of Calories in a chocolate bar as you do in a piece of chicken – 270. But the chicken also has protein and other things your body needs to grow and stay healthy. The average 10 year-old needs about 2300 Calories a day.

## Lesson plan

### Warm up

Present the students with a chocolate bar. Explain that it contains about 270 Calories. Ask them to think about some activities that they might do to burn off the Calories from the bar. They might run, walk, swim, stand and sing, watch TV, or sleep. Ask them to put these in order according to how long it would take to burn the Calories from the bar.

It would take 40 minutes to burn off the Calories by running, 24 by swimming, 52 by walking, over two hours by standing and singing, four hours by watching TV and five hours when sleeping.

### Activity 1 p20

Students carry out the activity to compare the energy content of different foods.

### Activity 2 p22

The students are asked to examine the labels of different foods to find out which contains the most Calories per 100 grams. They will find other ingredients are there, some of which are quite puzzling.

Corn syrup and, glucose, liquid invert sugar, corn starch and sugar all add flavour and sweetness to foods, but they are also major sources of calories.



## Extension

Ask the students to compare the labels on ordinary and low-fat versions of different foods. Ask them to compare both the fat and sugar content. The fat may be reduced, but has the amount of sugar being increased? Ask them to compare these with some apparently healthy foods, like energy bars, and find out their calorific content. They may be surprised.

## Concluding the lesson p22

### What you have learnt answers

Different foods provide different amounts of energy. Scientists measure the energy content of foods by burning them in a calorimeter. When you are resting, your body needs about one Calorie of energy per minute. Your energy needs increase when you are active. Fats and oils are the most energy-rich foods. The energy content of packaged foods can be found on the food label.

### Check your progress answers

- 1 900 Calories per 100g
- 2 2000–3000 Calories a day
- 3 you become overweight and possibly obese

## After the lesson

### Workbook p9

#### Answers

- 1 18; 38; 54
- 2 **a** chocolate **b** dry bread **c** because of the difference in the initial and final water temperatures
- 3 to make a fair test
- 4 Chocolate has more Calories.

# Lesson 5: Digestion

## Lesson preparation

### Objectives

- 🕒 describe how food moves through the alimentary canal
- 🕒 explain how food is digested and absorbed as it passes through the digestive system

### Science skills

investigating movement through the alimentary canal



## Equipment

**Warm up:** hoops

**Activity 1** a tape measure, a hosepipe, a marble slightly bigger than the inside diameter of the pipe

## Key words

**absorption:** to soak up or take in

**acid:** a chemical that reacts strongly with substances such as calcite; acid in the stomach kills bacteria

**alimentary canal:** the tube that connects the mouth to the anus; includes the stomach and intestines

**digestion:** the process by which the body breaks down food for materials and energy

**enzymes:** special chemicals that speed up processes in the body, for example digestion

## Background information

The digestive system is the place where food is broken down into a state to go into the bloodstream. Food may be inside the gut for 30 hours, and be squirted with 17 different chemicals.

This all takes place below the heart and lungs in the stomach, or more correctly, the abdomen. Here, the chewed food is thoroughly munched up with chemicals that help to dissolve it. The stomach can hold about as much as a large drinks bottle – around two litres. It takes about two to four hours to turn a meal into a thick soup that is squirted into the small intestine. The first part of this journey is through a 30 cm length called the duodenum, where digestive juices – enzymes from the pancreas and bile from the liver – are added. The bile squirts in like washing-up liquid.

Through the rest of the 6.5 metres of the 2.5 cm wide small intestine, the food is absorbed into the bloodstream ready for the body to use. The velvety lining of the small intestine, with its villi ‘fingers’, acts like blotting paper, soaking up all the useful materials and passing a thick pasty sludge into the large intestine. The shorter (1.8 metre long), thicker (7.5 cm wide) large intestine is full of harmless bacteria that help break down the rest of the food so that the body can use the water and minerals. The remaining food waste – coloured brown by pigments from the bile – begins to pile up behind the anus, waiting for you to go to the lavatory.

Food is pushed along on its journey by waves of muscular squeezes. These work so well that you can eat and swallow when you are upside down or in weightless conditions in space.

## Lesson plan

### Warm up

Use the classroom as a model of the gut, using one door as the mouth and the other door (if you have one) the anus. Students take their places around the room as body organs. They might carry hoops: ‘crawl through the hoop to enter the stomach’. Other students make their way through the system, explaining what is happening to them as they go.

Ask the students what they are representing, and what their role is.

### Activity 1 p23

For understandable reasons, the topic is chiefly theoretical, but this activity demonstrates how food is pushed through the gut.



## Activity 2 p25

### Answers

- |                                                                                    |                                                                  |
|------------------------------------------------------------------------------------|------------------------------------------------------------------|
| <p>1 It's the place where digestion starts; food is mixed with gastric juices.</p> | <p>2 small intestine<br/>3 It is absorbed through the walls.</p> |
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## Extension

During your life, you will eat the equivalent weight of 14 adult elephants (without the tusks). You can expect to eat 80,000 meals, running your gut continuously for 650,000 hours. Ask students to present ideas like these in imaginative ways.

Students are fascinated by faults in the digestive system including sickness, constipation and diarrhoea! Use this to teach them more about food hygiene and sensible eating.

Your stomach will reject more than it can handle or anything that irritates the stomach lining. If you stretch your stomach too far, it will tell your brain that it's in pain; this is stomach ache. The 'vomit centre' in the brain gets signals from your body, which include the signals it sends when you are on a tossing ship. If the signals are strong enough, they trigger a convulsion of your stomach muscles, and you are sick. The sour taste is from the acids working in your stomach.

Your stomach stops digesting if you are very frightened, preparing your body for the danger; you get 'butterflies' or cramps. Diarrhoea is a safety mechanism set off by food that irritates. Your gut pushes all its contents through in a rush, to prevent damage.

Fibre is hardly digested at all. It fills your large intestine, pushing out food that has dried out and is hard to get rid of. Fibre-rich foods like brown rice and wholemeal bread help deal with constipation.

## Concluding the lesson p25

### What you have learnt answers

The food you eat passes through the alimentary canal. The stomach makes acid to kill any bacteria on the food. Digestion changes the food into substances the body can use. Special chemicals called enzymes break the different nutrients into smaller parts. Absorption takes place through the walls of the small intestine. This is where the substances produced by digestion pass into the blood.

### Check your progress answers

- Students produce an accurate drawing of the alimentary canal.
- Students label any three of mouth, stomach, duodenum or small intestine, large intestine.
- Students label small or large intestine.

## After the lesson

### Workbook p10

### Answers

- a** gullet **b** stomach **c** small intestine **d** large intestine **e** rectum **f** anus
- a** true **b** false **c** false **d** true
- Accept any labels that are correct.
- Accept a clear description of digestion.