To keep fit and healthy we need to understand the importance of the food we eat and how that food is used for growth and maintenance of body cells, to provide energy, and to protect us from ill health.

Foods are made up of nutrients, and learning about these is the study of nutrition. The examination course you are following is called 'Food and Nutrition', so the study of the functions and sources of nutrients is a very important part of the course.

In this chapter you will learn about:

- the study of nutrients and their functions, sources and effects on the body
- the application of nutritional knowledge to the special dietary needs of different population groups
- dietary analysis
- functions of macronutrients in the growth and repair of body cells, and in providing energy and fat-soluble vitamins
- the main food sources for proteins, fats and carbohydrates
- functions of micronutrients in regulating body processes and protecting against infection
- the main food sources for vitamins and minerals
- current nutritional advice and its role in the formation of good eating habits in a multicultural society
- the dietary reference values (DRV) for different population groups
- energy balance and ideal weight
- recommended energy intake from proteins, fats and carbohydrates
- the glycemic index of foods
- the digestion and absorption of nutrients.

What you should already know:

✅ You may have covered healthy eating in Year 9, so you will know that we should eat a balanced diet made up of lots of different foods, and not too many sugary, fatty or salty foods.

✅ You may have heard about the 'Five a Day' fruit and vegetable campaign, from the National Health Service, which aims to get us to eat more fruit and vegetables to improve our health.

✅ You may have seen TV programmes about healthy school meals which tried to get schoolchildren to eat healthier meals at lunchtime.
What is nutrition?

Nutrition is the study of the nutrients found in food and their functions in the body. The food we eat affects our bodies in many ways, so to stay healthy we need to understand the importance of good nutrition.

What are nutrients?

- Nutrients are chemical compounds which form molecules in food.
- Most foods are made up of more than one nutrient, but no individual food provides all the nutrients that are needed by the body.
- For example, some nutrients help us grow and repair our body tissues: these are called proteins. Others give us energy for our normal daily activities: these are called carbohydrates and fats.
- Lastly, we need small amounts of nutrients called vitamins and minerals. These help to protect the body from infection and regulate body processes such as clotting of the blood and release of energy from food.

Why do we need a balanced diet?

- A balanced diet is a diet which contains all the nutrients needed for good health in the correct amounts to meet individual needs.
- For example, an active teenager will need more energy foods than a less active elderly person.
- A good way of making sure we eat a balanced diet is to eat a wide variety of foods, including at least five portions of fruit and vegetables a day and not too many sugary, or fatty foods and drinks.

Malnutrition

Malnutrition can occur when not enough food is eaten to meet dietary needs or when too much is eaten, causing obesity.

Diet can become unbalanced for a variety of reasons:

- Eating too much of one type of food and too little of others. For example, too much carbohydrate and fat and not enough protein, vitamins and minerals. If we eat more energy rich foods than we use up in activity the extra energy will be stored as body fat and we may become obese. Whilst a lack of vitamins and minerals in our diets can result in poor resistance to infections.
- In some countries not enough food is available, so the diet is often deficient in certain nutrients. This can cause poor growth in children and deficiency diseases such as beri-beri and pellagra.
- Some people may not eat enough food to meet their dietary needs. This is called under-nutrition. It can be caused by not liking certain foods, such as fruit and vegetables, or by intolerances to foods such as dairy products. Food intake may also be restricted because of a condition called anorexia nervosa which causes severe weight loss and under-nutrition.
Elderly people may suffer from under-nutrition if they lose interest in food or are not able to cook for themselves. Under-nutrition can cause many health problems such as depression, anaemia, and weak bones and teeth.

The eatwell plate from the Food Standards Agency (FSA) shows us how much to eat from each food group to stay healthy. You can see that about one third of our food should be from fruits and vegetables; one third from bread, rice, potatoes and pasta; and the rest from milk and dairy foods; and from meat, fish, eggs and beans. Only a very small amount of our intake should be from foods that are high in fat and sugar. Eating a balanced diet that contains a variety of fresh foods helps us stay healthy.

Investigation

- Plan a well balanced packed lunch for yourself including foods from each of the five groups shown in the eatwell plate.
- Give reasons why you have chosen each of these items.

Questions

1. What are nutrients?
2. List the five main nutrient groups needed for a balanced diet.
3. Why do we need a balanced diet?
4. What is malnutrition?
5. What health problems can be caused by under-nutrition?

Summary

A healthy diet is one that includes the right amounts of proteins, fats, carbohydrates, vitamins and minerals to meet our energy and growth needs.

If we eat more food than we use up in activity we will become overweight.
Why do people have different nutritional needs?

Our individual nutritional requirements are determined by our age, gender, activity levels, lifestyle and special needs such as pregnancy or illness.

Factors which affect nutritional requirements

Age
From birth until adulthood the body needs increasing amounts of nutrients for growth and to provide energy for everyday activities. Growth is most rapid from birth to five and during the teenage years. The diet during these growth spurts should provide adequate amounts of: protein for growth; calcium and vitamin D for the formation of healthy bones and teeth; and iron and vitamin C for red blood cells and to prevent anaemia in girls. Teenagers who take part in active sports will also need more energy giving foods.

Once the body is fully grown, metabolism slows down and nutrients are needed to repair and maintain the body and help protect us from infection. As we grow older, and less active, energy requirements decrease, but we still need a good supply of: protein to repair body cells; calcium and vitamin D to prevent brittle bones; and vitamin C to help resist infections.

Gender
Males generally need more energy from foods than females. This is because males have a higher metabolic rate and more muscle tissue.

Physical activity level (PAL)
PAL levels vary depending on work and leisure activities. For example, someone with a sedentary job (mostly sitting down) who does not exercise will have a lower PAL rate than someone with an active job who plays a lot of sport.

Pregnancy and breastfeeding
Pregnant women need to increase their intake of protein, vitamin B (particularly folic acid), vitamins D and C, and calcium, in order to keep themselves and their baby healthy. They do not need to increase their energy intake as they are generally less active and their metabolic rate is slower, particularly during the last few months of pregnancy.

However, breastfeeding mothers do need to increase their energy intake as their food has to supply the energy needs of the baby through breast milk, in addition to their own needs.

Babies
From birth to about six months old, babies should be fed only breast or formula milk as their digestive systems are not able to cope with solid foods. Once they reach six months, solid foods can be introduced gradually along with their milk feeds. This process of introducing solid foods is called weaning.
From six months old the baby should be eating a variety of solid foods along with most of its milk feeds. Ready prepared weaning foods can be bought in jars or packets, but it is easy to prepare suitable foods by sieving or puréeing foods such as cooked vegetables, fruits and pasta. The texture of weaning foods should be smooth, without lumps, and no salt or sugar should be added. A variety of flavours and textures can gradually be introduced, as long as the foods are salt and sugar free.

By the time babies reach the age of 18 months they should be eating small portions of family meals.

**Illness and recovery from operations**

The need for different nutrients will vary depending on the type of illness or injury a person has suffered. For example, someone with a bone fracture may need extra calcium and protein; or where blood has been lost, through injury or operation for example, extra iron may be required. A person who is ill may only have a small appetite so the food served should contain protein, and vitamins and minerals with only small amounts of fat and carbohydrate: chicken and vegetable soup, for example.

### Questions

1. Why do some people require different amounts of nutrients to others?
2. Why do males need more energy foods than females?
3. How does age affect nutritional needs?
4. What is meant by PAL?
5. Which nutrients should be included in the diet of someone recovering from a broken leg?
6. Why do pregnant and breastfeeding women need to increase their intake of certain nutrients?

### Summary

People at different life stages need different amounts of nutrients.

Age, gender and physical activity levels (PAL) affect the amounts of nutrients needed by the body.

Pregnant women need to increase their intake of protein, folic acid, vitamins D and C, and calcium.

### Links

For more information on weaning please see nhs website: www.healthystart.nhs.uk
1.3 Introduction to nutrition 3

Dietary analysis

Dietary analysis, using food tables in books or computer programs, is useful as it highlights deficiencies or excesses in a person’s nutrient intake. It is a useful tool for carrying out primary research (see 6.4) for investigations into special dietary needs or food related diseases.

Is your diet healthy?

In order to find out if your diet provides adequate amounts of all the nutrients required you should keep a dietary diary for at least three days, including one weekend day. This is because we often eat different foods or meals at the weekend.

You should list everything you eat or drink for the three days, including snacks and drinks. You should also record the amount you eat or the size of the portion. For example: a small, medium or large bowl of cereal with semi-skimmed milk; a large jacket potato with two tablespoons of tuna mayonnaise; and a large glass of fresh orange juice. You should also give the number and type: for example, three large slices of granary bread or six roast potatoes.

If you are calculating the nutrient content using a food table book, the weight of different portion sizes can be checked in a book called Food Portion Sizes by Helen Crawley (available from H.M.S.O.). Most computer programs used for nutritional analysis will calculate the portion size for you.

Investigation 1

- Keep a three day dietary record for yourself, using a table like the one below.
- Carry out dietary analysis using a nutritional analysis program or food tables.
- Compare the nutrient intake of your diet with the recommended DRVs for your age group.
- Suggest ways in which your diet might be improved.

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Foods eaten</th>
<th>Amounts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>orange juice</td>
<td>large glass / 125 ml</td>
</tr>
<tr>
<td></td>
<td>cornflakes</td>
<td>medium bowl / 30 g</td>
</tr>
<tr>
<td></td>
<td>semi-skimmed milk</td>
<td>1 cup / 100 ml</td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evening meal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snacks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Objectives

Develop skills of dietary analysis using food tables or nutritional analysis programs.

Key terms

Dietary diary: a record of all the food and drink intake of a person over a given period of days.

AQA Examiner’s tip

Dietary diaries are only a guide to an individual’s food intake as they depend on how accurately they have been recorded. When drawing conclusions on the analysis of dietary diaries remember to make allowances for any inaccuracies in recording.

Remember

When using computer programs to calculate nutritional content, make sure you analyse and interpret the data.
Investigation 2

Using a nutritional analysis program, analyse this sample of a day’s food intake of a 15 year old schoolgirl.

Breakfast
- medium glass of fresh orange juice
- 2 Weetabix® with semi-skimmed milk
- 1 large banana

Mid morning
- medium chocolate muffin
- small glass water

Lunch
- 1 large jacket potato with cheddar cheese
- small portion baked beans
- 1 medium sultana flapjack
- small carton of apple juice

Afternoon snack
- bag of salt and vinegar crisps
- small can of diet coke

Evening meal
- medium portion of vegetable curry with rice
- small bowl of vanilla ice cream with 3 tinned peach slices

Snacks
- 2 chocolate digestive biscuits
- small bag of roasted salted peanuts

Questions
1. Why is dietary analysis useful?
2. List the rules to follow when completing dietary diaries.
3. Why is it useful to include a weekend day in a dietary diary?

Summary
Dietary analysis is a method of assessing the nutritional value of meals.
You can check to see if your diet is lacking in any nutrients by keeping a dietary diary and analysing it using a nutritional analysis program.
### What are macronutrients?

These are nutrients needed by the body in fairly large amounts. They include **proteins**, fats and carbohydrates.

### Why do we need protein foods?

Protein foods are needed for growth, maintenance and repair of all body cells.

Excess protein is converted into glucose and stored in the liver as glycogen which can be used as a secondary source of energy.

Protein molecules are made up of long chains of **amino acids**. There are approximately 22 known amino acids of which 10 are essential for growth and repair in children and 8 are essential for adults.

These essential amino acids are sometimes called **indispensable amino acids** because we cannot live without them.

Different proteins are made up of different combinations of amino acids. To stay healthy our bodies need a diet containing a wide variety of protein foods.

#### Protein values of different foods

<table>
<thead>
<tr>
<th>Animal proteins</th>
<th>Protein per 100 g</th>
<th>Vegetable proteins</th>
<th>Protein per 100 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red meat</td>
<td>25 g</td>
<td>Cereals such as wheat, rice, oats</td>
<td>12 g</td>
</tr>
<tr>
<td>Chicken</td>
<td>23 g</td>
<td>Pulses (peas, beans, lentils)</td>
<td>7 g</td>
</tr>
<tr>
<td>Fish</td>
<td>20 g</td>
<td>Nuts</td>
<td>11 g</td>
</tr>
<tr>
<td>Eggs</td>
<td>12 g</td>
<td>Tofu</td>
<td>8 g</td>
</tr>
<tr>
<td>Cheese</td>
<td>26 g</td>
<td>Soya protein (TVP)</td>
<td>16 g</td>
</tr>
<tr>
<td>Milk</td>
<td>3.5 g</td>
<td>Quorn™</td>
<td>12 g</td>
</tr>
</tbody>
</table>

*Source: adapted from Food Tables, by A E Bender & D A Bender*

### Is there a difference between animal and vegetable sources of protein?

- Animal proteins contain all of the indispensable amino acids. These are sometimes called high biological value (HBV) proteins.
- Vegetable proteins lack one or more of the indispensable amino acids. These are sometimes called low biological value (LBV) proteins.
Does it matter which type of proteins we eat?
Not if we mix and match the protein foods we eat together. For example, a peanut butter sandwich will give us different amino acids in the bread to those in the peanut butter. This is known as complementation of protein and can be used in many different ways: for example, cheese on toast, or hummus and pitta bread. Vegetarians can make sure that they get all the essential amino acids by eating different vegetable protein foods together.

Novel proteins
Novel proteins are grown from micro-organisms which produce mycoprotein, known as Quorn™. It is manufactured into chunks and mince and can be used in pies, sausages, burgers and ready meals. Quorn™ is low in fat, has no cholesterol and is a good source of protein for vegetarians.

How much protein do we need to eat each day?
- Adult females need approximately 45 g per day.
- Adult males need approximately 55 g per day.
- Pregnant women need approximately 51 g per day.
- Breastfeeding women need approximately 56 g per day.

Deficiency
Deficiency is very rare in the UK. In countries that suffer from famine, protein deficiency results in retarded growth in children and wasting of muscles and internal organs.

Questions
1. What are macronutrients?
2. Why is protein needed by the body?
3. What is protein made up of?
4. What is the nutritional difference between animal and vegetable proteins?
5. Why do some people need more proteins than others?
6. Give examples of how protein foods can be combined to complement each other.
7. What are novel proteins?

Summary
Macronutrients are needed by the body in relatively large amounts.

Proteins, fats and carbohydrates are macronutrients.

Animal proteins contain all the essential amino acids (HBV).

Vegetable proteins lack one or more essential amino acids (LBV).
1.5 Macronutrients 2

Fats

Why do we need fats?
Fats provide the body with the most concentrated source of energy and supply the fat-soluble vitamins A, D, E and K. Fats also provide a protective layer around delicate internal organs such as the kidneys.

Composition of fats
- Fats are composed of the elements carbon, oxygen and hydrogen.
- They are made up of one molecule of glycerol and three fatty acids.
- The chemical composition of fats varies according to the number of double bonds in their structure.
- **Saturated fatty acids** have no double bonds, as all the carbon atoms are saturated with hydrogen.
- **Unsaturated fatty acids** have two or more double bonds.
- Monounsaturated fatty acids have one double bond.
- Polyunsaturated fatty acids contain many double bonds.
- Fats containing double bonds are healthier than fats that do not contain double bonds.

Animal fats
These are mostly made up of saturated fatty acids which are converted to cholesterol in the liver. We need some cholesterol for healthy body cells and hormones, but if we eat too much saturated fat the resulting cholesterol can block our arteries and cause heart disease.

Examples of foods containing animal fats are: all meats, including bacon and sausage; pate; suet; eggs; milk, cream and butter. Animal fats are usually solid at room temperature.

Vegetable fats
These are mostly made up of unsaturated fatty acids which are not converted into cholesterol and are thought to be healthier than animal fats. People who live in Mediterranean countries, and eat olive oil and fish and very little animal fat, tend to have lower rates of heart disease than people who eat large amounts of animal fat.

Examples of foods containing vegetable fats are: corn, olive and sunflower oils; margarine; nuts and seeds; wholegrain cereals; and avocado pears. Oils are usually liquid at room temperature.

**Objectives**

Understand the function of fats in the provision of energy and fat-soluble vitamins.

**Remember**

Fat should provide no more than 35% of total energy and saturated fat no more than 11% of total energy.

**Key terms**

**Saturated fatty acids**: from animal food sources – have no double bonds, as all the carbon atoms are saturated with hydrogen. **Unsaturated fatty acids**: from vegetable sources – have two or more double bonds.

**Examiner’s tip**

Look at food labels to find out which foods are high in fat. Learn the difference between saturated and unsaturated fats.
Ways of cutting down on saturated fat

- Reduce the amount of fried foods eaten, including chips.
- Cut all visible fat off meat and bacon.
- Eat more chicken and fish and less red meat.
- Eat low fat spreads, cheese and yoghurts.
- Use an oil spray or a nonstick frying pan to reduce the amount of fat used in cooking.
- Buy lean mince and low fat sausages.
- Cut down on cakes, biscuits and pastries.
- Reduce the fat content in recipes when baking.

<table>
<thead>
<tr>
<th>Type of fat</th>
<th>Production method</th>
<th>Uses in cooking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard or block</td>
<td>Made from different animal and vegetable fats which are hardened by a process</td>
<td>Adds colour to pastry, scones and biscuits.</td>
</tr>
<tr>
<td>margarine</td>
<td>called hydrogenation.</td>
<td>Useful for rubbed-in mixture, as it does not go oily when handled.</td>
</tr>
<tr>
<td>Soft</td>
<td>Made from vegetable oils which have been hydrogenated and emulsified.</td>
<td>Used for spreading on bread etc.</td>
</tr>
<tr>
<td>margarine</td>
<td>It is not hydrogenated as much as hard margarine and is softer in texture.</td>
<td>Suitable for creaming methods.</td>
</tr>
<tr>
<td>Low fat spread</td>
<td>This is made in the same way as soft margarine but contains added water which</td>
<td>Used mainly for spreading.</td>
</tr>
<tr>
<td></td>
<td>reduces the fat content.</td>
<td>Some claim that they can be used for baking and frying.</td>
</tr>
<tr>
<td>Butter</td>
<td>Made by churning cream from milk.</td>
<td>Used in cooking to give extra flavour to pastry and biscuits.</td>
</tr>
<tr>
<td></td>
<td>Butter must be at least 82 % fat and is high in saturates.</td>
<td>Can be used for sauces.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Used for spreading on bread etc.</td>
</tr>
<tr>
<td>Ghee</td>
<td>Clarified unsalted butter.</td>
<td>Used in curries and sauces.</td>
</tr>
<tr>
<td>Lard</td>
<td>Made from rendered pig fat.</td>
<td>Used to give a crumbly texture to shortcrust pastry.</td>
</tr>
<tr>
<td></td>
<td>It is a solid saturated fat.</td>
<td>Can be used for frying.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vegetarians and some religious groups will not use lard.</td>
</tr>
<tr>
<td>Suet</td>
<td>Made from the shredded fatty tissues found round the internal organs of animals.</td>
<td>Used in suet pastry, dumplings and some Christmas puddings.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vegetarians will not eat suet.</td>
</tr>
<tr>
<td>Oils</td>
<td>Vegetable and fish oils are liquid at room temperature.</td>
<td>Used in salad dressings.</td>
</tr>
<tr>
<td></td>
<td>They are refined and bottled, ready for use.</td>
<td>Can be used for frying and roasting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can be used in some baked recipes such as bread.</td>
</tr>
<tr>
<td>White vegetable</td>
<td>Made from emulsified vegetable oils such as sunflower oil.</td>
<td>Can be used for making pastry.</td>
</tr>
<tr>
<td>fat</td>
<td>Low in saturated fat and a healthier alternative to lard.</td>
<td>Can be used for frying and roasting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suitable for vegetarians.</td>
</tr>
</tbody>
</table>

Questions

1. Why are fats needed by the body?
2. What is the difference between animal and vegetable fats?
3. Why are saturated fats less healthy than unsaturated fats?

Summary

Fats are the most concentrated source of energy and provide fat-soluble vitamins.

Saturated fats are from animal sources such as meat and dairy products.

Unsaturated fats are from vegetable sources such as sunflower oil, nuts and seeds.
1.6 Macronutrients 3

**Carbohydrates**

**Why do we need carbohydrates?**

Carbohydrate foods are needed to provide energy. Carbohydrates, in particular starchy foods, are the cheapest source of energy and are easily digested. When carbohydrate foods such as bread, pasta and potatoes are eaten they are broken down into glucose during digestion and absorbed into the bloodstream to be used for energy. Excess glucose is stored in the liver as glycogen and can be used when extra energy is needed.

Carbohydrates eaten with proteins allow the proteins to be used for growth and repair rather than for energy. As protein foods are usually more expensive than carbohydrates this is sometimes called protein sparing.

Carbohydrates should provide 50 per cent of the total energy intake, with no more than 11 per cent from sugars.

If too much carbohydrate is eaten, and it is not needed for energy or glycogen stores, it is stored as body fat.

**Main food sources**

Carbohydrates can be divided into three main groups: sugars, starches and dietary fibre or non-starch polysaccharide (NSP).

### Key terms

- **Non-starch polysaccharide (NSP), also known as dietary fibre:** The indigestible fibrous structure of plants. It is not a nutrient, but is essential for the elimination of waste products from the large intestine.

### AQA Examiner’s tip

Make sure you are familiar with high fibre foods and ways in which sugar can be reduced in recipes.

### Objectives

Understand the function of carbohydrates in the provision of energy.

### Intrinsic sugars

- **(sometimes called natural sugars)**
- Form part of the cell structure of plants in some fruits and vegetables.
- **Fructose:** found in fruit and honey.
- **Glucose:** found in ripe fruits and some vegetables such as onions and beetroot.
- **Galactose:** found in milk as part of the milk sugar lactose.
- **Lactose:** found in milk and milk products.

### Extrinsic sugars

- **(added sugars)**
- Not part of the cell structure of plants, but are added to foods to provide sweetness and a quick source of energy.
- **Sucrose:** obtained by refining cane sugar or sugar beet.
- This is the sugar that is used in recipes or added to drinks.
- No food value other than providing a quick source of energy, so sometimes referred to as ‘empty’ calories.
- **Honey:** obtained from honeycomb produced by bees.

### Starches

- Formed from long chains of glucose units.
- Produced during photosynthesis in plants.
- Take longer to digest than sugars so release energy more slowly into the bloodstream and over a longer period of time.
- Sometimes referred to as slow releasing carbohydrates.

### Non-starch polysaccharide (NSP)

- (dietary fibre)
- Found in the cell structure of plants in the form of cellulose and pectin.
- Humans cannot digest dietary fibre, but it is very important in moving waste materials in the large intestine.
- Dietary fibre can also help to control blood sugar levels. Foods rich in dietary fibre can help us to feel full for longer, so we are less likely to snack on sugary foods.
- Foods containing dietary fibre are also low in fat and contain valuable vitamins and minerals.

### Sources

- **Intrinsic sugars**
  - Fruit, onions, tomatoes, beetroot, milk

- **Extrinsic sugars**
  - Sucrose is refined from sugar cane and sugar beet into granulated, castor, and demerara sugar; and golden syrup.
  - Honey is obtained from honeycomb and undergoes various degrees of refinement.

- **Starches**
  - Cereals, bread, root vegetables, pulses (peas, beans and lentils), bananas, rice, pasta

- **Non-starch polysaccharide (NSP)**
  - Pulses (beans, peas and lentils), wholemeal bread, wholegrain cereals, wholewheat pasta, brown rice, baked potato with skin, dried fruits (including apricots, dates and figs), all vegetables

### Food sources of sugars, starches and NSP

Make sure you are familiar with high fibre foods and ways in which sugar can be reduced in recipes.
### Types of carbohydrate and uses in cooking

<table>
<thead>
<tr>
<th>Type of carbohydrate</th>
<th>Production method</th>
<th>Uses in cooking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>Flour is produced from cereals by a process called milling, which creates a fine powder. • The flour is sieved to remove the bran and husk. • Wholemeal flour contains the bran, which provides dietary fibre in wholemeal produce.</td>
<td>Wheat flour can be plain, self-raising or wholemeal. • Used for bread, biscuits, cakes and pastries.</td>
</tr>
<tr>
<td>Oats</td>
<td>Oats are rolled to produce flakes. • Can be sold as oatmeal which is more finely rolled. • Oats are high in dietary fibre and may help to reduce cholesterol in the blood.</td>
<td>Breakfast cereals such as muesli and porridge. • Flapjacks, cakes and biscuits. • Oatmeal can also be used for coating fish.</td>
</tr>
<tr>
<td>Rice</td>
<td>Rice is a cereal plant and is milled after harvesting to remove the husk. • It can be crushed and made into ground rice.</td>
<td>Two main types of rice are: • long grain (or patna) – usually boiled and served with savoury dishes such as curries. • short grain – used for puddings and rice cakes.</td>
</tr>
<tr>
<td>Maize (sweetcorn)</td>
<td>Grains are crushed and made into a flour or refined to make cornflour.</td>
<td>• Cobs can be boiled and eaten as a vegetable. • Maize flour is used to make tortillas. • Cornflour is pure starch and is used as a thickening agent.</td>
</tr>
<tr>
<td>Pasta</td>
<td>Pasta is produced from durum wheat flour, which is mixed with water, oil and sometimes egg, to produce a dough that can be rolled and cut to various shapes.</td>
<td>Usually boiled and served with meat, fish or vegetable sauces or made into dishes such as lasagne.</td>
</tr>
<tr>
<td>Potatoes and other root vegetables</td>
<td>Potatoes and root vegetables are a good source of carbohydrate in the diet and can be used fresh or dried.</td>
<td>Can be boiled, roasted, fried or baked; and used in soups, curries and casseroles.</td>
</tr>
<tr>
<td>Sugar (sucrose)</td>
<td>Refined sugar is made from crushing, milling and sieving sugar cane or sugar beet. • Brown sugar is the least refined. • White sugar has been refined to remove all of the coloured residue.</td>
<td>Brown sugar is used for coffee; for baking gingerbread and flapjacks; and making toffee and syrups. • White sugar is used in baking cakes, biscuits and pastry.</td>
</tr>
</tbody>
</table>

### Investigation

- Look in a recipe book and find one sweet and one savoury recipe that you could alter to increase the dietary fibre content.
- Use a nutritional analysis program to work out the dietary fibre content of the original recipe and your adapted version.
- Comment on your results, making reference to the DRVs for dietary fibre.

### Questions

1. Why do we need carbohydrates in our diets?
2. What are the three groups of carbohydrates?
3. What is the difference between intrinsic and extrinsic sugars?
4. What is dietary fibre?
5. Why is it important in our diets?
6. List the foods that are good sources of dietary fibre.

### Summary

The three types of carbohydrates are sugars, starches and non-starch polysaccharide (NSP), also known as dietary fibre.

Starchy carbohydrates, such as bread and potatoes, are the healthiest sources of energy in the diet.

Wholegrain carbohydrates, such as cereals, provide the body with dietary fibre.
What are micronutrients?

Micronutrients are vitamins and minerals. These are nutrients which are needed in smaller quantities than the macronutrients (see 1.4–1.6) and are used by the body for protection from infection, and to regulate body processes such as the absorption of energy from food.

Vitamins

Vitamins can be divided into water soluble vitamins (those which dissolve in water) and fat-soluble vitamins. Water soluble vitamins cannot be stored in the body and need to be eaten every day. Most fat-soluble vitamins can be stored in the liver so do not have to be eaten every day.

**Objectives**

Understand the functions and food sources of micronutrients in our diet.

**Key terms**

- **Water soluble vitamins**: vitamins B and C dissolve in water.
- **Fat-soluble vitamins**: vitamins A, D, E and K are present in the fat content of foods.

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Function</th>
<th>Sources</th>
<th>Deficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B₁ (thiamin)</strong></td>
<td>Releases energy from carbohydrates.</td>
<td>Fortified flours and breakfast cereals; yeast extract; meat (especially pork); milk, cheese, and eggs; peas and potatoes</td>
<td>• Loss of appetite, fatigue and dizziness.</td>
</tr>
<tr>
<td></td>
<td>Promotes healthy nervous system.</td>
<td></td>
<td>• Slow growth in children.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Severe deficiencies can cause beri-beri.</td>
</tr>
<tr>
<td><strong>B₂ (riboflavin)</strong></td>
<td></td>
<td>Liver and kidney; breakfast cereals; yeast extract; cheese, eggs and milk; wholemeal bread; potatoes and cabbage</td>
<td>• Cracks around mouth and lips.</td>
</tr>
<tr>
<td></td>
<td>Promotes healthy skin and mouth.</td>
<td></td>
<td>• Tongue and eyes may become inflamed.</td>
</tr>
<tr>
<td></td>
<td>Releases energy to body cells.</td>
<td></td>
<td>• General tiredness.</td>
</tr>
<tr>
<td><strong>B₃ (nicotinic acid)</strong></td>
<td></td>
<td>A wide range of foods including: all meat; tuna; yeast extract; beef extract; bread; cheese; potatoes</td>
<td>• Skin problems such as dermatitis.</td>
</tr>
<tr>
<td></td>
<td>Releases energy from carbohydrates, fats and proteins.</td>
<td></td>
<td>• Severe deficiency causes pellagra but this is very rare in the UK.</td>
</tr>
<tr>
<td><strong>B₁₂ (cyanocobalamin)</strong></td>
<td></td>
<td>Liver, meat and fish; cheese, milk and eggs; fortified breakfast cereals</td>
<td>• Anaemia.</td>
</tr>
<tr>
<td></td>
<td>Helps prevent anaemia.</td>
<td></td>
<td>• Strict vegetarians may suffer from deficiencies, as B₁₂ is mostly found in animal products.</td>
</tr>
<tr>
<td></td>
<td>Promotes healthy nervous system.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Folic acid (folate)</strong></td>
<td></td>
<td>Broccoli, cabbage, spinach, cress and rocket leaves; bread; potatoes; yeast extract; nuts and seeds; breakfast cereals</td>
<td>• Tiredness.</td>
</tr>
<tr>
<td></td>
<td>Helps to prevent premature birth and neural tube defects during pregnancy.</td>
<td></td>
<td>• Anaemia.</td>
</tr>
<tr>
<td></td>
<td>Needed for the formation of red blood cells.</td>
<td></td>
<td>• Pregnant women should take a folic acid supplement during the first half of pregnancy to prevent birth defects.</td>
</tr>
<tr>
<td><strong>C (ascorbic acid)</strong></td>
<td></td>
<td>Green vegetables and potatoes; citrus fruits and blackcurrants</td>
<td>• Mouth and gum infections.</td>
</tr>
<tr>
<td></td>
<td>Needed for formation of connective tissue, bone and tooth enamel.</td>
<td></td>
<td>• Slow healing of wounds and fractures.</td>
</tr>
<tr>
<td></td>
<td>Helps absorb iron into the blood.</td>
<td></td>
<td>• Extreme deficiency causes scurvy but this is almost unknown in the UK.</td>
</tr>
<tr>
<td></td>
<td>Needed for the healing of wounds and fractures.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>An antioxidant vitamin.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Investigation**

- Plan a day’s meals that would provide a good supply of folic acid for a pregnant woman.
- Analyse your meals using a nutritional analysis program and evaluate your results.
### Functions and sources of fat-soluble vitamins

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Function</th>
<th>Sources</th>
<th>Deficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (retinol)</td>
<td>• Needed for healthy mucous membranes in nose, throat and digestive system.</td>
<td>Milk and cheese; eggs; oily fish and cod liver oil; liver and kidney</td>
<td>• Poor eyesight or night blindness.</td>
</tr>
<tr>
<td>(animal sources)</td>
<td>• Needed for formation of visual purple in the eye which helps us to see in dim light.</td>
<td>Carrots, spinach, tomatoes and broccoli; apricots; fortified margarines</td>
<td>• But deficiency is rare in the UK as vitamin A is found in a wide variety of foods.</td>
</tr>
<tr>
<td>A (beta-carotene)</td>
<td>• Beta-carotene is an antioxidant vitamin.</td>
<td></td>
<td>• Excess in pregnancy can cause birth defects. Pregnant women are advised not to eat liver, as it contains large amounts of retinol.</td>
</tr>
<tr>
<td>(vegetable sources)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D (cholecalciferol)</td>
<td>• Promotes the absorption of calcium to form healthy bones and teeth.</td>
<td>Fish liver oils and oily fish; eggs, cheese and butter; fortified margarines; the action of sunlight on the skin</td>
<td>• Deficiency can cause rickets in children and brittle bones in older people.</td>
</tr>
<tr>
<td>E (tocopherols)</td>
<td>• Needed for healthy skin and reproductive system.</td>
<td>Most plant foods and vegetable oils; eggs; cereal products</td>
<td>• Deficiency very rare.</td>
</tr>
<tr>
<td>K</td>
<td>• Needed for normal clotting of the blood.</td>
<td>Green leafy vegetables such as spinach and cabbage; meat and liver</td>
<td>• No evidence that vitamin E delays ageing.</td>
</tr>
</tbody>
</table>

**Antioxidant vitamins**

The antioxidant vitamins protect body cells from damage and help to reduce the risk of cancer and heart disease. They are:

**Vitamin A**

This is in the form of beta-carotenes which are found in orange and dark coloured vegetables and fruits. These include: sweet potatoes, carrots, tomatoes, apricots, peaches, mango, spinach and broccoli.

**Vitamin C**

Vitamin C (ascorbic acid) is plentiful in our diets if we eat at least five portions of fruit and vegetables a day. Most people in this country get a large amount of vitamin C from potatoes as we tend to eat them every day. Other good sources of vitamin C include: fresh orange juice, blackcurrant juice, broccoli and tomatoes.

**Vitamin E**

Foods rich in vitamin E include: vegetable oils, such as sunflower and wheatgerm, nuts, cereal products and eggs.

**Remember**

ACE = antioxidant vitamins which may protect the body from heart disease and cancer.

**AQA Examiner’s tip**

When answering questions on micronutrients, make sure you name the vitamin to get maximum marks.

**Summary**

Micronutrients are vitamins and minerals.

They are only needed in very small amounts in our diets, but are vital for good health.
Minerals

Minerals are used by the body for:
- building strong bones and teeth
- forming healthy blood cells and carrying oxygen around the body
- controlling body processes such as nerve impulses
- regulating body fluids.

Some minerals are needed in fairly large amounts and these include calcium and iron. Others are only needed in very small amounts and are known as trace elements, which include fluoride and iodine.

Are you getting enough calcium?

Calcium is a very important mineral for everyone, as it is used to build strong bones and teeth and to protect us from bone diseases in later life. Some research has shown that calcium may also help to reduce high blood pressure and to protect us from some forms of cancer.

To absorb calcium effectively we must also have an adequate supply of vitamin D, which is present in dairy produce and fortified margarine, and is also produced by the action of sunlight on the skin.

Eating a varied diet containing milk, cheese, green vegetables, soya products, nuts and bread should provide you with adequate amounts of calcium.

The recommended amount of calcium for adults is 700 mg per day.

### Objectives

Develop knowledge of the function of minerals in the body.

### Key terms

- **Calcium**: mineral needed for strong bones and teeth.
- **Iron**: mineral needed for healthy red blood cells and carrying oxygen round the body.
- **Trace elements**: minerals needed in very small amounts in the diet.

### AQA Examiner’s tip

Look in a book of food tables, for example, Bender & Bender, and make a list of the best food sources of calcium and iron.

### Functions and sources of minerals

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Function</th>
<th>Sources</th>
<th>Deficiency</th>
</tr>
</thead>
</table>
| Calcium | • Used to develop strong bones and teeth.  
• Needed for muscle contraction, blood clotting and a healthy nervous system. | Milk, cheese, butter and yogurt; eggs; sardines; white bread; nuts; cabbage, spinach and oranges | • Weak bones and teeth.  
• Rickets in children and osteomalacia in adults. |
| Iron | • Used in formation of haemoglobin in red blood cells which carry oxygen around the body. | Red meat and liver; oily fish; breakfast cereals and wholemeal bread; spinach, cabbage and broccoli; dried fruit; pulses; cocoa powder and plain chocolate | • Can cause tiredness and anaemia.  
• Menstruating women can be deficient where dietary intakes of iron are low. |
| Fluoride | • Strengthens teeth by combining with enamel coating, making them more resistant to attack by acids. | Tea; drinking water in areas where fluoride is added; seafood | Deficiency is very rare. |
| Sodium | • Maintains correct concentration of body fluids. | Table salt; cooked meats; bacon and sausages; canned foods; ready meals; salty snack foods | Deficiency is very rare. |
| Iodine | • Makes the hormone thyroxine, which is produced by the thyroid gland in the neck.  
• Used to control the body’s metabolism. | Seafood; milk; cod liver oil; green vegetables; tap water; iodised salt | • Slow metabolism.  
• Enlargement of the thyroid gland causing goitre neck. |
Chapter 1  Nutrition, diet and health  

Are you getting enough iron?

Iron is essential for making red blood cells which carry oxygen around the body. It is important for everyone to have a varied diet that contains iron rich foods.

There are two main sources of iron: **haem iron**, which is found in meat and is easily absorbed by the body; and **non-haem iron**, which is found in beans, nuts, soya products, wholegrains and fortified breakfast cereals, and is less easily absorbed by the body. Some green vegetables such as watercress, broccoli and curly kale also supply good amounts of non-haem iron.

However, spinach, made popular by ‘Popeye the sailor man’, is not a good source of iron. This is because, although it contains iron, it also contains phytic acid which makes it harder for the body to absorb the iron. Tea and coffee contain polyphenols, which also reduce the amount of iron absorbed from food, so it is better not to drink tea and coffee with meals.

Vitamin C helps to increase absorption of iron from food so drinking orange juice, or eating fruit and vegetables rich in vitamin C, as part of a meal helps to increase the amount of iron absorbed.

The recommended intake of iron per day is: 8.7 mg for a man, and 14.8 mg for a woman.

**Investigation 1**

- Make a list of everything you ate and drank yesterday.
- Analyse your list using a nutritional analysis program, or use a book of food tables, to work out the calcium content.
- Compare your totals with the DRVs for calcium for your age group.
- If your diet is low in calcium, make suggestions as to ways in which you could improve it.

**Investigation 2**

- Follow the link below for information on iron rich meals and snacks.
- Print off the information.
- Analyse the menus using a nutritional analysis program and work out the total iron content of the day’s meals.
- Compare the totals with the DRVs for iron for a teenage girl.
- Examine your own diet to find out if you are deficient in iron.

**Questions**

1. Why is calcium needed by the body?
2. Which group of foods is particularly rich in calcium?
3. Why do we need iron in the diet?
4. Why do teenage girls need good supplies of iron rich foods?
Where do we get current nutritional advice from?

There are different sources of information and advice about nutrition, some are official and others are voluntary.

**Official sources of information**
- Government reports – for example, COMA report 1991
- Government departments – for example, MAFF Balance of Good Health
- Food Standards Agency – for example, Eatwell Plate and Traffic Light System
- National Health Service – for example, Five a Day campaign
- British Nutrition Foundation – nutrition information
- Schools Food Trust – new standards for school meals

**Voluntary sources of information**
- Food labels
- Free leaflets
- Media – including TV programmes, magazines, newspapers and books

Healthy eating guidelines advise us to:
- eat less fat, sugar and salt.
- eat more **dietary fibre** and starchy foods.
- eat at least five portions of fruit and vegetables every day.

The Government published these eight tips for eating well in October 2005.
- Base your meals on **starchy foods**.
- Eat lots of fruit and vegetables.
- Eat more fish.
- Cut down on **saturated fats** and sugar.
- Try to eat less salt – no more than 6 g a day.
- Get active and try to be a healthy weight.
- Drink plenty of water.
- Don’t skip breakfast.

**Why do we need to follow dietary guidelines?**

To keep us healthy and prevent dietary related diseases. For example:
- too much fat can lead to obesity and coronary heart disease.
- too much sugar can lead to obesity, diabetes and tooth decay.
- too much salt can lead to hypertension (high blood pressure) and strokes.
- too little dietary fibre can lead to constipation and diverticulitis.

**Objectives**
- Understand current nutritional advice.
- Understand the DRVs for different groups of people.

**Key terms**
- **Dietary fibre**: refers to non-starch polysaccharides which are found in fruit and vegetables.
- **Starchy foods**: cereals, vegetables, fruit, pasta, rice, potatoes and bread.
- **Saturated fats**: fats from animal sources such as meat, eggs, milk, butter and cheese.

**Investigation**
- Carry out an investigation of a person with a special dietary need, such as someone suffering from diabetes or heart disease.
- Plan a range of healthy dishes that would be suitable for a person suffering from the chosen condition.
- Make up some of the dishes in your practical lessons.
- Carry out a sensory and nutritional analysis of your practical work.
- Evaluate the results of your case study.
How do we know how much of each nutrient we should be eating each day?

Government guidelines for nutrient intakes try to cover a wide range of individual needs but these are only general guidelines for average nutrient requirements.

**DRV – Dietary reference value.** This is an overall term used to cover EAR, LRNI and RNI.

**EAR – Estimated average requirement** for any group of people but, like any average, some will need more and some will need less.

**RNI – Reference nutrient intake.** An amount of a nutrient that is enough, or more than enough, for approximately 97 per cent of a population group.

**LRNI – Lower reference nutrient intake** is the amount of nutrient that is enough for a few people in a population group who have low needs.

**Safe intake** – This term is used where there is lack of evidence regarding how much of a nutrient is needed by the body. Safe intake, as its name suggests, is the amount that is thought to satisfy most people’s needs without any harmful effects.

**GDA – Guideline daily amounts** were developed by food manufacturers and retailers. Based on DRVs they are intended to simplify nutritional information on food labels.

### DRVs for 11–18 year olds

<table>
<thead>
<tr>
<th>Males (per day)</th>
<th>Females (per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protein</strong></td>
<td>55.5 g</td>
</tr>
<tr>
<td><strong>Fat</strong></td>
<td>No more than 35% of total food energy, of which no more than 11% should be from saturated fat</td>
</tr>
<tr>
<td><strong>Total energy</strong></td>
<td>11–14 years 2220 kcals</td>
</tr>
<tr>
<td></td>
<td>15–18 years 2755 kcals</td>
</tr>
<tr>
<td><strong>Vitamin A</strong></td>
<td>700 μg</td>
</tr>
<tr>
<td><strong>Vitamin B₁ (thiamin)</strong></td>
<td>1 mg</td>
</tr>
<tr>
<td><strong>Vitamin B₂ (riboflavin)</strong></td>
<td>1.3 mg</td>
</tr>
<tr>
<td><strong>Vitamin B₃ (nicotinic acid)</strong></td>
<td>17 mg</td>
</tr>
<tr>
<td><strong>Folate</strong></td>
<td>200 μg</td>
</tr>
<tr>
<td><strong>Vitamin C</strong></td>
<td>35–40 mg</td>
</tr>
<tr>
<td><strong>Vitamin D</strong></td>
<td>No recommendation for school age children</td>
</tr>
<tr>
<td><strong>Vitamin E</strong></td>
<td>Safe intake not more than 4 mg</td>
</tr>
<tr>
<td><strong>Vitamin K</strong></td>
<td>No DRVs</td>
</tr>
<tr>
<td><strong>Minerals</strong></td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>8.7 mg</td>
</tr>
<tr>
<td>Calcium</td>
<td>1000 mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>1600 mg</td>
</tr>
</tbody>
</table>

*Source: For further information on DRVs for other groups, see Dietary Reference Values: A Guide, Department of Health, 1991*
1.10 Energy from foods

**Why do we need energy?**

We need energy for every bodily process from breathing, blood circulation and brain function, to playing football and dancing. We even need energy when we are sleeping. Different activities require different amounts of energy, and the more active we are the more energy we use up.

**Basal metabolic rate (BMR)** is the rate at which the body uses energy when it is warm and resting. Energy requirements depend on age, gender and activity levels. More energy is needed during periods of rapid growth such as infancy and teenage years. Less energy is needed once our bodies are fully grown, and even less during middle and old age when we are less active.

**Energy giving foods**

Energy is provided by the food we eat after it has been digested. The three main nutrients that provide energy are:

- carbohydrates (sugars and starches)
- fats
- proteins.

Carbohydrates, such as bread, pasta, rice and potatoes, are the cheapest sources of energy. They also tend to be low in fat so are healthy options for providing energy.

Fats are said to be **energy dense** as they provide more than twice the amount of kilocalories per gram than carbohydrates or proteins. Fats, in particular saturated fats, are not such a healthy source of energy and fat should not exceed 35 per cent of total energy food intake.

Proteins can provide energy in a diet which is low in carbohydrate, but it is an expensive way of providing energy.

**The glycemic index (GI) of foods**

This is the rate at which carbohydrates are converted into glucose during digestion.

Foods with a high glycemic index are converted rapidly and give an immediate burst of energy. These foods are usually made from refined sugar or white flour and include most sweets, cakes, biscuits and fizzy drinks.

Low GI foods are converted to glucose more slowly and are sometimes referred to as slow releasing carbohydrates as they provide energy over a longer period of time. These foods include wholegrain products, nuts, seeds, and fruits such as apples and bananas.

Low GI foods are healthier as they help you to feel fuller for longer and control the release of the hormone insulin into the body. They also contain more dietary fibre than high GI foods.

**Objectives**

Understand energy needs throughout life.

Understand the importance of energy balance in maintaining healthy body weight.

**Key terms**

**Basal metabolic rate (BMR):** the rate at which the body uses energy when it is warm and resting.

**Energy dense:** containing high amounts of fat and sugar.

<table>
<thead>
<tr>
<th>Age</th>
<th>Males (kcal per day)</th>
<th>Females (kcal per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–6 months</td>
<td>690</td>
<td>645</td>
</tr>
<tr>
<td>7–12 months</td>
<td>920</td>
<td>865</td>
</tr>
<tr>
<td>1–3 years</td>
<td>1230</td>
<td>1165</td>
</tr>
<tr>
<td>4–6 years</td>
<td>1715</td>
<td>1545</td>
</tr>
<tr>
<td>11–14 years</td>
<td>2220</td>
<td>1845</td>
</tr>
<tr>
<td>15–18 years</td>
<td>2755</td>
<td>2110</td>
</tr>
<tr>
<td>19–49 years</td>
<td>2550</td>
<td>1940</td>
</tr>
<tr>
<td>50–59 years</td>
<td>2550</td>
<td>1900</td>
</tr>
<tr>
<td>60–74 years</td>
<td>2330</td>
<td>1900</td>
</tr>
<tr>
<td>75 +</td>
<td>2100</td>
<td>1810</td>
</tr>
</tbody>
</table>

Source: Adapted from Dietary Reference Values, Department of Health, 1991
Energy balance

To remain healthy and prevent obesity we must balance the amount of food we eat with the amount of energy we use up in activity. If more food is eaten than is used up as energy it is stored as body fat. To lose weight we need to eat fewer energy dense foods, in particular those high in fat and sugar, and increase our physical activity.

Recommended sources of food energy in the UK

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Recommended Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>No more than 15% of total food energy from protein.</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>Bulk of food energy (50%) from carbohydrates. Most of carbohydrate food energy (39%) from starch. No more than 11% from non-milk extrinsic sugars.</td>
</tr>
<tr>
<td>Fat</td>
<td>No more than 35% of total food energy from fats. No more than 11% of food energy from saturated fats. Other sources of energy from fats: 12.1% monounsaturated fats; 6.5% polyunsaturated fats and 1.2% trans fats.</td>
</tr>
</tbody>
</table>

Source: Department of Health, 1991

Questions

1. Why do we need energy?
2. What are the energy giving nutrient groups?
3. What is BMR?
4. Look at Table A and explain the different energy requirements for different individuals.
5. Why are low GI foods healthier sources of energy than high GI foods?
6. Give six examples of low GI foods.

Summary

Energy is needed by the body for every process and activity.

Carbohydrates, fats and proteins provide the body with energy.

Energy balance is when the energy intake of food equals that used up in energy expenditure.
1.11 Digestion and absorption of nutrients

What happens to food once we have eaten it?
To allow the body to use the nutrients in food for energy, growth, repair and protection, the food must be broken down or digested.

Digestive process
- Food enters the mouth where it is broken down into smaller pieces by the action of chewing.
- Saliva in the mouth contains a digestive enzyme (salivary amylase) which starts to break down cooked starch into sugars.
- When food is swallowed it passes down the oesophagus into the stomach.
- The enzyme pepsin, in the gastric juice of the stomach, starts the digestion of proteins into amino acids.
- The liver produces bile which emulsifies fats.
- Food stays in the stomach for four to five hours where it is moved around by muscular action and mixed with gastric juices.
- Food then passes through the first part of the small intestine (duodenum) where enzymes (proteinase) continue to break down proteins; fat is broken down into fatty acids and glycerol by the enzyme lipase; and carbohydrates are broken down into glucose by the enzyme amylase.
- It then passes into the second part of the small intestine (ileum) where most of the nutrients are absorbed into the bloodstream and carried around the body.
- Finally, the undigested food (including fibre) passes to the large intestine (colon) and is excreted through the anus.

Water
Almost 70 per cent of the human body is made up of water. Water is needed for:
- body fluids, such as blood, sweat and urine
- regulation of body temperature
- body processes, such as digestion
- preventing dehydration.

Water is lost from the body in urine, faeces and sweat, and through respiration. So we need to replace it every day to prevent dehydration.

Objectives
- Develop outline knowledge of digestion and absorption of nutrients.
- Understand the functions of water in the diet.

Key terms
- Digestive enzymes: chemicals in the digestive juices which speed up the breakdown of food and the release of nutrients.
- Respiration: process in which air passes into and out of the lungs so that the blood can absorb oxygen and give off carbon dioxide and water.
Chapter 1  Nutrition, diet and health

Water in the diet

Many foods such as vegetables and fruit provide water, but we mainly get water from drinks, including fizzy drinks, fruit juices, tea and coffee. Altogether we need about two to three litres a day (the equivalent of six to eight glasses) to stay healthy. Drinking tap water is the best way of making sure we get enough fluids, especially in hot weather when the body loses fluids through sweating. Extra water is also needed during illness where the patient has a high temperature and after strenuous exercise to prevent dehydration.

How does water aid digestion?

Water is needed: to eliminate waste products from the large intestine; to prevent constipation; and to filter impurities from the kidneys, by the production of urine.

Investigation

- Keep a dietary diary of everything you eat and drink in one day.
- Analyse your food intake for the water content, and calculate whether you meet your daily requirement of two to three litres of water a day.

Questions

1. What is the function of saliva in the digestive process?
2. Name the enzyme in the gastric juice that starts the digestion of proteins.
3. Where are most of the nutrients in food absorbed into the bloodstream?
4. Why is water important in the digestive process?
5. Copy Diagram A and discuss the digestive process that would be involved after eating a meal of poached egg and wholemeal toast.

Summary

Digestion starts in the mouth where food is broken down by the action of chewing.

Different digestive enzymes work on different nutrients.

Nutrients are absorbed into the bloodstream in the small intestine.

Water is needed to eliminate waste products.

<table>
<thead>
<tr>
<th>Food</th>
<th>Water content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cucumber</td>
<td>96</td>
</tr>
<tr>
<td>Onions</td>
<td>93</td>
</tr>
<tr>
<td>Melon</td>
<td>93</td>
</tr>
<tr>
<td>Cabbage</td>
<td>90</td>
</tr>
<tr>
<td>Strawberries</td>
<td>88</td>
</tr>
<tr>
<td>Milk</td>
<td>87.6</td>
</tr>
<tr>
<td>Yogurt</td>
<td>79</td>
</tr>
<tr>
<td>Bananas</td>
<td>70</td>
</tr>
<tr>
<td>Apples</td>
<td>65</td>
</tr>
<tr>
<td>Chicken</td>
<td>63</td>
</tr>
<tr>
<td>Minced beef</td>
<td>59</td>
</tr>
<tr>
<td>Sausages</td>
<td>48</td>
</tr>
<tr>
<td>Bread</td>
<td>39</td>
</tr>
<tr>
<td>Cheddar cheese</td>
<td>37</td>
</tr>
<tr>
<td>Crisps</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Bender AE & Bender DA, Food Tables, 1986
Chapter summary

In this chapter you have learnt:

- that a balanced diet is one which contains all the nutrients we need to keep us healthy
- that an unbalanced diet can cause malnutrition
- how to use computer programs to carry out nutritional analysis
- the function and sources of macronutrients and micronutrients in the diet
- how energy is used by the body and the importance of energy balance
- about the process of digestion and absorption of nutrients.

Revision quiz

1. Which of the following is the nutrient needed for growth and repair of body cells?
   a) Protein
   b) Carbohydrate
   c) Fat

2. Which of the following nutrients provides the most energy per gram?
   a) Protein
   b) Carbohydrate
   c) Fat

3. Which of the following groups of people have the greatest energy requirement?
   a) Babies
   b) Teenagers
   c) Elderly people

4. Malnutrition is:
   a) when you eat too much food
   b) when you don’t eat enough food
   c) when you don’t eat the right kinds of foods to meet individual dietary requirements.

5. Males need more energy foods than females because:
   a) males are more active than females
   b) males have a higher metabolic rate than females
   c) males have more body fat than females.

6. Amino acids are found in:
   a) fats
   b) vitamins
   c) proteins.

7. Which of the following foods contains dietary fibre?
   a) Chicken
   b) Potatoes
   c) Cheese

8. Calcium is used in the body to:
   a) prevent infection
   b) make red blood cells
   c) build strong bones and teeth.

9. Which of the following vitamins is an antioxidant?
   a) Vitamin C
   b) Vitamin B
   c) Vitamin D

10. Which of the following foods is a good source of iron in the diet?
    a) Apples
    b) Cauliflower
    c) Red meat