1.3 Macronutrients – protein

An introduction to nutrients

The components found in food are called nutrients. The food you eat should provide your body with the nutrients it needs to stay alive and healthy.

There are two main types of nutrients:

- **macronutrients** are needed in large amounts by the body and are called protein, fats (lipids) and carbohydrates.
- **micronutrients** are needed in smaller amounts and are called vitamins and minerals.

Protein

Protein is one of the five nutrients, and is an essential part of your diet.

It is needed for growth, repair, maintenance and energy. Some groups of people need more protein than others. For example, children and pregnant women need more protein for growth, and everyone needs more protein after injury to repair the body.

What are proteins made from?

Proteins are made up of **amino acids**. These are linked together to make a chain (see the diagram below). There are about 20 amino acids. These amino acids make lots of different types of protein, depending on which amino acids are in the chain.

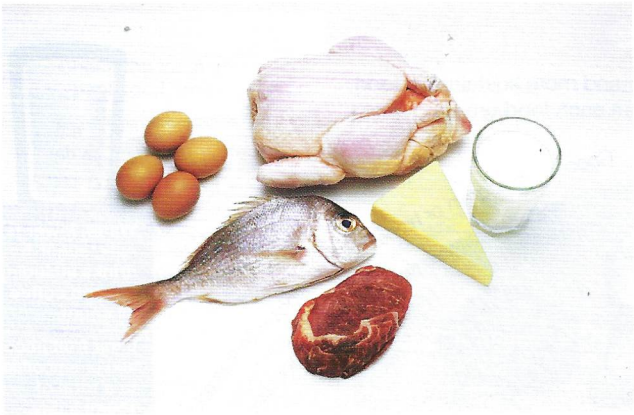
▲ A chain of amino acids

- Of these 20 amino acids, 10 are **essential amino acids** for children and 8 for adults. They need to be provided by your diet as the body can't make them.
- The two extra amino acids needed by children are for growth.
- The **non-essential amino acids** can be made by the body.

Types of protein

High biological value (HBV)

High biological value proteins contain all of the essential amino acids. The foods that provide these are mainly foods from animals, such as meat, fish, milk and eggs. There are some plant foods that are also HBV, such as soya beans and quinoa.

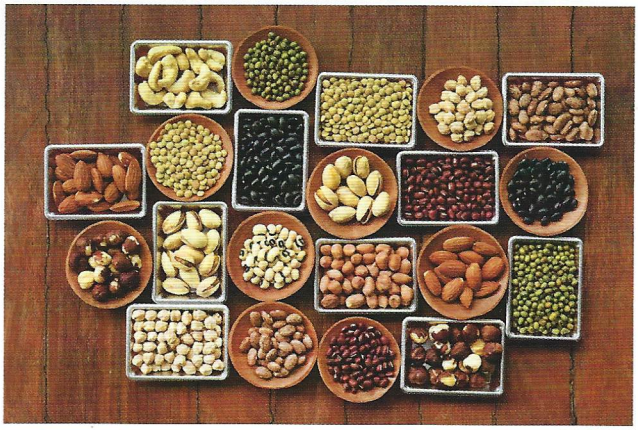


▲ HBV protein foods

Low biological value (LBV)

Low biological value proteins are missing one or more essential amino acids. The foods that provide these are mainly foods from plants, such as peas, beans, lentils, nuts, seeds and cereals. The exception is **gelatine**, which is an animal-based product, and is a LBV protein.

When two or more LBV proteins are combined, these can produce HBV protein: for example, hummus and pitta bread, peas and rice, or beans on toast. This is known as **protein complementation**. This means that when two LBV protein foods are combined, they provide all 10 of the essential amino acids.



▲ LBV protein foods

Activity

1. Use samples of foods or make food cards to classify foods into HBV and LBV.
2. Make a list of LBV protein foods which can be combined to make HBV snacks and meals.
3. Copy and label the chain of amino acids as shown above. Why do you think the amino acids have different shapes and colours?

Key words

macronutrients – nutrients needed by the body in large amounts

micronutrients – nutrients needed by the body in smaller amounts

amino acids – the building blocks of protein

essential amino acids – amino acids your body needs as it can't make them by itself

non-essential amino acids – amino acids that your body can make by itself

high biological value – protein foods which contain all of the essential amino acid

low biological value – protein foods which are missing one or more essential amino acid

gelatine – protein made by boiling animal bones, used for setting food

protein complementation – when two LBV protein foods are combined to form HBV protein

Knowledge check

1. What is protein?
2. Give two reasons why some people need more protein than others.
3. What are the building blocks of protein called?
4. Why do children need two more essential amino acids than adults?
5. Which two plant foods are the exception to the rule, and are HBV (contain all the essential amino acids)?

Extension

6. Make a list of 10 snacks which contain a protein food and would appeal to adults. Name the protein food(s) in each snack.

Find out more

Protein shakes are very popular drinks, especially for sportsmen and women.

- Find out how many grams of protein these drinks contain per 100 ml.
- Find out how many grams of protein whole milk contains per 100 ml.
- How many grams of protein do you need per day?

In practice

Make a dish high in protein, such as baked Scotch eggs or a layered fish dish.

OR

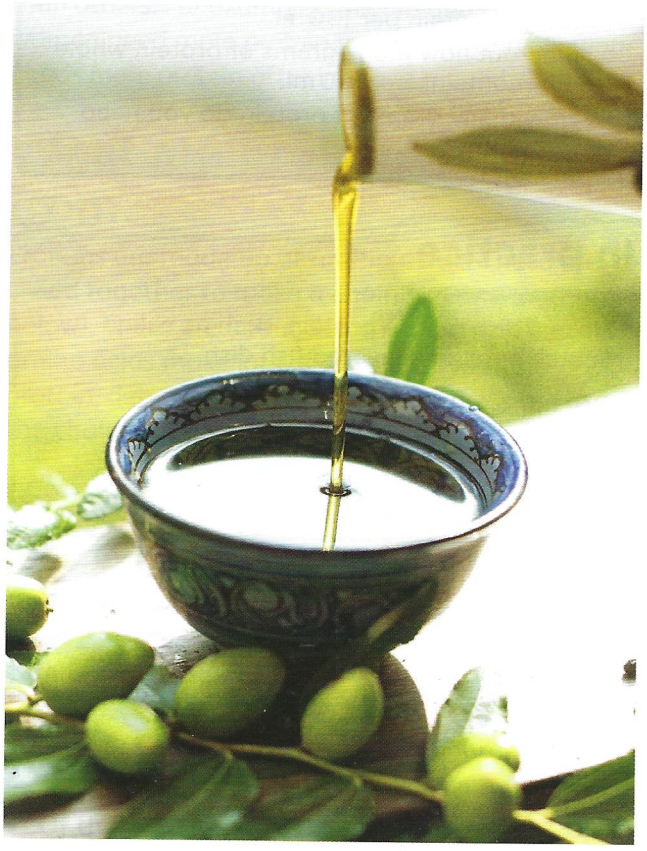
Make a dish which shows protein complementation (using two LBV foods to make an HBV dish).

1.4 Macronutrients – fats and oils (lipids)

Fat is one of the five nutrients and is an essential part of your diet. However, many people eat too much fat, which is not good for their health.

Fats may also be called oils or lipids. Fats such as butter are solid at room temperature. Oils are liquid at room temperature.

▲ Butter is solid at room temperature



▲ Olive oil is liquid at room temperature

Why is fat important in the diet?

- It keeps the body warm.
- It provides energy.
- It protects and cushions internal organs by covering them with fat.
- It provides **fat-soluble vitamins**.

Fats may be either:

- **animal fats** – butter, lard, suet, cream, hard cheese. Animal fats are usually **saturated**.

OR

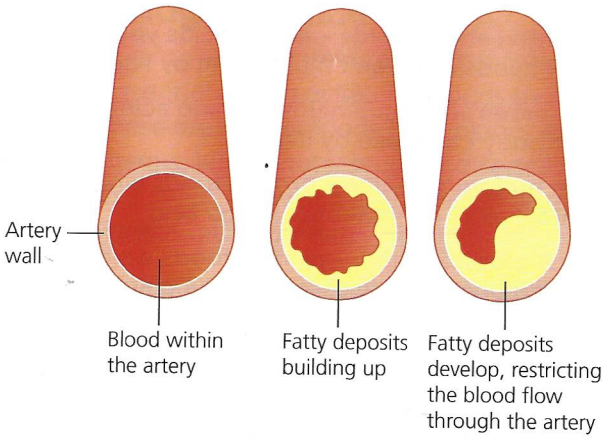
- **vegetable fats** – sunflower oil, olive oil, rape seed oil, nuts. Vegetable fats are usually **unsaturated**.

What happens if we eat too much fat?

Eating foods high in fat can raise the cholesterol levels in the blood. Cholesterol is a fatty substance needed for the body to function properly. There are two types of cholesterol, good and bad. The bad cholesterol can cause health problems.

Eating too much fat can also lead to obesity, higher 'bad' **cholesterol** levels, and an increased risk of **type 2 diabetes** and **heart disease**. Most people agree that unsaturated vegetable fats are better for our health.

Saturated animal fats have been linked to increased cases of heart disease.



▲ How fatty deposits build up in the blood vessels

Activity

Make a leaflet suitable for young children, showing the main functions of fat in the diet. Use the website www.foodafactoflife.org.uk for ideas.

Key words

fat-soluble vitamins – these are vitamins A, D, E and K

saturated fats – usually from animal sources; can be harmful to health

unsaturated fats – usually from plant sources; can be good for health

cholesterol – a fatty substance which is needed for the normal functioning of the body

type 2 diabetes – a condition where the body's sugar levels cannot be controlled properly

heart disease – a build-up of fatty deposits in the coronary arteries

Knowledge check

1 Describe the difference between fat and oil.
2 Name three functions of fat.
3 Name three sources of animal fat.
4 Name three sources of vegetable fat.
5 Which types of fat are linked to an increased risk of heart disease?

Extension

6 Find out how a low-fat diet may help to prevent type 2 diabetes and/or heart disease.

Find out more

Make a list of the different types of fat spreads, butter and margarine for sale. Use a supermarket website if available.

- Record the price per 100g and the percentage of fat per 100g.
- Is the fat from animals or plants?
- Which vitamins have been added to these fats?

In practice

Make a scone-based pizza, using butter for the base and a vegetable oil to shallow fry some vegetables (for example, onions, mushrooms and garlic for the topping).

OR

Make a dish using vegetable oil for stir frying, such as chicken chow mein.

1.5 Macronutrients – carbohydrates

▲ Foods high in fibre

Carbohydrate is one of the five nutrients and is an important part of your diet. Carbohydrates are divided into three groups:

1. **Sugar** – all sugars, treacle and syrups, honey, jam and marmalade. These are called either simple sugars (e.g. glucose) or double sugars (e.g. sucrose).
2. **Starch** – potatoes, rice, pasta, bread and yams. These are also called complex carbohydrates as they are made up of many simple sugars joined together.
3. **Dietary fibre** – found in the cell walls of fruits, vegetables and cereals. This is also called a complex carbohydrate as it is made up of many simple sugars joined together.

Free sugars are **added sugars** such as sugar, syrup and honey, which are more harmful to your health. **Fruit sugars** are natural sugars in the cell walls of plants.

The main function of carbohydrates is to provide energy for the body.

▲ Foods high in sugar

What happens if we eat too many carbohydrates?

- If the diet contains more carbohydrate than the body needs, it will be turned into fat and stored by the body. This can lead to **obesity**.
- If too much sugar is eaten, this can lead to tooth decay.

Why is fibre important?

Fibre is important as it keeps the **digestive system** healthy by helping the food waste travel through the body more easily.

If you don't eat enough fibre, this can cause **constipation**, which can eventually lead to cancer of the bowel.

Fibre can reduce your chances of getting heart disease and type 2 diabetes.

The recommended amount of fibre for adults is 30g a day.

Activity

Make a chart with three headings: Sugar, Starch, Dietary fibre.

Under each heading, write down examples of different carbohydrate foods which belong in each group.

Knowledge check

1. Name the three groups of carbohydrates.
2. Which type of carbohydrate should we eat less of? Why?
3. Which type of carbohydrate should we eat more of? Why?
4. What happens if excess (too much) carbohydrate is eaten?
5. How much fibre should adults eat each day?

Extension

6. Find out the daily amount of fibre needed each day for children of different ages.

Key words

carbohydrate – one of the five nutrients

sugar – simple sugars (e.g. glucose) and double sugars (e.g. sucrose)

starch – a complex sugar (e.g. potatoes, rice and bread are high in starch)

dietary fibre – a complex sugar found in the cell walls of plants

free sugar (added sugar) – sugars added to food (e.g. sugar, syrup and honey)

fruit sugar – natural sugars contained in the cell walls of plant foods (e.g. the sugar in a banana)

obesity – being very overweight, carrying more body fat than is healthy

digestive system – parts of the body where food is broken down to provide nutrients

constipation – when stools are dry and hard to pass

wholegrain – the whole grain is crushed and often made into flour, e.g. wheat flour

Find out more

Search the website **www.nhs.uk/live-well/eat-well/how-to-get-more-fibre-into-your-diet** to find out how much fibre you need a day. Use this information to plan a menu which is high in fibre.

In practice

Make a fibre-rich bread, which could be sweet or savoury. It should contain **wholegrain** cereals and be low in free sugar and salt.