AQA GCSE

Food Preparation and Nutrition

SECOND EDITION

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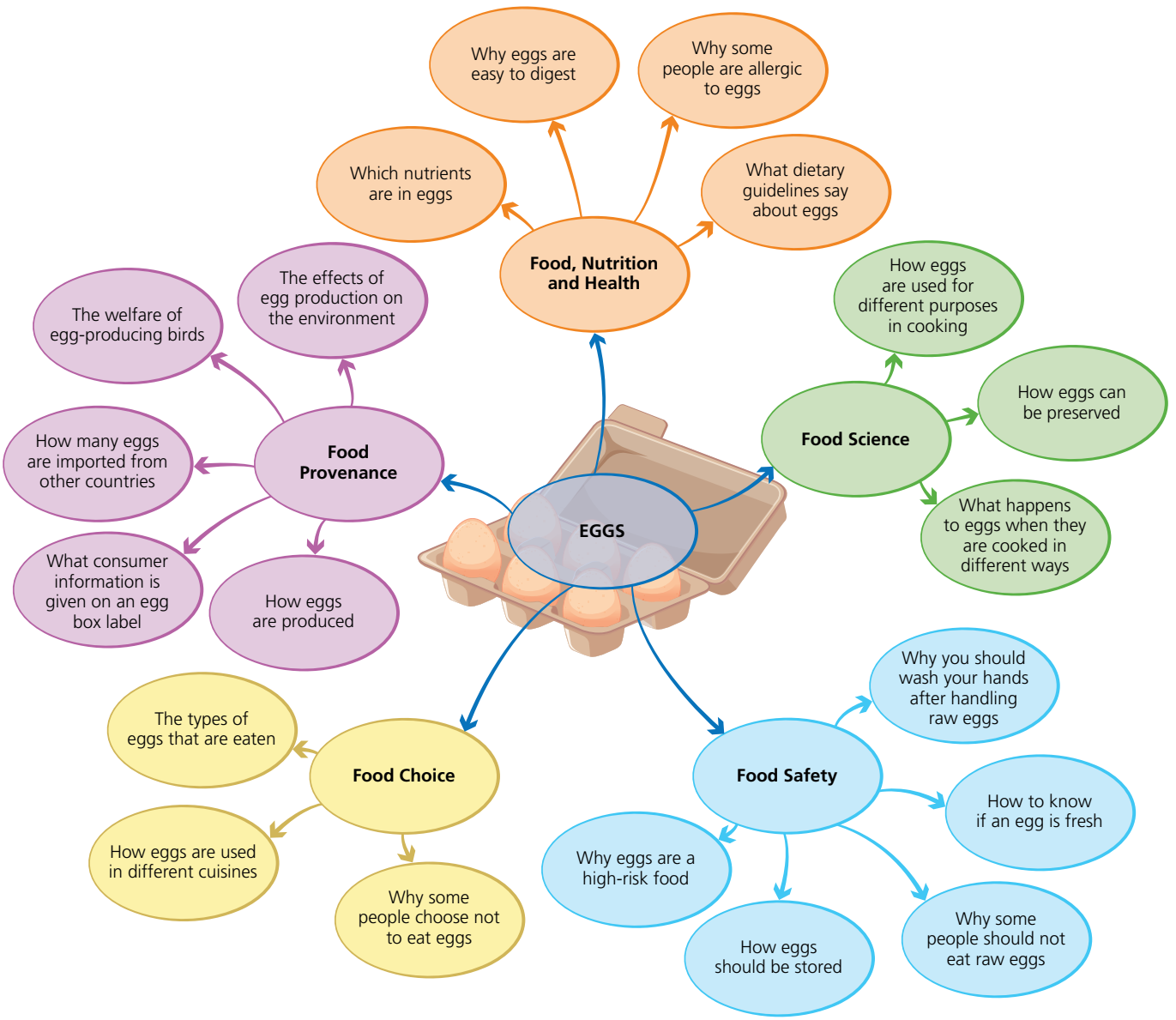
Contents

How to use this book

The book is divided into five core topics:

- Food, Nutrition and Health
- Food Science
- Food Safety
- Food Choice
- Food Provenance (where food comes from)

It is important to realise and remember that all these topics are linked, so you should not treat them as completely separate pieces of information. For example, if you take a topic such as eggs, there will be something to learn and know about eggs in each section, and you will also put some of this knowledge into practice if you use eggs in your practical work, as shown below:



It is important that you try to make, understand and remember these links as you go through the course.

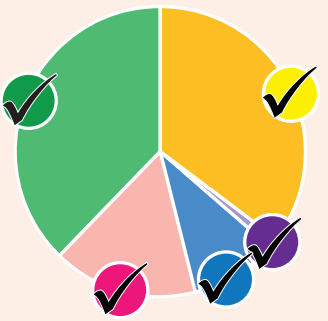
Features to help you

Throughout the book, there are a number of features to help you to study and progress through the course:

Key terms

Key terms give you the definitions of the key terminology (words) in each of the topics that you need to know and use.

Recipes



A variety of recipes, related to particular topics, are provided. Each recipe gives the ingredients and method for making it. To help you link these to the various sections of the specification, you will find at the end of some of the recipes a chart showing the nutritional profile of the recipe as well as an Eatwell Guide logo, indicating, by the use of tick symbols, which sections of it are provided by the ingredients in the recipe. The cooking methods and practical skills used and the science behind the recipe are also given. To help you understand and develop your meal planning skills, you may also be asked how you could vary and/or modify the ingredients or cooking method in the recipe for different situations.

Tips

These will give you tips on how to develop your understanding, recall and revision skills, as well as information, resources and further research you might find useful in your studies.

Extension activities

These are activities in which you will need to find out more about a topic and practise being able to answer questions at a higher level, showing your detailed knowledge and understanding.

Practical activities

These activities give you the opportunity to further develop your practical skills.

Activities

A range of activities are given throughout the book. Some of these are practical activities you can do in class, some are theory-based. They are designed to encourage you to think more widely about a topic and work with other people and discuss, analyse and evaluate what you find out.

Practice questions

These are end-of-topic questions, written in different styles and with a range of command words. They are designed to give you opportunities throughout the course to practise and improve your techniques for answering questions.

Photographs and drawings

There are many of these throughout the book. They are included to help you further understand and visualise a topic, particularly what happens when ingredients are prepared and cooked (food science), produced and processed.

Skill 1: General practical skills

Weighing and measuring

Most recipes depend on accurate measurements for success, so it is important to be able to weigh and measure accurately. If you are making a cake, for example, and you add too much sugar or too much flour, the results are likely to be poor. However, in some recipes it does not matter so much, for example if you put two onions instead of one in a Bolognese sauce.

Digital scales will give a more precise and accurate check on weight

Conversion tables

Some recipes use grams (metric); others use ounces/pounds (imperial).

Measurements are based on weight for solids (dry ingredients) and on volume for liquids. The table below is a useful guide for approximate conversions from imperial to metric for weight and volume; they have been rounded up or down.

Weight		Volume	
Ounces	**Grams**	**Fluid ounces**	**Millilitres**
1 oz	25 g	1 fl oz	30 ml
2 oz	55 g	2 fl oz	50 ml
3 oz	85 g	5 fl oz (¼ pint)	150 ml
4 oz	115 g	½ pint	300 ml
5 oz	140 g	¾ pint	425 ml
6 oz	175 g	1 pint	600 ml
7 oz	200 g	1 ¾ pint	1 litre
8 oz	225 g		
16 oz (1 lb)	450 g		

Equipment

The following equipment is useful for weighing and measuring:

- Kitchen scales – digital/electronic kitchen scales are the most widely used.
- Measuring jug – a measuring jug is used to measure liquids; the side of the jug is usually marked with millilitres or fluid ounces or both.
- Measuring cups – some American recipes use cups for dried ingredients such as flour and sugar. Cups should not be used to weigh fat.
- Measuring spoons – these are very useful for measuring an accurate teaspoon or tablespoon. 1 teaspoon is 5 ml, 1 tablespoon is 15 ml.

Key term

Mise en place: preparation before starting to cook

Mise en place

Preparation before starting to cook is called **mise en place**.

You should organise:

- yourself
- the area you are working in
- the equipment and ingredients needed.

You should follow hygiene and safety rules.

A good way to remember how to set up your area ready to cook is the word HATTIE.

Choosing the correct tins and dishes

It is important to use the exact size of tin or dish recommended in the recipe.

Some tins need preparing before use. For example, tins used to make Swiss rolls need to be lined with non-stick baking paper and greased.

Selecting and adjusting cooking times

When cooking food, you do not want it to be spoiled by under or over cooking, so always check the timings in the recipe as a guide, check visually, check high-risk foods with a temperature probe and do a taste test.

Fish and shellfish

- For thinner fillets of fish, such as plaice or sole, if the outside of the fish is opaque (which means it will not be see-through and is less shiny), the fish is done.
- For thicker fillets, such as salmon or cod, insert a small, thin knife into the thickest part of the fillet to see if it is opaque throughout.
- Raw prawns are grey in colour and turn pink when cooked.

Meat and alternatives

Larger joints of meat need long, slow cooking – cooking times are not as precise because they are unlikely to overcook if left in for a few minutes too long.

Smaller cuts, such as steak or burgers, can be grilled more quickly. They can overcook easily so need to be watched while cooking.

Mycoprotein products (i.e. Quorn) can be cooked using an oven, grill or microwave. You can use Quorn mince, fillets and pieces in a recipe in the same way you would use meat. Generally, Quorn cooks quicker than meat or poultry.

Recipe: Bolognese sauce

Ingredients

500 g of mycoprotein (Quorn)
1 onion
50 g mushrooms
1 small pepper
1 clove garlic
400 g tin of chopped tomatoes
1 tbsp of tomato purée
18 ml (1 tbsp) oil
1 tsp of mixed herbs
1 vegetable stock cube
A pinch of ground black pepper

Optional ingredients:
Red/yellow/green pepper
1 courgette
1 carrot

Method

1. De-seed and chop all vegetables into dice. Heat oil and fry the vegetables until soft, approximately five minutes.
2. Add the mycoprotein and stir in.
3. Add all the other ingredients.
4. Decide on whether to add some water and how much. The amount of water added will alter the consistency, making it thicker or thinner – add water (125–250 ml).
5. Bring to the boil and simmer for until the sauce has the consistency you would like.
6. Adjust seasoning to taste.

Vegetables

Vegetables are usually steamed or boiled and can take as little as five minutes to cook. When they are cooked '**al dente**' they should be firm to the bite. Check vegetables regularly using a knife.

Key term

Al dente: meaning 'firm to the bite'; a description of the texture of correctly cooked pasta and some vegetables

Pasta and rice

- Pasta is cooked by placing in boiling water.
- Rice can be cooked in a number of different ways, such as steaming or boiling.

Baked products

Generally, individual cakes, breads and pastries cook in a shorter time than large cakes and bread. Larger cakes sometimes need a lower temperature to avoid the top of the product overcooking.

When it gets near to the cooking time recommended in the recipe, test for readiness regularly.

Testing for readiness

You can check whether food is cooked in different ways.

Temperature probe/knife

Raw meats (such as chicken and beef burgers) must be cooked thoroughly to 75 °C in order to kill any bacteria present.

To test for readiness, you can use a temperature probe, or use a knife to cut into the thickest point and check that the juices are clear and not pink or bloody.

Skewer

When making deep cakes, it is difficult to judge whether the centre is cooked. You can check by inserting a skewer – if the skewer comes out clean, then the cake is cooked. If it is coated with sticky cake mixture, it needs longer in the oven.

Finger/poke test

The finger/poke method is most commonly used to check if small cakes are cooked. When you touch them with a finger, they should feel springy and spongy, not runny or gooey. Smaller cuts of meat can also be checked by pressing them; the fibres should feel set not soft.

Visual colour check/sound check

Most baked products should be a golden brown in colour. In the case of bread, there is also a sound check – when the bread is turned upside down and tapped with a knuckle, it will sound hollow if it is cooked.

Taste test

Foods such as rice or pasta can be tasted to check if they are cooked. Pasta should be al dente, which means firm to the bite. Rice should be cooked through and have a soft rather than gritty texture.

Judging and modifying sensory properties

In order for us to want to eat food, it needs to look and smell appetising. We then judge by taste.

As you cook more, you will gradually learn the skills of tasting food to check for flavour, texture and seasoning.

The characteristics of food that our senses respond to are know as **sensory properties**. Judging food based on these characteristics is sensory evaluation.

Key term

Sensory properties: the characteristics of food that our senses respond to

You will learn about sensory testing methods and how to taste food in Section 5.3 Sensory evaluation.

Testing for flavour and seasoning

It is necessary to make sure that the food being cooked retains its taste. Checking its taste is essential during the cooking process, but particularly just before the end of cooking when it may need adjusting by simply adding some seasoning or some herbs or spices.

Changing taste and aroma

An aroma is usually a pleasant smell.

Taste and aroma can be changed in the following ways:

- By infusion – to **infuse** is to flavour liquid with aromatic ingredients by slowly heating it to boiling point and then allowing it to cool. When making bread sauce, the milk is infused with cloves, black peppercorns, bay leaf and an onion.
- By **reduction** – a reduction is a concentrated liquid formed when it is boiled rapidly; it will concentrate its flavour and colour.
- By making a paste – a paste such as a **beurre manié** is made from equal quantities of butter and flour mixed together to form a soft paste, which is added to liquids to thicken them.

Changing texture and flavour

Tasting food for texture is as important as testing for flavour. In fact, in many cases, changing the texture of food also changes the flavour.

Breadcrumbs can be added as a garnish to dishes such as a pasta bake or cauliflower cheese. This will give the dish more texture as it will be crispy and crunchy on top.

Meat should be allowed to rest after cooking as this allows the muscle fibres to relax, which makes the texture more tender.

When making a product such as crème brûlée, the sugar on the top is heated using the grill or a blow torch; the effect of the heat on the sugar causes it to melt and change to a brown colour (**caramelisation**).

Foods such as pastry can be glazed, e.g. with milk, oil or beaten egg, which will deepen the colour of the top of the pastry and make it look shiny and attractive.

You will learn more about dextrinisation and caramelisation in Section 3.2 Functional and chemical properties of food.

Key terms

Infuse: to flavour liquid with aromatic ingredients by slowly heating to boiling point and then allowing to cool

Reduction: a concentrated liquid formed when it is boiled rapidly

Beurre manié: a paste made from equal quantities of butter and flour mixed together, which is added to liquids to thicken them

Caramelisation: the breaking up of sucrose (sugar) molecules when they are heated, which changes the colour, flavour and texture of the sugar as it turns into caramel

Aesthetics: the art of making food look good or attractive

Presentation and food styling

When we eat, we often judge food by its initial appearance.

Presentation and how the food is styled will improve a dish's **aesthetic** qualities. If food looks delicious, it is likely that the person eating it will think it tastes delicious before they eat it. There are many different ways in which food can be styled and presented to make it look as attractive as possible.

Garnishes and decorative techniques

Adding food to a finished dish can improve its aesthetic appearance. Decorations on savoury food are called **garnishes**. Examples of garnishes are sliced tomato, chopped coriander and lemon wedges.

Styled food – duck breast with cherries

Key terms

Garnishes: decorations on savoury food

Decorations: items added to sweet foods to improve their taste and/or appearance

Accompaniments: additions such as a sauce or vegetables that add colour to a dish

A styled dessert

You can learn more about how to prepare garnishes in Section 1, Skill 3 Preparing fruit and vegetables.

Decorations on sweet foods are simply called decorations. Examples of decorations are grated chocolate, a dusting of icing sugar or cocoa, a strawberry fan, piped cream and chopped nuts.

Accompaniments, such as a sauce or vegetables, also add colour to a dish.

Presenting food for serving

It is always important to consider the serving dish and how the food will be placed on the dish. A number of different techniques can be used:

- Use the centre height of the dish – a mound of food will look more attractive than if it is flattened on a plate or serving dish.
- If laying out a plate of biscuits or canapés, arrange them in contrasting rows, as these look attractive.
- Overlap food such as fruit slices or slices of meat, as this stops the food looking flat and dull on the plate.
- Keep colours of serving dishes to a minimum – lots of different colours can be overbearing. Using two colours or different shades of a single colour works very successfully.

Portioning

How you portion food and finish it off for presentation is important to make the food look as attractive as possible.

Different pieces of equipment are used to portion food, such as:

- a scoop for mashed potato and ice cream
- an individual pie dish for lasagne or shepherd's pie
- individual ramekin dishes for brûlées, mousses and pâtés
- stacking food on plates to add extra shape.

Tips

Faults relating to general practical skills could be tested on the written paper.

What can go wrong with general practical skills?

It is important to avoid making mistakes to ensure that what you make in practical lessons is successful. If your dish does not turn out as expected there will be a reason for it which can usually be resolved or avoided in the future.

Mistake	How to resolve it
Ingredients were not weighed correctly	Follow the quantities stated in the recipe and use accurate weighing scales
Liquid was not measured correctly	Follow the quantities stated in the recipe and use a measuring jug, spoons or cups
The dish was bland (had very little flavour)	Too little seasoning was added; taste test the food and add more seasoning as necessary
The dish was salty/too spicy	Too much seasoning was addedw; add a little seasoning to begin with, then taste test towards the end of cooking and adjust the flavour if necessary
Baked dishes have stuck to the tin	Make sure the tins are greased enough or lined properly with baking paper

2.1 Macronutrients

Introduction to nutrients

Food gives our bodies materials to:

- help us grow from a baby to an adult
- repair and replace parts of the body that become damaged or worn out
- protect us from illness
- work properly, including being able to move, keep warm, think, digest food and get rid of waste products.

The materials we need are found in natural (unprocessed) foods, and some of them are called **nutrients**. **Nutrition** is the study of nutrients. There are many nutrients, and they each have certain **functions** in the body. If we eat a variety of different natural foods, we will give our bodies a wide range of nutrients.

There are also many other materials (apart from nutrients) that are naturally present in foods (especially plant foods) that are important for our bodies, for example fibre (see Section 2.1.3) and antioxidants (see Section 2.2.1). These work together with nutrients to keep the body strong and healthy.

The rest of this section teaches you about the different nutrients, what can happen if there is too much (**excess**) or too little (**deficiency**) of certain foods and nutrients in a **diet**. Although each nutrient will be studied separately to make it easier for you to learn about them, it is important to remember that all the nutrients work together in the body.

Key terms

Food: a liquid or solid substance that contains nutrients and other materials needed by the body

Nutrient: a natural substance found in foods that has a specific function in the body

Nutrition: the study of what people eat and how all the natural materials in foods (including nutrients) work together in the body to enable it to grow, stay healthy and work properly

Function: the job or jobs that a nutrient does in the body

Excess: eating more of a particular nutrient than the body needs

Deficiency: eating less of a particular nutrient than the body needs

Diet: the food that you eat every day

2.1.1 Protein

What will I learn?

In this section you will learn about:

- the definition of protein
- why proteins are important
- the functions of protein in the body
- the main sources of protein in the diet
- the effects of a deficiency (too little) or an excess (too much) of protein in the diet
- the amount of protein needed every day for different life stages.

What is protein?

Protein is a **macronutrient** that is needed by all animals, including humans.

Protein molecules are made up of individual 'building blocks' called **amino acids**. There are at least 20 different amino acids and they can be found in any number or combination in different proteins.

When we eat foods containing proteins, our body breaks up (**digests**) the protein molecules into individual amino acids and makes new protein molecules for our body to use.

Why are proteins important?

Some amino acids cannot be made in the body and have to come ready-made from the foods we eat. These are called **essential amino acids**, and there are eight of these needed by adults and children, and at least two extra ones needed just by children because they are growing.

Protein foods that contain all of the essential amino acids are called **high biological value (HBV) proteins**. This means that they are of great value to the body because it does not have to make these amino acids from the food we eat.

Protein foods that are missing one or more of the essential amino acids are called **low biological value (LBV) proteins**. If you eat a mixture of LBV proteins together, the essential amino acids that are missing in one will be provided by another LBV protein, so you will get all the amino acids you need. This is called **protein complementation**.

Functions of protein in the body

Protein has three main functions (jobs) in the body:

1. To make the body grow from a baby into an adult and, when it has stopped growing, to make certain parts of the body continue to grow (e.g. hair, finger nails and toe nails).
2. To repair the body when it is injured or recovering from an operation or illness, and replace certain parts of the body regularly, such as skin cells and red blood cells.
3. To give the body energy, although the body prefers to get most of its energy from foods containing carbohydrates and fats, rather than protein.

Also, many important natural substances in the body are made from proteins, including:

- **hormones** which make you grow and reproduce
- **enzymes** which digest your food
- **antibodies** which help your immune system fight infections from bacteria and viruses.

Main sources of protein in the diet

Protein is found in animal foods including meat, fish, poultry, milk, cheese and eggs, and in plant foods including beans, peas, lentils, nuts and cereals.

Key terms

Macronutrient: a nutrient that is needed by the body in relatively large amounts. Protein, fat and carbohydrate are all macronutrients

Amino acids: the 'building blocks' that join together to make protein molecules

Essential amino acids: amino acids that the body cannot make by itself and must get ready-made from food

Biological value: the number of essential amino acids that a protein food contains

Protein complementation: eating different LBV protein foods together in order to get all the essential amino acids that the body needs

Source: a food that contains nutrients. Rich sources contain a lot of the nutrient and poor sources contain only small amounts

High biological value protein

Main sources
Meat, poultry, fish, shellfish, eggs, milk, dairy foods (e.g. cheese, yogurt, quark, fromage frais), soya beans, quinoa


Meat


Eggs


Dairy foods


Quinoa


Soya beans


Fish

Low biological value protein

Main sources
Lentils, peas, beans (except soya beans), cereals (e.g. wheat, rice, oats, barley, rye, millet, sorghum), nuts, seeds, gelatine


Nuts


Seeds


Cereals


Beans and lentils


Sorghum


Gelatine sheets and powder

Protein alternatives

- Protein alternatives are manufactured products that are used as alternatives to meat.
- They all have a high protein content and often a low fat content.
- They have little flavour on their own, but readily take up other flavours.
- These proteins are often consumed by vegetarians and are used in a wide range of recipes in place of meat or fish.


Tofu (soya bean curd) – made from treated soya milk, sold as soft (silken), firm or smoked


Tempeh – made from fermented whole soya beans


Mycoprotein (e.g. Quorn) – made from a high protein fungus (myco = fungus), sold as chunks, fillets or mince


TVP (textured vegetable protein) – made from soya bean flour (after the soya oil has been removed), sold as chunks or mince

Examples of protein complementation

Beans on toast

Rice and bean salad

Vegetarian tortilla wraps

Lentil soup

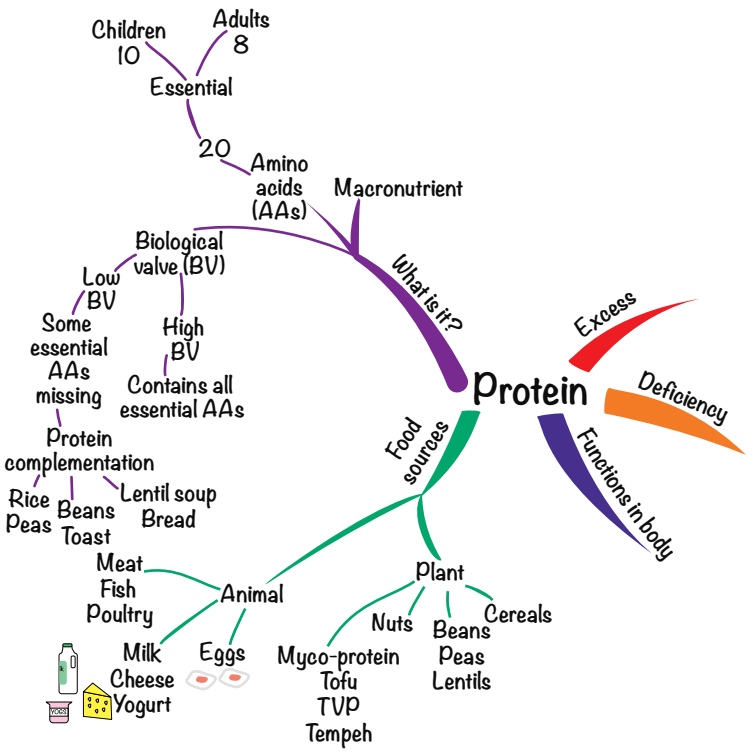
Nut butter on bread

Fried noodle with tofu

Tips

- To help you learn and revise the information about nutrients, you could try creating a mind map.
- Here is an incomplete example of a mind map for protein, for you to finish as practice.
- It uses colour to separate the different sections of the information and just a few words or numbers to help prompt your memory.
- You could also use simple pictures if that helps you to remember the information (some examples are shown).

Activity



Copy and complete this mind map for proteins.

Effects of a deficiency of protein in the diet

Children and adults need protein for many jobs in the body, so if their diet is deficient in protein, they will show a range of symptoms (signs) as shown in the table below.

Effect	Why does this happen?
Children will not grow properly and may never reach their full height	The body cannot grow to the height it is meant to be without the right quality and quantity of 'materials' (nutrients) that it needs, including protein
Some hair may be lost	Hair is made of protein. People can live without hair, so if there is a deficiency of protein, the body will use any protein it does get for something more important.
Skin and nails will be in poor condition	Skin and nails contain protein and if there is a deficiency of protein, they will not be maintained properly and will weaken
Infections will develop easily	Protein is needed for the immune system to protect us from infections. If there is a deficiency of protein, the immune system will weaken and infections will take hold
Unable to digest food properly	A deficiency of protein causes changes in the digestive system, which means various nutrients cannot be absorbed into the body

Deficiencies are rare in high-income countries like the UK but are seen in children from low-income places where often they do not have enough to eat. Extreme protein deficiency in children results in a condition called kwashiorkor where the body retains fluid and swells around the abdomen.

Effects of an excess of protein in the diet

Protein contains different chemical elements, including nitrogen. Too much nitrogen in the body is dangerous, so it is removed from the body in the urine, which is excreted.

If the diet contains too much protein, the liver and kidneys have to work harder to get rid of the nitrogen. This puts them under stress and could cause them to be harmed.

Daily amount of protein needed for different life stages

The table below shows the average amount of protein needed by different groups of (healthy) people every day.

Age/sex		Grams of protein per day
Children	1–3 years	14.5 g
	4–6 years	19.7 g
	7–10 years	28.3 g
Teenagers (male)	11–14 years	42.1 g
Teenagers (female)	11–14 years	41.2 g
Teenagers (male)	15–18 years	55.2 g
Teenagers (female)	15–18 years	45.0 g
Adults (male)	19–50 years	55.5 g
Adults (female)	19–50 years	45.0 g
Adults (male)	50+ years	53.3 g
Adults (female)	50+ years	46.5 g
During pregnancy		an extra 6 g
During lactation (breastfeeding) for up to 4 months		an extra 11 g
During lactation (breastfeeding) for over 4 months		an extra 8 g

The figures given for the amount of nutrients needed to maintain good health in the majority of people in the population are called **dietary reference values** (DRVs).

The recipe below shows how HBV protein can be included in a main meal.

Key term

Dietary reference values: figures that show the recommended amounts of different nutrients that are needed by the majority of (healthy) people in the population every day

Recipe: Fish pie

Ingredients

(serves 6 people)

Topping:
700 g potatoes
60 g butter or vegetable fat spread
50 ml milk
Seasoning
30 g grated Cheddar cheese
1 tomato – sliced (optional)

Fish:
500 g haddock or other white fish (e.g. pollock, whiting, hake, cod)
100 g peas or sweetcorn
A small bunch dill (optional)
Béchamel sauce:
50 g unsalted butter or vegetable fat spread
50 g plain flour
550 ml milk

Variations

Try using other vegetables instead of or mixed with the potato (e.g. carrot, sweet potato, butternut squash, parsnip, swede, turnip, yam).

To save time and money, canned fish (e.g. tuna) can be used instead of fresh fish. As canned fish is already cooked, you just need to drain the oil or water from it, break it up with a fork and add it to your dish with the peas or sweetcorn, then add the sauce and complete the recipe as shown.

Storage instructions

Fridge: allow to cool then cover and store in the fridge (0 °C to below 5 °C) for up to 3 days. Reheat only **once** until at least 70 °C ('piping hot').

Freezer: allow to cool then chill in fridge. Place in a suitable container or cover carefully with suitably strong foil or plastic and freeze for up to 3 months.

Method

Potato topping:

1. Peel and chop the potatoes into small chunks.
2. Place in a pan of cold water, bring it to the boil and gently boil for 15–20 minutes until the potatoes are soft.
3. Drain the water away and mash the potatoes with the butter/vegetable fat spread and 50 ml of milk until they are smooth.
4. Season with salt and pepper.

Fish:

1. While the potatoes are boiling, prepare the fish.
2. Wash the fish in cold water and place it on some greaseproof or baking paper inside a steamer pan.
3. Carefully place the steamer over a pan of gently boiling water and put the lid on the steamer.
4. Do not let the water in the steamer completely evaporate.
5. Steam the fish until it breaks up easily and comes away easily from its skin (about 10–15 minutes depending on the thickness of the fish).

   If you do not have a steamer, there are two other ways you can cook the fish:
   - **a** Make a kitchen foil casing, put the fish in it, seal it up and bake it in the oven (Gas 4/180 °C; 170 °C if you are using a fan oven) for 15–20 minutes.
   - **b** Poach the fish in the milk in a pan for a few minutes until it is cooked.
6. Carefully remove the fish and place it on a board or plate. Break the fish into small pieces with a knife and fork and remove any skin. Check carefully and remove any bones.

Sauce:

Either:

***All-in-one microwave method*:**

1. Put the flour in a mixing bowl.
2. Gradually add the milk, mixing it with a wooden spoon or balloon whisk to make it smooth.
3. Add the butter.
4. Place the bowl into the microwave oven and set the timer to 1 minute.
5. When it stops, stir the sauce thoroughly and microwave again for 1 minute – stir the sauce again.
6. Repeat this 4–5 times until the sauce has thickened and is smooth and glossy.
7. Take it out of the microwave.

Or:

***Béchamel (roux) method*:**

1. In a small saucepan, melt the butter on the hob – do not let it burn.
2. Add the flour and continue heating it, stirring the roux all the time with a wooden spoon for 1 minute.
3. Remove the pan from the heat.
4. Gradually add the milk to the roux, stirring well each time to avoid any lumps forming, until all the milk has been added.
5. Put the pan back on the heat and, stirring all the time, heat the sauce until it boils and thickens – the sauce should coat the back of the wooden spoon and be smooth and glossy in appearance.
6. Remove the pan from the heat.

Assemble and finish the fish pie:

1. Preheat the oven to 190 °C, set grill on high. Mix the peas or sweetcorn into the sauce. If they are fresh (i.e. not canned or frozen) they will need to be boiled in water for about 5 minutes until tender before they are added to the sauce.
2. Chop the dill leaves with either kitchen scissors or a knife.
3. Place the fish in the bottom of an ovenproof dish.
4. Scatter the dill leaves over the fish.
5. Pour the sauce over the fish and mix gently with a fork.

6 Spread the mashed potato evenly over the fish and sauce. You could use a piping bag and star nozzle to pipe the potato on to give a different finish.
7 If you are using a tomato, slice it thinly and arrange the slices neatly on top of the potato.
8 Sprinkle the top with the grated cheese.

Either: Place the pie in the oven (Gas 5/190°C; 180°C if you are using a fan oven) for approximately 20 minutes until the top is browned.

Or: Place the pie under a hot grill for a few minutes until the top is golden brown.

Which nutrients does this recipe contain?

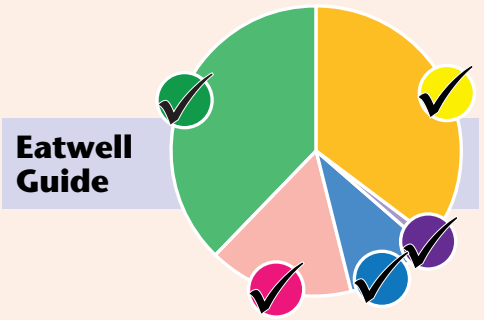
Ingredient	Macronutrients	
	Protein	
	Fish, milk, cheese	HBV
	Peas, sweetcorn, flour	LBV
	Fat	
	Butter, cheese	
	Carbohydrate	
	Flour, potatoes	Starch
	Onion	Sugars (fruit sugar)
	Peas, sweetcorn, tomato	Dietary fibre

Ingredient	Micronutrients	
	Vitamins	
	Tomato	Vitamin A: *Beta carotene*
	Milk, cheese, butter	Vitamin A: *Retinol*
	Milk, cheese, peas	Vitamin B: *Thiamin B1*
	Milk, cheese	Vitamin B: *Riboflavin B2*
	Milk, flour	Vitamin B: *Niacin B3*
	Milk, cheese, peas	Vitamin B: *Folic acid B9*
	Milk, cheese, fish	Vitamin B: B12
	Tomato (a little)	Vitamin C
	Milk, cheese, butter	Vitamin D
	Milk, cheese, butter	Vitamin E
	Cheese	Vitamin K
	Minerals	
	Milk, cheese, fish	Calcium
	Fish	Fluoride
	Milk, cheese, fish	Iodine
	Flour	Iron
	Cheese	Sodium
	All ingredients	Phosphorus

Which cooking methods and practical skills does this recipe use?

Cooking methods
Boiling vegetables
Bake or steam fish
Microwave option for sauce
Bake or grill fish pie

Practical skills
Béchamel sauce
Fish preparation
Knife skills – vegetables and fish
Piping option for mashed potato



What is the science behind this recipe?

Gelatinisation of starch for béchamel sauce and cooking of boiled potatoes.
Denaturation and coagulation of protein in fish.
Melting of fat in cheese, and denaturation and coagulation of protein.

Heat transfer	
Convection	Heating oven to bake fish and complete fish pie Boiling potatoes Steaming of fish
Conduction	Heat passing through the foil to bake the fish and the baking dish into the completed fish pie
Radiation	Grilling option for completed fish pie Microwave option for béchamel sauce making

Extension activity

How could this recipe be modified ...	... for a vegetarian (does not eat fish)? ... for someone with coeliac disease? ... for someone who is lactose intolerant? ... to increase the fibre content? ... to reduce the fat content?
What variations could you make to ...	... the sauce? ... the potato topping? ... the type of fish?
What would you serve with the fish pie?	

2.1.2 Fats

What will I learn?

In this section you will learn about:

- the definition of fat
- the functions of fat in the body
- the main sources of fat in the diet
- the effects of a deficiency (too little) or an excess (too much) of fat in the diet
- the amount of fat needed every day for different life stages.

Key terms

Fat: macronutrient that supplies the body with energy

Oils: fats that are liquid at room temperature

Triglyceride: fat molecule

What is fat?

Fat is a macronutrient that is needed by all animals.

Fats are **solid** at room temperature.

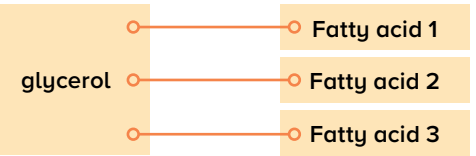
Fats are called **oils** when they are liquid at room temperature.

Fats and oils have the same basic chemical structure and provide the same amount of energy (9 kcals per gram).

Chemical structure of fats

The basic chemical structure of a fat/oil is shown below.

Fat molecules are made of one unit of glycerol and three fatty acids, like this:



This molecule is called a **triglyceride**.

Fatty acids are made up of carbon and hydrogen atoms. They are either full up (saturated) or not full up (unsaturated) with hydrogen atoms. **Unsaturated fatty acids** have spaces where more hydrogen atoms can fit in. If an unsaturated fatty acid has one space, it is called **monounsaturated**; if it has more than one space, it is called **polyunsaturated**.

Foods with a lot of **saturated fatty acids** in them are often called **saturated fats**. They include butter, lard, suet, block vegetable fat, ghee, the fat in meat, palm oil, coconut and chocolate.

Foods with a lot of unsaturated fatty acids in them are called unsaturated fats or polyunsaturates. They include plant oils such as olive, rapeseed, sunflower and corn; oily fish, avocado pears, nuts, seeds and some vegetable fat spreads.

Liquid vegetable oils can be turned into solid vegetable fats in a factory by adding hydrogen to fill in the spaces in the unsaturated fatty acids. This process is called **hydrogenation**. You may see the words 'hydrogenated fat' on food ingredient labels.

Essential fatty acids

When we eat foods containing fat, our body breaks up (digests) the fat molecules they contain and makes new fatty acids and fat molecules for our body to use. Two fatty acids cannot be made in the body and must come ready-made from the foods we eat. These are called essential fatty acids and are needed by adults and children. They are mainly found in oily fish, plant and seed oils, eggs and fresh meat.

Functions of fat in the body

Fat has four main functions in the body:

- To provide a store of energy in the adipose tissue under the skin.
- To insulate the body from the cold and help it to stay warm.
- To protect bones and the kidneys from damage by providing them with a protective cushion of fat.
- To give the body fat-soluble vitamins A, D, E and K (see Section 2.2.1).

Main sources of fat in the diet

When we talk about the nutritional aspects of fat, it is called 'fat'. You also sometimes see the word 'lipid', which also means fat. In food preparation, it is called either 'fat' or 'oil'.

Fat found in foods is either solid fat or liquid oil. Some of these are easy to see (e.g. the fat on a piece of meat or the oil in a can of tuna). These are called **visible fats and oils**.

In many foods, however, it is difficult to see the fats and oils they contain because they are mixed with other ingredients in the food, and therefore it is not easy to know how much fat and oil you are eating. These are called **invisible fats and oils** and are found in foods such as cakes, pastries, potato crisps, biscuits, chocolate, nuts, etc.

Key terms

Fatty acids: parts of a fat molecule

Unsaturated fatty acids: fatty acids found mainly in liquid oils

Monounsaturated fatty acid: fatty acid found in solid fats and liquid oils

Saturated fatty acids: fatty acids found mainly in solid fats

Hydrogenation: the process that turns liquid oils into solid fats

Visible fats and oils: fats in a food that you can see (e.g. fat on meat)

Invisible fats and oils: fats in a food that you cannot see (e.g. butter in pastry)

Tips

Remember:

- Fats and oils have the same basic chemical structure and the same energy value.
- The difference is whether they are solid or liquid at room temperature.

Types of fat

Solid animal fats

Main sources
Visible animal fats: butter, lard, suet, ghee, fat on meat.

Foods containing *invisible* animal fats:
- cheese
- butter in cakes, biscuits and pastries
- meat products (e.g. sausages, corned beef, salami)
- meat (in between muscle cells)
- many processed ready meals and takeaway foods.




Solid plant fats

Main sources
Visible plant fats: white vegetable fats, vegetable fat spreads (previously known as margarines), coconut cream, cocoa butter.

Foods containing *invisible* plant fats:
- many processed foods (ready-made curries, ready meals and fast foods that have been fried in hydrogenated vegetable fat (solid fat that has been made in a factory from vegetable oils), e.g. fried chicken, fish and chips)
- chocolate (including white chocolate)
- pastries, cakes, biscuits, doughnuts and breads made with hydrogenated white vegetable fats and vegetable fat spreads.

Liquid animal oils

Main sources
Visible animal oils: cod liver oil (capsules), oily fish (e.g. mackerel, sardines).

Foods containing *invisible* animal oils:
- milk, cream
- egg yolk
- oily fish (e.g. sardines, salmon, herring).




Liquid plant oils

Main sources
Visible plant oils: nut and seed oils (e.g. sunflower, rapeseed, sesame, corn, olive, almond).

Foods containing *invisible* plant oils:
- seeds, e.g. pumpkin, sunflower, sesame, groundnuts (peanuts)
- nuts, e.g. walnuts, almonds, pecans, cashews
- fruits, e.g. olives, avocado pears
- vegetable fat spreads, blended butter spreads
- fried foods, e.g. doughnuts, chips, chicken nuggets
- many processed foods, ready meals and takeaway foods (e.g. curries, ice cream, salad dressings, sauces, dips such as hummus).

Effects of a deficiency of fat in the diet

A deficiency of fat is rare in the UK.

Effects	Why does this happen?
If carbohydrate intake is also reduced, body weight will be lost	The body will use its store of energy from fat cells and these will not be replaced
The body chills quickly	There will not be enough fat to insulate the body from the cold
The body bruises easily and the bones hurt if they are knocked	There will not be a thick enough cushion of fat (adipose tissue) to prevent damage to blood vessels and bones
The body will not receive enough vitamins A, D, E or K	These vitamins are found in foods that contain fat

Effects of excess fat in the diet

- Fat provides the body with energy (9 kcals per gram).
- Foods that contain fat are therefore **energy dense** (see Section 2.3.2).
- If the energy from fat eaten in foods every day is not all used in physical activity, it will be stored by the body under the skin in adipose tissue and elsewhere in the body (e.g. around the intestines (visceral fat)). Consequently, the body will gain weight and could become obese (see Section 2.3.4).
- Eating a lot of foods that contain high levels of **saturated fatty acids** has been linked to the development of **coronary heart disease (CHD)** in some people (see Section 2.3.4).

Key term

Trans fatty acids: formed when liquid oils are turned into solid fats during hydrogenation

Amount of fat needed every day for different life stages

The amount of fat we need is calculated as a **percentage of our total daily energy** intake, rather than by weight. The amount of fat recommended by health experts for different groups of (healthy) adults every day is shown in the table below.

Type of fat	% of food energy per day
Total fat, of which	**No more than 35%**
Saturated fatty acids	11%
Monounsaturated fatty acids	13%
Polyunsaturated fatty acids	6.5%
Trans fatty acids	No more than 2%

Trans fatty acids are formed in processed foods during hydrogenation when oils are turned into solid fats. They have been linked to an increasing risk of developing heart disease in humans.

Tips

To help you to understand which foods contain fat, have a look at a variety of ingredients lists on different food labels and see if you can identify the visible and invisible fats and oils they contain. Remember that the words 'lipid' and 'triglyceride' are sometimes used instead of the word 'fat'.

Many foods contain invisible fat and are energy dense

Recipe: Roasted Mediterranean vegetable flan

Ingredients

(serves 6–8 people)

Pastry:
150 g plain wholemeal flour, or white flour or half and half (75 g of each)
75 g vegetable fat spread (solid block, not soft in a tub)
8 tsp (40 ml) cold water
Filling:
1 pepper
1 courgette
1 small onion
1 tomato or 2 medium mushrooms
2 tbsp olive oil
1 clove garlic
A few basil leaves (optional)
2 medium eggs
150 ml milk
100 g mature Cheddar cheese, grated
Ground black pepper

This recipe contains a variety of visible and invisible fats and oils.

You will need a 23–25 cm ovenproof flan tin or dish.

Variations

Try varying the vegetables that you use.

Try different cheeses (e.g. a blue veined cheese such as Stilton, or Red Leicester).

To lower the fat content, you could use reduced fat Cheddar cheese and semi-skimmed, skimmed or 1% milk.

Storage instructions

Fridge: When cooled, store in the fridge for up to 5 days.

Freezer: The flan can be frozen, once it has cooled, for up to 4 months.

Method

1 Heat the oven to Gas 6/200°C (190°C if you are using a fan oven).

Roasted vegetables:

2 Wash and dice the onion, pepper, courgette, tomato and mushrooms all to the same size.

3 Mix the vegetables in a bowl with the olive oil, crushed garlic and ½ tsp black pepper.

4 Arrange the vegetables on a baking tray and roast them in the oven for 25–30 minutes until lightly browned and tender. Half way through the cooking time, stir them around with a wooden spoon to ensure that they cook evenly.

5 While the vegetables are cooking, make the pastry.

Pastry:

6 Rub the vegetable block fat into the flour, using your fingertips, until it looks like breadcrumbs.

7 Add the water and mix to a dough. If you are short of time, this could be made in the food processor.
8 Lightly knead the dough with your fingertips until it is smooth, then roll it out on a floured work surface and line the flan tin or dish, taking care not to stretch the pastry.
9 If you have time, give the pastry time to rest in the fridge for 15 minutes to allow the gluten molecules to relax, which will reduce the risk of the pastry shrinking in the oven.
10 Put some baking paper in the flan case and add some baking beans to hold it down. Bake the pastry case 'blind' (without the filling) for 15 minutes. It should be cooked and crisp.

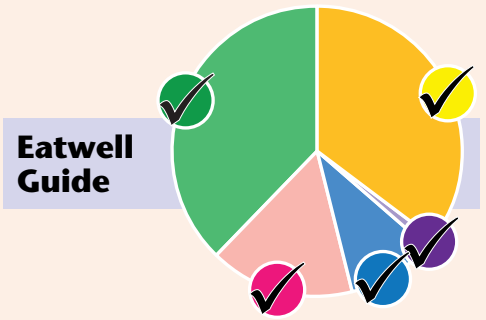
11 Carefully remove the baking beans and paper. If the base of the flan looks undercooked, return it to the oven for a further 5 minutes.
12 Turn the oven down to Gas 5/190 °C (180 °C if you are using a fan oven).

13 Place the flan tin/dish on a baking tray.
14 Place half of the grated cheese in the cooked pastry case.
15 Place the roasted vegetables on top of the grated cheese and add the roughly chopped basil leaves.
16 Mix the eggs and milk together and pour them over the vegetables.
17 Add the rest of the cheese and bake the flan for 25 minutes until the filling has set and the top is a golden brown colour.
18 Serve warm or cold with a fresh, crisp **salad.**

Which nutrients does this recipe contain?

Ingredient	Macronutrients	
	Protein	
	Eggs, milk, cheese	HBV
	Wheat flour	LBV
	Fat	
	Butter/vegetable fat spread, cheese, eggs, milk, olive oil	
	Carbohydrate	
	Wheat flour	Starch
	Vegetables, milk	Sugars (fruit sugar)
	Whole wheat flour, vegetables	Dietary fibre

Ingredient	Micronutrients	
	Vitamins	
	Vegetables	Vitamin A: *Beta carotene*
	Milk, cheese, butter, vegetable fat spread	Vitamin A: *Retinol*
	Milk, cheese, eggs, flour, vegetables	Vitamin B: *Thiamin B1*
	Milk, eggs, cheese	Vitamin B: *Riboflavin B2*
	Milk, flour	Vitamin B: *Niacin B3*
	Wheat flour, cheese, eggs	Vitamin B: *Folic acid B9*
	Milk, eggs, cheese	Vitamin B: B12
	Peppers	Vitamin C
	Butter/vegetable fat spread, cheese, eggs	Vitamin D
	Vegetable fat spread, cheese, eggs, olive oil, whole wheat flour	Vitamin E
	Cheese	Vitamin K
	Minerals	
	Milk, cheese, vegetables	Calcium
	–	Fluoride
	Vegetables	Iodine
	Whole wheat flour, eggs, vegetables	Iron
	All ingredients	Phosphorus
	Cheese	Sodium



Which cooking methods and practical skills does this recipe use?

Cooking methods
Roasting
Baking
Baking blind

Practical skills
Shortcrust pastry making
Lining a flan tin/dish
Vegetable preparation/knife skills

What is the science behind this recipe?

Shortening: rubbing the fat into the flour when making the pastry gives the gluten a waterproof coating, so when the water is added, the gluten is prevented from forming long strands in the pastry – it can only make short strands. This gives the pastry a tender, 'short' texture.

Roasted vegetables: as the vegetables cook in the oven, the water they contain is driven out by the heat, which concentrates their flavour and makes them shrink. The fruit sugars in the onion will start to caramelise and change their colour to brown. The starch granules will swell and cause the vegetables to soften.

Coagulation: the filling will set in the oven because the protein in the eggs, milk and cheese will coagulate.

Dextrinisation: this will also occur as the starch changes in the heat.

Heat transfer	
Convection	Heating oven to roast the vegetables
Conduction	Heating the roasting tray and then the vegetables Baking the pastry case and the flan

Extension activity

How could this recipe be modified ...	... for someone on a low-fat diet? ... for someone with coeliac disease? ... for someone who is lactose intolerant?
What variations could you make to ...	... the filling? ... the pastry?

2.1.3 Carbohydrates

What will I learn?

In this section you will learn about:

- the definition of carbohydrate
- the functions of carbohydrate in the body
- the main sources of carbohydrate in the diet
- the effects of a deficiency (too little) or an excess (too much) of carbohydrate in the diet
- the amount of carbohydrate needed every day for different life stages.

What is carbohydrate?

Carbohydrate is a macronutrient that is needed by all animals. It is made by green plants during a process called **photosynthesis**.

Functions of carbohydrate in the body

Carbohydrate has two main functions in the body:

- To give the body energy: carbohydrates are the main source of energy in our diet.
- To help the body get rid of waste products: dietary fibre is a type of carbohydrate that helps us to produce soft, bulky faeces (solid waste), which are easy to pass out of our body when we go to the toilet.

Main sources of carbohydrate in the diet

There are two groups of carbohydrates: **sugars** and **complex carbohydrates**.

Sugars

Sugars are a group of carbohydrates that taste sweet. Plants produce two different types of sugars during photosynthesis:

- **Monosaccharides**, which are made of one sugar molecule. There are three monosaccharides: **glucose**, **galactose** and **fructose** (fructose used to be called 'fruit sugar' because it is found in many fruits).
- **Disaccharides**, which are made of two sugar molecules joined together. There are three disaccharides: **sucrose**, **lactose** and **maltose**.

Complex carbohydrates

Complex carbohydrates do not taste sweet. Plants produce several types of complex carbohydrates during photosynthesis. They are called **polysaccharides**. Polysaccharides include **starch**, **pectin**, **dextrin** and **dietary fibre**.

Animals (including humans) make a polysaccharide called **glycogen** in their bodies from the carbohydrates they eat.

Type of carbohydrate – sugars: Monosaccharides

Main sources

Glucose: ripe fruits and vegetables (e.g. apples, onions, beetroot, parsnip, sweet potato). Also available in drinks, tablets and powders.

Fructose: fruits, vegetables and honey. High fructose corn syrup (HFCS) is used as a sweetener in many processed foods and carbonated soft drinks.

Galactose: milk from mammals.

Glucose

Fructose

Galactose

Key terms

Photosynthesis: the process where green plants trap energy from the sun and make carbohydrates

Sugars: group of carbohydrates that taste sweet

Monosaccharides: group of sugars that are made of one sugar molecule

Disaccharides: group of sugars that are made of two sugar molecules

Polysaccharides (complex carbohydrates): group of carbohydrates that are made from many sugar molecules joined together, but do not taste sweet

Type of carbohydrate – sugars: Disaccharides

Main sources

Maltose: cereals such as barley, also available as a syrup (malt extract), added to commercially made breakfast cereals, biscuits, hot drink powders, confectionery.

Sucrose: extracted from sugar cane and sugar beet and used in cooking and many processed foods, drinks and confectionery. Commonly known as 'sugar' (e.g. caster, granulated, brown, demerara, icing and golden syrup).

Lactose: milk from mammals and products made from it (e.g. yogurt, evaporated milk, cheese).

Maltose

Sucrose

Lactose

Type of carbohydrate – Complex carbohydrates: Polysaccharides

Main sources

Starch: cereals (e.g. wheat, rice, oats, barley, maize [corn]) and cereal products (e.g. breakfast cereals, pasta, bread, cakes, pastry, biscuits); starchy vegetables (e.g. potatoes, yams, sweet potatoes, parsnip, pumpkin, butternut squash, peas, beans, lentils); seeds, quinoa.

Dietary fibre: There are two types:

- Soluble fibre helps to reduce blood cholesterol and glucose levels by slowing down the digestion and absorption of carbohydrates. It is found in oats, nuts, fruits such as apples, plums, apricots, pears and prunes, vegetables such as carrots, broccoli, potatoes, peas, beans and lentils.
- Insoluble fibre absorbs water in the intestines, making the faeces soft, bulky and easy to pass. It is found in wholegrain cereals and cereal products, such as breakfast cereals, bread, rice, pasta; seeds, nuts, fruit and vegetable skins, stalks, leaves and peel.

Pectin: some fruits (e.g. oranges, citrus fruit peel (lemons, oranges, limes), apples, apricots, plums, greengages) and some root vegetables (e.g. carrots).

Dextrin: formed when starchy foods (e.g. bread, cakes, biscuits) are baked or toasted. Commercially prepared dextrins are used as thickening agents in salad dressings and sauces.

Starch

Pectin

Dextrin

Dietary fibre

Effects of a deficiency of carbohydrate in the diet

A deficiency of carbohydrates is rare in high-income places. The following table shows the effects of a deficiency in carbohydrate.

Effects	Why does this happen?
Lack of energy/tiredness (fatigue)	If insufficient carbohydrate has been eaten, the level of glucose in the blood (the blood sugar level) will drop and the cells in the body will not have enough energy.
Weight loss	If this situation continues, the body will start to use the energy stored in its fat cells (adipose tissue [fat stored under the skin] and visceral fat [fat stored inside the body, e.g. around the intestines]) so the person will lose weight over a period of time.
Severe weakness	The body must make sure that the brain and vital organs receive energy from glucose, so once all the fat stores are used up, the body will start to break down the protein that makes up muscles in order to obtain energy.
Constipation and intestinal diseases such as diverticular disease and colon cancer	Dietary fibre helps the body to get rid of solid waste products (faeces). Too little dietary fibre in the diet results in the faeces becoming hard and dry and difficult to pass out of the body.

Effects of an excess of carbohydrate in the diet

- If the diet contains more carbohydrate (and therefore more energy) than the body needs and uses, some of it will be converted into fat and stored in the body. This could lead to obesity if the surplus stored energy is not used up in physical activity.
- Refined and processed carbohydrate foods (e.g. sugar and sugary foods, sweetened soft drinks, white bread, biscuits, potatoes, white rice) are quickly broken down and absorbed in the body. This causes a rapid rise in the level of sugar in the blood. If the diet contains lots of these types of foods and drinks and they are eaten frequently throughout the day, over a period of time, this will put stress on the pancreas, an organ in the body that produces a hormone called insulin. Insulin allows glucose to enter body cells so that they can use it to produce energy. Eventually the pancreas may stop working properly or the cells will become resistant to the insulin (unable to let the glucose into the cells) and the person may develop Type 2 diabetes (see Section 2.3.4).
- Eating certain types of sugars (and the acids found in fizzy soft drinks and other foods) frequently throughout the day can lead to tooth decay. Sugars that have been released from foods, such as fruit, during food processing (e.g. in fruit juices (especially concentrated juices)) or added to foods by manufacturers, cooks and consumers to sweeten them (e.g. the sugar used in cooking, honey, syrups and unsweetened fruit juices) are the most likely to cause tooth decay (see Section 2.3.4). These sugars are called **free sugars**.
- Sugars that are found naturally in foods such as apples, plums, carrots, onions and milk are less likely to cause tooth decay. These sugars are called **fruit sugars**.

Tips

There are many types of sugars that you are probably not aware of when buying food. When looking at the ingredients lists, an ingredient ending in 'ose' (e.g. maltose) is usually a sugar.

Free sugars can cause tooth decay

Amount of carbohydrate needed every day for different life stages

The average amount of carbohydrate we need is calculated as a percentage of our total daily energy intake, rather than by weight (except for dietary fibre/NSP). The energy value of carbohydrate is: 1 g of pure carbohydrate provides 3.75 kcals of energy. This is the amount of carbohydrate recommended by health experts for different groups of (healthy) people from age 2 years upwards every day:

Type of carbohydrate	% of food energy per day
Total carbohydrate: *most of which* should come from starch and fruit sugars	50%
Free sugars (sugar added to foods and drinks by manufacturers, cooks and consumers to sweeten them during processing; and sugars in honeys, syrups and unsweetened fruit juices)	***No more than 5% of total carbohydrate intake.** This means: ● no more than 19 g/day (approximately 4 teaspoons) of free sugars for children aged 4–6 ● no more than 24 g/day (approximately 5 teaspoons) for 7–10 year-olds ● no more than 30 g/day (approximately 6 teaspoons) for children from age 11 and adults.
Dietary fibre	***Adults at least 30 g each day** ***Children:** 2–5 years: 15 g each day 5–11 years: 20 g each day 11–16 years: 25 g each day 16–18 years: 30 g each day

* These are the recommendations of the Scientific Advisory Committee on Nutrition (SACN) in their report published in 2015.

Tips

The Scientific Advisory Committee on Nutrition Report (2015) contains recommendations for carbohydrates: **www.gov.uk/government/publications/sacn-carbohydrates-and-health-report**

Recipe: Courgette, onion and cheese muffins

Ingredients

(serves 12 people)

225 g self-raising flour (wholemeal or white)
50 ml oil
175 ml semi-skimmed milk
1 egg
100 g Cheddar cheese
1 small courgette (skin left on)
1 small onion
Black pepper

This recipe contains a variety of carbohydrates.

You will also need:
- 12 muffin cases
- muffin tin.

Storage instructions

Allow to cool, then place in an airtight tin or plastic box for up to 3–5 days.

Method

1. Preheat the oven to Gas 6/200 °C (190 °C if you are using a fan oven).
2. Peel and finely chop the onion.
3. Wash then cut off the ends of the courgette and grate it into a mixing bowl with the cheese and the onion.
4. Add the flour, oil, milk and beaten egg and season with ground black pepper.
5. Mix the ingredients together with a spoon to form a batter.
6. Divide the batter equally between the muffin cases using two spoons.
7. Bake for 20 minutes, until well risen and golden brown in colour.
8. Serve warm or cold. Could be served with soup or stews.

Which nutrients does this recipe contain?

Ingredient	Macronutrients	
	Protein	
	Egg, milk, cheese	HBV
	Flour	LBV
	Fat	
	Oil, egg yolk, cheese, milk (a little)	
	Carbohydrate	
	Flour, onion, courgette	Starch
	Onion, courgette, milk, cheese	Sugars (fruit sugar)
	Onion, courgette, wholemeal flour if used	Dietary fibre

Ingredient	Micronutrients	
	Vitamins	
	Courgette, egg yolk, milk	Vitamin A: *Beta carotene*
	Milk, cheese	Vitamin A: *Retinol*
	Cheese, milk, courgette, white flour	Vitamin B: *Thiamin B1*
	Eggs, milk, cheese	Vitamin B: *Riboflavin B2*
	Milk, eggs	Vitamin B: *Niacin B3*
	–	Vitamin B: *Folic acid B9*
	Cheese	Vitamin B: B12
	–	Vitamin C
	Eggs	Vitamin D
	Wholemeal flour, oil	Vitamin E
	Cheese	Vitamin K
	Minerals	
	Milk, cheese, flour	Calcium
	–	Fluoride
	Milk and cheese	Iodine
	Egg yolk, wholemeal flour	Iron
	Cheese	Sodium
	All ingredients	Phosphorus

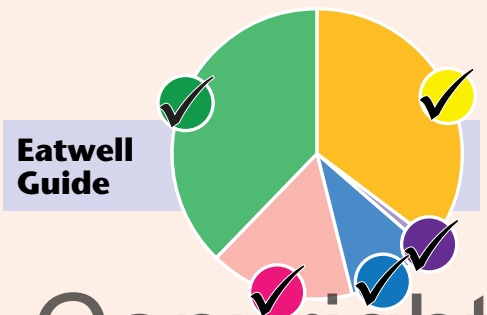
Which cooking methods and practical skills does this recipe use?

Cooking methods
Baking

Practical skills
Vegetable preparation
Batter making

What is the science behind this recipe?

Raising agent: CO_2 gas produced by baking powder in the flour will expand on heating and raise the mixture.	
Coagulation of egg and cheese protein to help set the mixture.	
Gelatinisation of starch in the flour and vegetables to help set the mixture.	
Caramelisation of fruit sugars in the onion.	
Dextrinisation of the starch in the flour.	
Heat transfer	
Conduction	Heat from the oven through the muffin tin to the muffins
Convection	Heat in the oven



Extension activity

How could this recipe be modified ...	... for someone with coeliac disease? ... for someone who is lactose intolerant? ... to increase the fibre content? ... to reduce the fat content?
What variations could you make to ...	... the vegetables? ... the overall flavour? ... the type of fish?
What could you serve the muffins with?	*For example, they could be served instead of bread with a soup.*