Zig Zag Education

Food and Nutrition GCSE | WJEC | 3560

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Course Companion

For WJEC GCSE Food and Nutrition: Principles of Nutrition

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Contents

Teacher's Introduction

This resource is designed to meet the Area 2: Principles of Nutrition element of the WJEC GCSE Food and Nutrition qualification.

Remember!
Always check the exam board website for new information, including changes to the specification and sample assessment material.

What it covers
The resource comprises three chapters covering the following:

Chapter 1: Macronutrients	**Chapter 2:** Micronutrients
• Protein • Fat • Carbohydrates and dietary fibre	• Vitamins • Minerals • Water • Complementary actions of nutrients

How to use this resource
The resource covers all aspects of the Area 2: Principles of Nutrition element, and is designed to increase knowledge of the topic and enable learners to test their understanding and skills through a variety of assessment methods.

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

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

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

M Golebiowska, March 2018

Chapter 1: Macronutrie

Overview

In this chapter we will investigate macronutrients – carbohydrates, proteins and fats – their role in the human body and their main sources. This chapter will help you discover how much of them you need and what the effects of deficiency and excess are for the human organism. We will also learn how to use them to create healthy, nutriti[illegible] mea[illegible]

Learning outcomes

After studying this chapter, you should be able to do the followi[illegible]

- ❑ Identify the main sources of proteins, carbohydrates, diet[illegible]
- ❑ List the main protein alternatives available
- ❑ List the functions of proteins, carbohydrates and fats in th[illegible]
- ❑ Understand the difference between high biological value a[illegible]
- ❑ Understand the differences between saturated and unsat[illegible]
- ❑ Understand the differences b[illegible]en the three carbohydra[illegible] monosaccharides [illegible]sa[illegible]rides)
- ❑ Unders[illegible] effects of deficiency and excess of macro[illegible]
- ❑ Ex[illegible]e related dietary reference values of proteins, fa[illegible]
- ❑ Modify recipes to meet the requirements of different dieta[illegible]
- ❑ Use your knowledge of macronutrients and apply it when [illegible] preparation skills

Key Terms

High biological value protein	A protein that contains all of the essential a[illegible]
Low biological value protein	A protein that does not contain all of the ess[illegible]
Textured vegetable protein	A protein derived from vegetable produce, s[illegible]
Protein alternative	A source of protein which is suitable for use [illegible] it does not come from animal sources
Protein complementation	The process of combining sources of incomp[illegible] complete protein
Saturated fats	Type of fat where all the bonds between fat[illegible]
Unsaturated fats	Type of fat that contains at least one double [illegible] (polyunsaturated fats and monounsaturated[illegible]
Dietary reference value	The amount of nutrients necessary to fulfil a[illegible]
Polysaccharide	A carbohydrate in which there are more tha[illegible] together into a long chain of starch or dietar[illegible]
Monosaccharide	A carbohydrate in which there is only one m[illegible] glucose, galactose
Disaccharide/oligosaccharide	A carbohydrate in whic[illegible]–10 molecules of s[illegible] sucrose (white sugar), lactose (sugar found i[illegible]
Dietary fibre	Indi[illegible] c[illegible]ohydrate found in plant cell[illegible] [illegible]ble in water and, therefore, perform d[illegible]
Amino acids	Molecules containing nitrogen which are bo[illegible] protein molecule
Vegetari[illegible]	People who do not eat meat, and sometime[illegible] otherwise eat products of animal origin, such[illegible]
Vegans	People who do not eat any produce of anim[illegible] dairy products, eggs, fats (such as lard) or ev[illegible]
Essential amino acids	Amino acids which cannot be built from scra[illegible] have to be provided as a part of a healthy di[illegible]
Non-essential amino acids	Amino acids which can be built from scratch[illegible]

Macronutrients

Macronutrients are organic compounds needed by our bodies in large amounts t
provide energy and building material to all of the cells around the human body. A
carbon, oxygen and hydrogen in different combinations, sometimes with the add
three macronutrients needed by humans are protein, fat and carbohydrates.

Protein

Proteins are large biomolecules consisting of amino acids bound together in a variety of ways. There are approximately 20 a**no acids**. Some of them can be made from scratch by the hum y these are called **non-essential amino acids**. The r of h have to be provided in the diet – they are calle **amino acids**.

D

The
acids
built
from

The function of

Proteins ar sa for a number of bodily functions:

- Building all around the body, e.g. myosin and actin make up muscle cel
- Transporting nutrients and waste, e.g. haemoglobin transports oxygen to the ti
- Making up hormones, e.g. insulin and glucagon, which are responsible for su
- Protecting the body by building the cells of the immune system, e.g. antibo
- Making most of the bodily processes possible by providing enzymes, e.g. pe protein chains into shorter chains and single amino acids in the digestive sys
- Maintaining the base–acid balance in the blood
- Proteins may also be used as an emergency energy source, mainly when oth carbohydrates and fats – are unavailable

Research

Research why protein-rich foods are more easily affected by microorganism gro

Low and high biological value proteins

A protein can be built from a number of amino acids. If a protein contains all of the essential amino acids in the correct proportion, it is known as a **high biological value (HBV)** protein. If it lacks one or more of the essential amino acids (in both quality and quantity), it is called a **low biological value (LBV)** protein. High biological value proteins are usually those of animal origin – including meat, fish, eggs or milk. Low biological value proteins usually come from plants, and include beans and other legumes, as well as nuts, seeds and grains.

The haemoglobin chain consists of the f g amino acids (among others):

Valine – Histidine – Leucin ryptophan – Proline – Glutamic acid – Glutamic

Given that i qu t least two molecules of glutamic acid, it will be impossi correctly g protein chain if there is too little glutamic acid available, even plenty of t her amino acids. So to build a protein, the body does not only n type of a given amino acid (quality) but also the sufficient amount (quantity or p

Protein alternatives

To make your diet more diverse and tasty, you can think of swapping your source protein for **protein alternatives**. These products are mainly designed to replace – thus, they are usually vegan and vegetarian friendly. The most popular protein alternative is **textured vegetable protein** (**TVP**), which you can find in the form of meat, soy chunks, soy sausages and a variety of soy-based products, such as tofu or tempeh. Other alternative products can be based on beans, lentils, chickpeas other legumes, as well as nuts, seeds and grains.

Things to think about

Some of the most popular British m... s... as steak pie or sheph...
What would you replace th... with to make them suitable for ...

Res... h

Go to the ...earest supermarket and make a list of the protein alternatives tha...

In the twentieth century, there were many concerns about food shortages. To help prevent shortages, in 1985 Marlow Foods Company launched Quorn™. Quorn™ is a product whose main ingredient is a mycoprotein derived from the *Fusarium venenatum* fungus. In addition to the mycoprotein, Quorn™ may contain egg white, potato starch, seasoning and other ingredients.

T... th... a ... 'm... A...

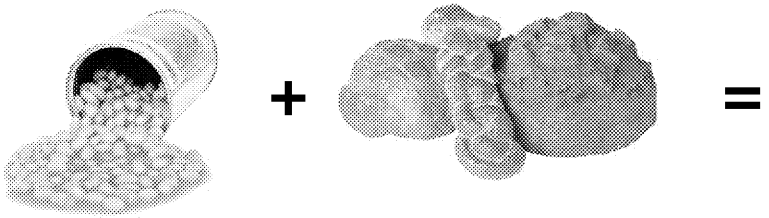
Things to think about

Do you think Quorn™ is suitable for vegans? Explain why.

Protein complementation

You might have noticed that some people do not wish to eat meat – for either re... They are called **vegetarians**. However, there are also people who do not eat any ... milk or honey), and these are called **vegans**. Since their diet is generally based o... are sources of low biological value, they need to complement their meals to imp... are eating. **Protein complementation** is a process of comb...g two or more sou... HBV meal. This can be achieved by:

- mixing legumes (such as beans, p... or lentils) with grains (such as wheat, r... amount of lysine
- eating legumes t... with nuts and seeds to increase the level of methio...
- mixing ...b... with grains, nuts or seeds to raise the amount of methion...
- eating ...s with corn to ameliorate the amount of tryptophan



Legumes and grains complement each other

Protein deficiency

As you already know, proteins are vital for many bodily functions. The lack of the sometimes severe, health issues. These include:

Health issue	Explanation
Loss of hair and weakening of nails	Hair and nails are not necessary for survival; thus, the resources on them if there are not enough available
Bedsores and skin lesions	Due to problems with the cell renewal process (not e process)
Swelling	Because of the pH and base – acid imbalance
Apathy	Protein is needed to stabilise b[illegible]d sugar levels and lead to exhausting high[illegible]ws in the mood. Prote nutrients arou[illegible]dy, so a lack of protein mean tissue[illegible]t receive as much food as they need, a [illegible]dy.
Fattening[illegible]e liver	Amino acids are needed by the liver to transform fat cell membranes) and lipoproteins (such as HDL and L there are not enough amino acids for the fats to be t accumulate in the liver, causing fatty liver disease.
Loss of immunity and muscle power	White blood cells and muscles are built of protein, so won't be enough to build them, and in effect your im muscle power will lower.
Inhibition of growth and development	Mainly due to lack of resources, as well as enzymes w

Protein deficiency is rare in developed countries, but may occur sporadically in pe products or don't eat enough food in general. The condition is more often found insufficient food supply occur. It is called 'kwashiorkor' and is easily recognisable kwashiorkor will have thin arms and legs and a big, swollen belly.

Things to think about

Think about who is at the highest risk of increasing protein deficien

Protein excess

At the other end of the spectrum, there is protein excess. It is not very common replace the carbohydrates in your diet with proteins. The effect might be depres kidneys and liver that might lead to their malfunction, slow metabolism and body to sportsmen).

How much protein does a human [illegible]eed?

Proteins are necessary for bod[illegible] growth and development; thus, it is logical to thin more protein he or she [illegible]. More protein is needed during adolescence (due to pregnancy [illegible]reastfeeding (due to the need to create a new body and produce

The reference nutrient intake for adults is usually set at 0.75 grams per kilogram change due to special requirements, such as adolescence, pregnancy or breastfe be increased to 1–1.5 g / kg body mass / day.

Age group	Reference nutrient intake (RNI) per day (g)	
	males	females
Under 1	13.5	
1–3	14.5	
4–6	19.7	
7–10	28.3	
11–14	42.1	41.2
15–18	55.2	45.0
19–50	55.5	45.0
50+	53.3	46.5
pregnancy	-	51.0

Reference nutrient intake for people [illegible] age and sex, HMS

Skills

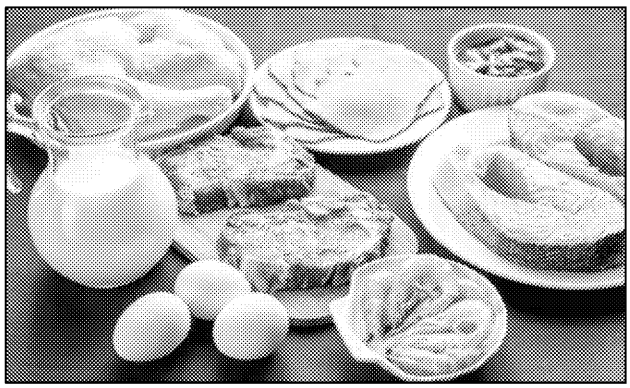
1. Cut a roast[illegible] into thin sli[illegible] Why?
2. Try to beat [illegible] of a little vi[illegible] you observe
3. Cook a bo[illegible] meat alter[illegible]

ngs to think about

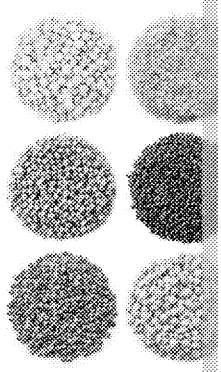
Discuss how the protein requirements change depending on a person

Sources of protein

The easiest available source of protein in the human diet is meat, fish, eggs and dairy products. These are complete proteins, which means that they contain all of the essential amino acids. Examples of plant sources of complete proteins include soya beans and quinoa. The other plant-based sources of proteins are grains, nuts, seeds, and legumes, such as peas, chickpeas or lentils. Since they do not contain all of the essential amino acids, they are called incomplete proteins.



Animal-derived proteins (meat, fish, eggs, milk and dairy)



Plant-derived p

The table below will help you to choose protein-r[illegible] ients when cooking p

Ingredient	Ar[illegible] protein in g per 100 g	Ingredient
Soybeans ([illegible])	14.0	Lean pork meat (raw)
Chickpeas [illegible]	9.0	Lean beef meat (raw)
Red kidney beans (boiled)	8.4	Chicken breast (raw)
Green lentils (boiled)	8.8	Salmon (raw)
Tofu	8.1	Cod
Quinoa (raw)	13.8	Eggs
Quorn™	14.0	Milk
Almonds (ground)	21.1	Cheddar cheese

Check your understanding:

1. Which of the following statements about proteins is TRUE? (*1 mark*)
   a. Proteins are needed in small amounts.
   b. Proteins denature in an acidic environment.
   c. Proteins are not necessary for health.
   d. The main source of protein is vegetables.

2. Which of the following is NOT suitable for a vegan? *(1 mark)*
   a. almond milk ☐ c. hummus
   b. Quorn ☐ d. miso soup

3. Which of the foll… / the protein complementation technique?
   a. … ☐ c. cheese on toa…
   … and eggs ☐ d. hummus

4. The RNI for protein for a healthy adult is usually set at… *(1 mark)*
   a. 1 g / kg body mass / day ☐ c. 0.75 g / kg bod…
   b. 1.5 g / kg body mass / day ☐ d. 0.5 g / kg body…

5. Name two plant sources of high biological value protein. (*2 marks*)

   .....

   .....

6. Describe the difference between essential and non-essential amino aci…

   .....

   .....

7. Explain what happens if you apply acid or heat to a protein. *(2 marks)*

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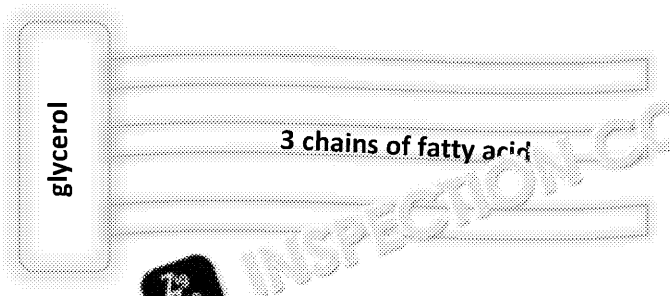
Fats, Oils and Lipids

Fats are molecules built from a molecule of glycerol and three chains of fatty acid (thus, they are also referred to as 'triglycerides'). The carbon molecules in the fat acids are tied together by single or double bonds; therefore, there are two types – **saturated** and **unsaturated** (also called oils).

Fatty acid chains can have different lengths, and this is what determines the temperature of their melting point. The longer the chain, the higher melting temperature. Fats are hydrophobic – that mea that their molecules are repelled from molecules water and do not disso Instead, fats float on th surface of water or cre emulsions.



Saturated fats

If all the bonds in a fat molecule are single, the fat is called '**saturated**'. These fa temperature. Some of the fats can be easily seen – thus, they are called 'visible f to spot, yet they are present in a range of foods – these are called 'invisible fats'.

Visible saturated fats	Invisible saturated fats
Lard, suet and goose fat	Meat and cold cuts
Fish oil	Fish
Butter and cream	Cheese, milk and dairy products
Bacon and ham	Pastry, cakes and cookies, ice creams

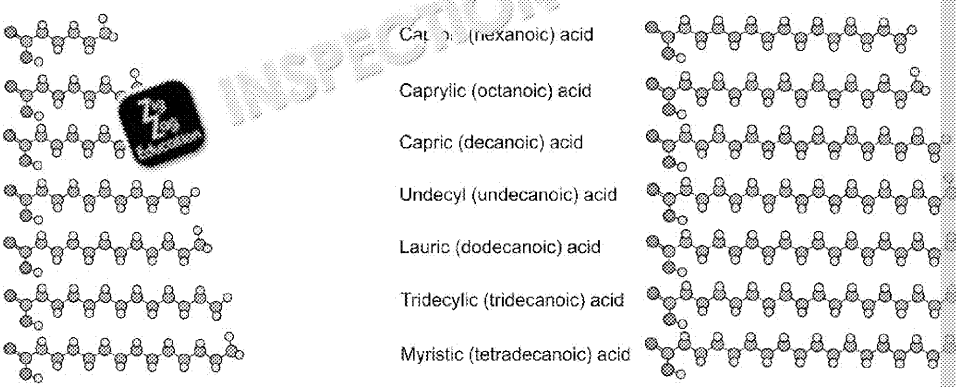
Sources of visible and invisible saturated fats

Did you know?

Fish oil is the only animal-derived fat that is liquid at room temperature.

Suet is the fatty tissue that surrounds internal organs of cattle and sheep.

The fatty acid chains can be shorter or longer. Their length determines the melti longer the chain, the higher the melting temperat this reason, butter wil temperature but the wax in a candle will no



Note how the fatty acid chains grow longer in the saturated fats. Dark grey atoms to the left are O note how they make a long chain which makes the core of the fat molecule; light grey atoms att

Unsaturated fats

If there is one double bond present in the fatty acid chain, the fat is called 'monou
than one double bond in the fatty acid, the fat is called 'polyunsaturated'. The u
or greasy at room temperature.

Did you know?

Lipids are a large group of organic compounds which include fatty acids, waxes, triglycerides and other substances that are oily to the touch.

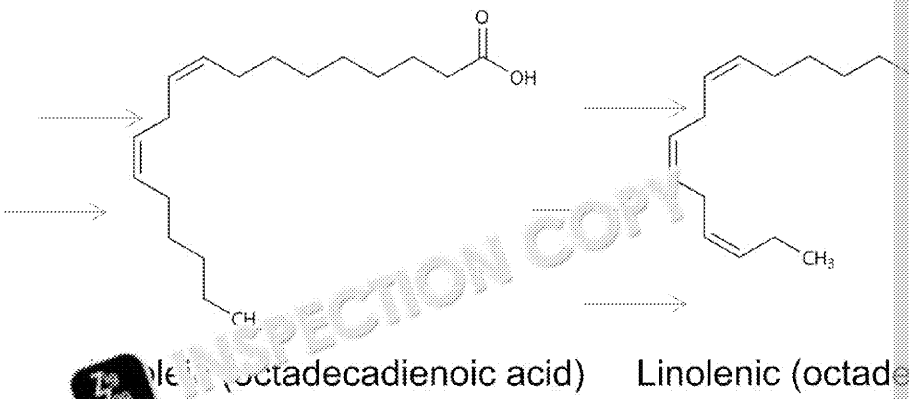
The unsaturated fats can have di
they occur in the conformation c
temperature, the conformation c
are formed. This is important be
can cause breast cancer, coronar
cholesterol levels. Most trans fa
foods, such as fast foods, deep-f
ma[illegible] with unsaturated fats.

Both mono- and polyunsaturated fatty acids with correct conformation (*cis*) are beneficial for health. In addition, some of them cannot be produced by the body and have to be consumed as part of a healthy diet (thus, they are called essential fatty acids). These are omega-6 and omega-3 fatty acids. Their intake can improve health and decrease the risk of cancer and heart failure. It is most beneficial if they are consumed in a proportion of 3:1.

Visible fats	Invisible fats
Vegetable oils (rapeseed oil, sunflower oil, safflower oil, olive oil, flax, pumpkin seed oil, soya oil, etc.)	Seeds, nuts and grains
Cocoa butter	Sweets, biscuits and cakes, chocolate and cocoa
Coconut oil	Coconut, avocado, olives

Sources of visible and invisible plant-derived fats

Linoleic acid is one of the most important omega 6 fatty acids, while linolenic acid
omega 3 fatty acid. Look where the double bonds are located in their chains: in t
sixth carbon atom from the end and in the omega 3 fatty acid it is at the third ca



[illegible]octadecadienoic acid) Linolenic (octad

Note the [illegible] bonds in the linoleic and linolenic fatty acids. They are important polyunsatu

Did you know?

The only plant-derived fats that are solid at room temperature are cocoa butter and coconut oil.

Did yo

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Cholesterol

Cholesterol is a fatty substance necessary to build cell membranes, bile (enzyme gallbladder in the liver) and certain hormones. Together with protein molecules fats all around the body.

Lipoproteins are usually split into two groups:

- Low-density lipoproteins (LDL), which carry fat from liver to muscles; they a because they raise the total amount of cholesterol in the blood
- High-density lipoproteins (HDL), which carry excess fat from tissues to the li or excreted; for this reason, they are also called 'good cholesterol'

High blood cholesterol levels are risk factors of such condit s as coronary hear and gall stones.

The function of fats

Fats, despite their bad co , are crucial to maintaining all of the bodily f number of p se as:

- Provid rgy – 1 g of fat provides 9 kcal of energy; moreover, fat can be
- Maintai g cell membrane structure, size and functions, especially in skin c (including brain)
- Transporting fats around the body – thanks to cholesterol molecules
- Dissolving some vitamins, making it possible to absorb them and use them i storing them for later use
- Giving our food a desirable taste and consistency, as well as making it easie
- Maintaining stable body heat by insulating it
- Stabilising and maintaining the position of certain body organs, such as kidn
- Building certain hormones, such as sex hormones (progesterone, oestrogen as cortisol)

Effects of deficiency and excess

Fat deficiency and excess are unfortunately easily observable in the United Kingdom. Fat deficiency usually occurs as an effect of undernourishment (not eating enough) or anorexia, leading to a number of health issues. Fat deficiency may manifest as:

- Loss of body weight
- Vitamin deficiency
- Dryness of the skin and keratosis (loosening of epidermis (skin))
- Decrease of immunity
- Growth disorders

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Research

Find information about why a vit de ency occurs when there is too litt health problems it might

Fat excess m be a result of genetic diseases, hormonal disorders, bad eating habits and/or lack of physical activity. In effect, there are more and more overweight and obese people in the world, and – what's even more worrying – the number of obese children is on the rise. Overweight and obesity are diseases in themselves, but they can also trigger other diseases, such as coronary heart disease, rise of blood cholesterol levels, rise of blood pressure, diabetes and even cancer.

Th
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Does a person really need fat?

YES! Fat is necessary to keep the body working correctly, and a shortage of it mi
diet should get between 25% and 35% of its energy from fat, which for a typical
that there should be from 55 to 77 g of fat.

Total fat	Up to 35% of total daily calori
Saturated fats	Up to 11%
Unsaturated fats	Up to 22%
Trans fats	Up to 2%

Daily reference values for fats, Public Health England 201

How to decrease the amount of fat in food

Sometimes it is necessary to make a meal m su ble for some people's dieta
a low-fat diet, or those with certa s). A low-fat diet may be beneficial i
blood cholesterol, lower g essure and allowing loss of body weight. W
avoid fat-rich du place them with low-fat equivalents. Choosing an a
helps in ob a low-fat meal.

Things to think about

List products which contain a lot of fat and their low-fat equivalen

Skills

1. Take three pieces of pork shoulder. Deep-fry one, bake another and boil the third. Then put each one on a piece of kitchen paper. What do you observe?

S9, S10, S12

Skills

1. Prepare a savoury)
2. Stuff you glaze it, a

Sources of fats

You already know that fats are present in animal- and plant-derived foods, both in visible and invisible form. When selecting ingredients, you might like to use the table below to calculate how much fat your dish will contain.

Ingredient	Amount of fat in grams per 100 g	Ingredient
Pork meat, lean (raw)	4.0	Whipping cream
Beef meat, lean (raw)		Sunflower seeds
Chicken br ra	4.8	Soybeans (boiled)
Salmon (ra	15.0	Bacon rashers, smoke
Cod (raw)	0.6	Ham, cooked
Eggs, whole	9.0	Avocado, raw
Milk, whole	3.6	Olives, pickled
Butter	82	Walnuts

Check your understanding

1. Which of the following statements about fats is TRUE? *(1 mark)*
   a. They are unhealthy. ☐ c. They are nece
   b. People should avoid eating them. ☐ d. They are harm

2. Which of the following is UNTRUE? *(1 mark)*
   a. It is possible to reduce the amount of fats in food.
   b. Fat deficiency might be fatal.
   c. Plant-derived fats are usually saturated
   d. Animal-derived fats are usually sat

3. How much fat do a balanced diet contain? *(1 mark)*
   a. up t ☐ b. up to 35% ☐ c. up to 10%

4. Which of the following has the most total fat? *(1 mark)*
   a. lettuce ☐ b. cottage cheese ☐ c. Cheddar

5. Name two plant-derived sources of saturated fats. (2 *marks*)

   .....

6. Describe how two different preparation or cooking methods help to l food. (*4 marks*)

   1.....

   .....

   .....

   2.....

   .....

   .....

7. Explain two effects of fat deficiency in the human body. *(4 marks)*

   1.....

   .....

   .....

   2.....

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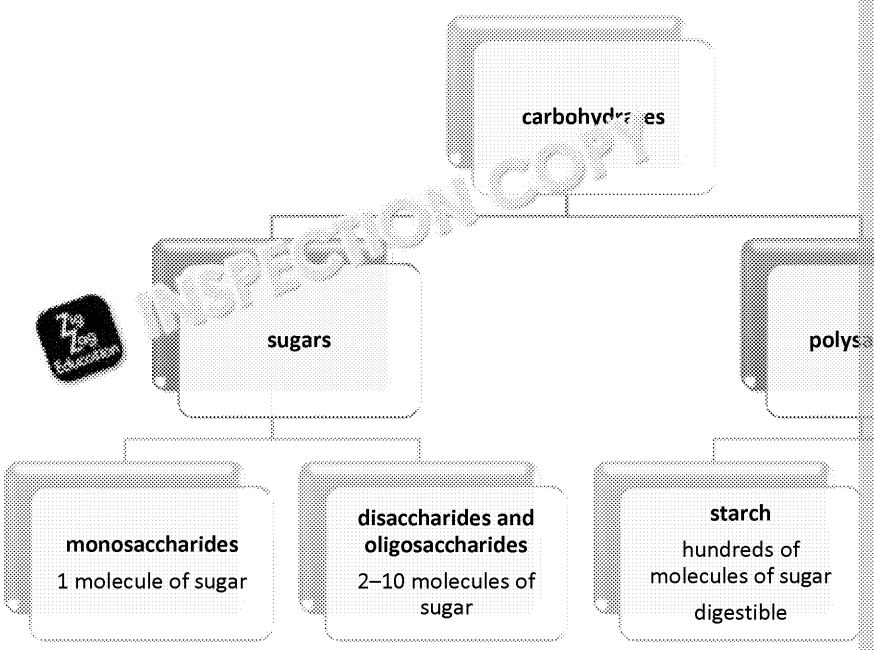
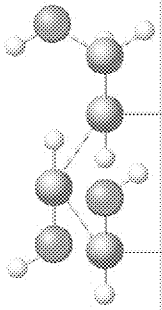
Carbohydrates and Dietary Fibre

Carbohydrates (also called saccharides) are molecules built from carbon, oxygen a
created by plants as the effect of the process called photosynthesis. Carbohydra
molecules called **monosaccharides**, such as glucose or fructose. They can be pre
of sugars or bind together to form shorter or longer chains of **disaccharides**, **olig
polysaccharides**. Monosaccharides are soluble in water, while polysaccharides a
suspension – a mixture in which starch molecules are hung.



The function of carbohydrates in the human body

Sugars and carbohydrates are necessary for the human body. They are the primary and most easily accessible source of energy, which means that they are used before any other nutrient (such as fat or protein). For that reason, they can also be called 'protein sparers'. During digestion, they are broken down to form glucose, which is the only substance that can be used by most cells, such as brain cells or muscles.
Carbohydrates are stored in the liver, muscle cells and brain in the form of glycogen (ready to be used as energy).



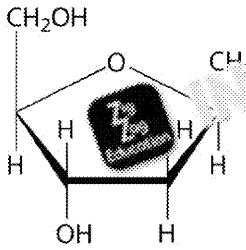
However they also have other functions including:

- Sugars such as ribose and deoxyribose are the core elements of DNA – genetic material present i[illegible]er cell of the body, which carries all the inf[illegible]or
- A polysaccharide called hep[illegible]ssary for proper blood clotting.
- Togeth[illegible]h i[illegible], sugars create corticosteroids, which are important horm cortex. [illegible]ample of this is cortisol – also called the stress hormone.
- With proteins, sugar create glycoproteins. An example of this is mucin – the thick and slimy.

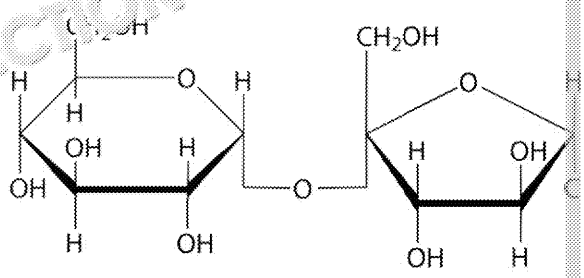
Sugars

The group of sugars consists of mono-, di- and oligosaccharides. Their molecules contain from 1 to 10 molecules of sugar. The most basic monosaccharides are *glucose* and *fructose*. Together they can form a disaccharide called *sucrose* (table sugar). They occur in large amounts in processed grain products such as plain flour (and everything made with it), white rice, table sugar, honey, syrups, soda drinks, sweets and most fruits. Sugars are also present in milk – that is because of the nutritional requirements of a baby. The amount of milk sugar varies depending on the species (human milk is around 7% sugar, cow milk around 4.5% and sheep milk around 5.5%). The sugar in milk is built of glucose and galactose and is known as *lactose*.

Fruit a



A molecule of fructose



A molecule of glucose joins the molecule of fructose to f
sucrose – known as table sugar

Polysaccharides

Polysaccharides are carbohydrates which consist of more than 10 molecules of s
polysaccharides. Those which can be broken down by the enzymes in the human
It is a concentrated energy source. During digestion, it is broken down into gluco
present in the saliva and pancreas juice. In this form, it can be absorbed (transported from the gut to the blood) and then carried to the tissues (such as muscles) or to the liver (where it can be stored for later use in the form of glycogen). Important sources of starch in the human diet are whole grains (such as wheat, rye, brown rice, buckwheat, and oats) and their derivatives (such as wholegrain bread or pasta), legumes, potatoes or parsnips.

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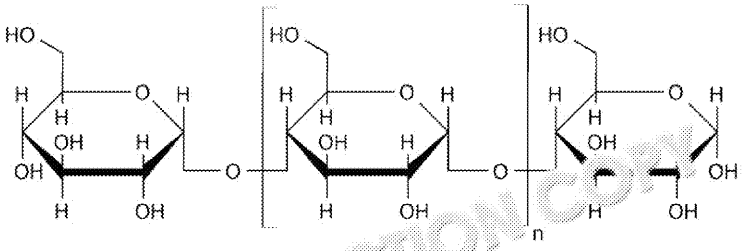


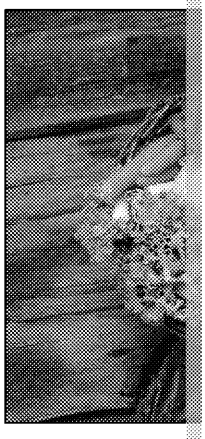
Amylo e example of starch

The second of polysaccharides is called ***dietary fibre***. There are two types insoluble.

1. Insoluble fibre is crucial for normal performance of the intestines. It can co movements and, therefore, regulate the bowel's performance. Studies sho lower the risk of bowel and breast cancer. Insoluble fibre is mostly found in fruit.
2. Soluble fibre slows down the ingestion of sugar and, therefore, prevents hig levels. This plays an important role in preventing sugar intolerance and typ lower blood cholesterol levels, helping to protect the heart from excess cho present in oats, apples, bananas, cooked fruit and vegetables, and dried fru

Most vegetables, fruits, grains and legumes are also rich in fibre, especially when

Whole grains are a good source of [illegible] and fibre



Fruit and vegetable

Things to think about

Try to explain why eating fruit is better than eating sweets.

Effects of deficiency and excess

The excess of carbohydrates (especially sugars) is the main cause of many health

Health issue	Explan
Increase of blood sugar level	Sugar doesn't have to be broken d quickly, causing blood sugar levels
Increased risk of type 2 diabetes	To prevent blood sugar levels from pancreas has to produce a lot of in just can't keep up, and high blood s the tissues in the body, causing the
Overweight and obesity, fattening of the liver	Excess sugar is transformed into fa form of fat tissue
Loss of skin and joint flexibility	Because sugar crystals destroy the
Increased risk of candidosis	A condition caused by the *Candida* sugar; may appear as a white tongu or low immunity
Tooth decay	Bacteria th[illegible]e in your mouth lov diss[illegible]r tooth enamel

The deficiency of carbohydrate[illegible] rare condition and does not usually occur in healthy people[illegible]ible, though, to develop it as an effect of not eating enou[illegible]as [illegible]ect of a badly managed diet in diabetics. As a result, blood sugar[illegible]rops (sometimes dramatically), causing hypoglycaemia. There are many symptoms indicating this, such as loss of control, nervousness or apathy (lack of motivation), drowsiness, tiredness, hunger, shaking and acceleration of the heartbeat. Usually, consuming something sugar-rich (such as a piece of chocolate or a sip of soda) helps. In severe hypoglycaemia, loss of consciousness may occur – such people require immediate medical attention.

Insufficient consumption of fibre also can lead to a number of problems. If there constipation and increase the risk of inflammatory bowel diseases and even bowe can cause diarrhoea and bloating, and affect the absorption of minerals.

Dietary reference values

According to SACN (Scientific Advisory Committee on Nutrition) 2015 recommendations, carbohydrates should make up around 50% of total calorie intake, which for a typical diet of 2000 kcal a day makes around 250 g of carbohydrates. The World Health Organisation also encourages lowering the intake of sugars to 5% of total daily calorie intake, which equals up to 25 g. That is around five teaspoons of sugar or honey, a glass of soda or fruit juice, half a bar of milk chocolate or one serving of vanilla ice cream.

Research

Try to find out why eating fresh fruit is healthier than drinking fruit juice.

Think about

Suggest three ways of increasing the amount of fibre in a meal.

Skills

1. Make two bread roll doughs, one with plain flour and one with high-fibre (wholegrain) flour. Leave for 30 minutes to prove. Write down your observations.

S17

Skills

1. Make a m
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Sources of carbohydrates

When developing recipes, it might sometimes be necessary to lower the sugar co
fibre. The table below shows the quantities of complex carbohydrates, sugars an
variety of food commodities.

	Starch	Sugars
White bread	45.8 g	3.0 g
Wholemeal bread	39.3 g	2.8 g
White rice, boiled	85.4 g	0.2 g
Brown rice, boiled	29.0 g	0.1 g
Potatoes, peeled (baked)	17.3 g	0.7 g
Potatoes, with skin (baked)	2 g	1.4 g
White pasta, boiled	36.1 g	1.1 g
Wholemeal pasta, boiled	27.5 g	-
Carrots, raw	0.1 g	7.2 g
Apples	-	11.6 g
Green beans, boiled	0.9 g	3.0 g
Prunes	19.0 g	38.0 g

Check your understanding: carb

1. Which of the following has the highest fibre content? (*1 mark*)
   a. wholegrain bread with beans ☐ c. white bre
   b. wholegrain bread with cheese ☐ d. white bre

2. Which of the following is TRUE? *(1 mark)*
   a. Dietary fibre causes bloating and digestive problems.
   b. Polysaccharides are found in sweets.
   c. Milk is a source of sugar.
   d. Sugars cause hypoglycaemia.

3. How much sugar [illegible] consumed as part of a healthy diet? *(1 ma*
   a. [illegible] ☐ c. up to 15%
   [illegible] to 5% ☐ d. up to 50%

4. Excess consumption of sugars can lead to… *(1 mark)*
   a. measles ☐ c. skin rash
   b. loss of consciousness ☐ d. tooth dec

5. State two health benefits of eating a high-fibre diet. (*2 marks*)

   1 .....

   2 .....

6. Explain whether fruit juice should be drunk to replace fresh fruit in a d

   .....

   .....

   .....

   .....

7. Give two reasons why wholemeal bread is healthier than white bread

   1 .....

   .....

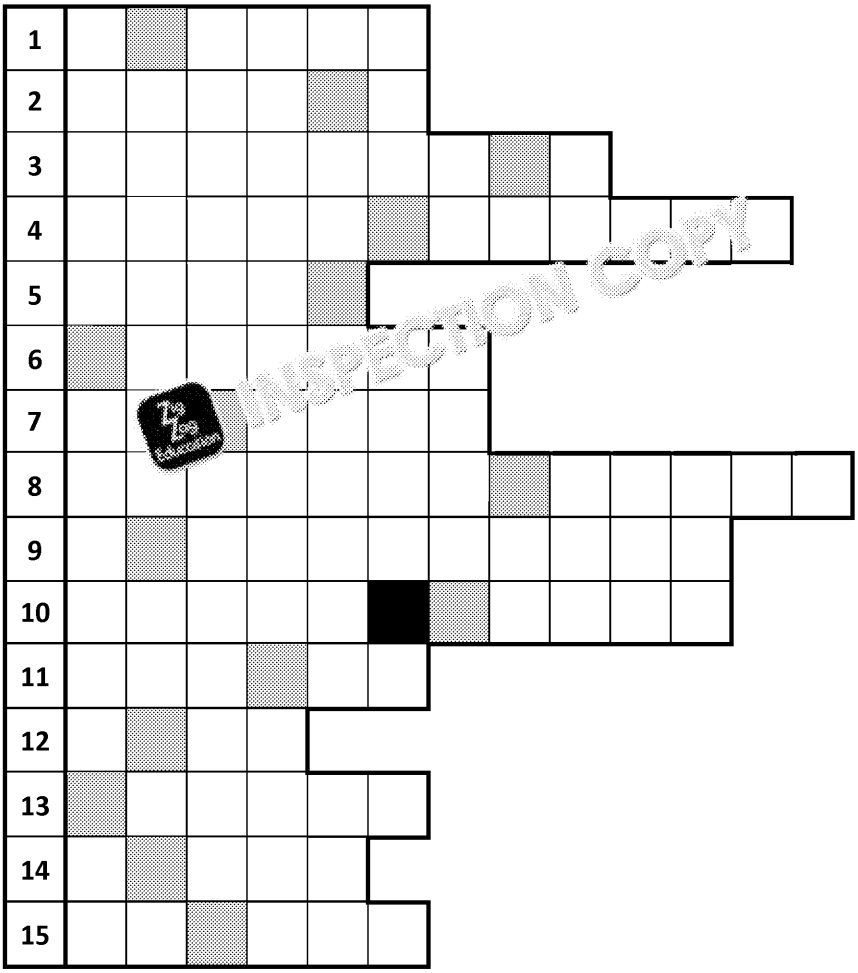
   .....

   2 .....

   .....

   .....

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



1. The main function of carbohydrates is to work as a protein _____ (6)
2. Protein alternative cereal which provides HBV protein (6)
3. Type of fibre responsible for healthy bowel movements (9)
4. Chemical name for a fat molecule (12)
5. __-fats are the harmful type of fats (5)
6. Pear-shaped fruit rich in polyunsaturated fats (7)
7. Disaccharide found in milk (7)
8. Very low blood sugar level (13)
9. The 'bad' type of this molecule can cause he rt disease (11)
10. Building blocks of protein (5, 5)
11. This value is measured in [illegible]ories (6)
12. ____ biological value protein is present in soy and meat (4)
13. Type of [illegible] bonds in unsaturated fats (6)
14. A perso[illegible] doesn't eat any produce of animal origin (5)
15. Legumes and grains together complement the amount of this amino acid (6)

The shaded squares reveal this word:

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Chapter 2: Micronutrien

Overview

In this chapter we will look at micronutrients (vitamins and minerals) and water – the ingredients that keep us healthy and in good condition. This chapter will explain what the function of certain micronutrients is and where to find them. We will also investigate what amount of micronutrients a person needs.

Learning outcomes

After studying this chapter you should be able to

- ❑ list fat-soluble and water-soluble vitamins
- ❑ identify the main sources of vitamins and m
- ❑ understand the meaning of micronutrients
- ❑ describe and identify effects of micronutrie
- ❑ explain the related reference nutrient intak
- ❑ identify and understand the role of antioxi
- ❑ monitor micronutrient and water intake

Key Terms

Micronu	A substance which is needed by the organism small amounts, such as vitamins and minerals measured in micrograms or milligrams
Vitamin	A group of organic chemical molecules essent the body; they might be natural or synthetic; a vitamins; thus, they have to be provided as a
Minerals	A group of inorganic chemical molecules esse of the body
Antioxidant	A substance or molecule that prevents oxidat
Dietary reference value	An estimation of the requirement for a certai accordance with sex and age; may be given as
Thiamine	The chemical name of vitamin B1
Riboflavin	The chemical name of vitamin B2
Niacin	The chemical name of vitamin B3
Ascorbic acid	A different name for vitamin C
Sodium chloride	The chemical name of kitchen salt
Hydrogen oxide	The chemical name of water
Reference nutrient intake	The amount of a micronutrient that is enough average person in the population
Metabolism	A number of chemical processes that take pla for survival; these pro s include catabolis obtain energy and anabolism (building up su resources with the use of energy)
Oxidation	A process in which free radicals 'steal' electro

Micronutrients are organic compounds (**vitamins**) and inorganic compounds (**mi**
small amounts. If the amount is very small, we call them trace elements. Iron, io
elements, while calcium, sodium and phosphorus are quantity elements. Micron
properly conduct all bodily functions and chemical reactions in cells and tissues.

Vitamins

Vitamins are a group of organic substances necessary for a proper functioning of the human body. Vitamins may be natural – meaning that they occur naturally in foods – or synth[illegible] made in a laboratory. Vitamins cannot be produce[illegible] human body and, therefore, have to be provide[illegible] part of a healthy diet. The human body needs them in [illegible] amounts only – usually milligrams or [illegible]

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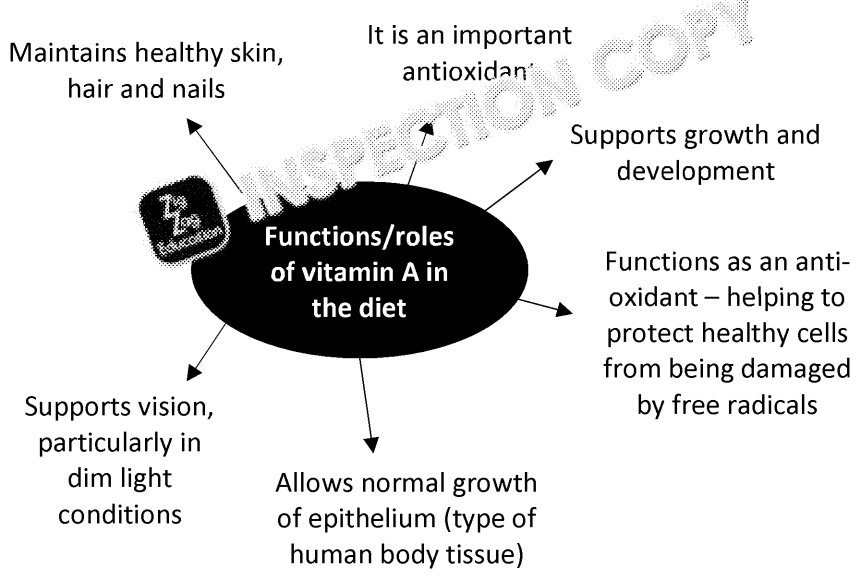
There are tw[illegible] groups of vitamins: fat soluble and water soluble. A complete lack of vitamins is called *avitaminosis*, while a low level of vitamins is called *hypovitaminosis* and an excess of vitamins is called *hypervitaminosis*. Specially designed laboratory tests can check whether there are enough vitamins in a blood sample, and a doctor can then suggest a treatment or supplementation.

Fat-soluble vitamins, their functions and sources

Fat-soluble vitamins are vitamins A, D, E and K. Like all other vitamins, they cann
scratch and, therefore, need to be provided as part of a healthy diet. The amoun
is measured in micrograms. Since they are fat soluble, they are stored in the fat t
excreted with urine or sweat.

Vitamin A

Vitamin A comes in two types: retinol and beta-carotene. Retinol derives from animal sources such as oily fish, dairy products (such as whole milk, cheese and butter) and eggs, while beta-carotene is mostly found in red, yellow and green fruits and vegetables, such as tomatoes, watermelon, carrots, pumpkin, broccoli or parsley leaves. Beta-carotene is present in many foods and is converted to Retinol in the liver.



Be
for

Vitamin A deficiency may cause:

- brittle hair and nails
- dry and flaky skin
- rash
- eyesight problems – especially after dusk

Vitamin A excess may cause:

- yellow shade of the skin
- swelling of the liver and spleen (since t
  metabolism)
- itching
- headaches
- hair loss

It might also be harmful for the baby wher

Did you know?

The condition caused by the lack
vitamin A is called 'night
means that a per
ther
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dark rooms.

Did y

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lines all of y
organs, inclu
and nose.

Reference nutrient intake of vitamin A

Vitamin A is needed in small doses. The following table indicates the number of
stages of life for both males and females:

Age	Reference Nutrient Intake (micrograms)	
	males	females
0–1 yrs	350	
1–7 yrs	400	
7–10 yrs	500	
11–14 yrs	600	600
15–50+ yrs	700	
pregnancy	-	+100
lactation	-	+350

Reference nutrient intake for vitamin A in micrograms, in accordance to age and sex, British Nutrition Foundation 2016

Research

Check and compare the amount of beta-ca ot ne aw carrot, cooked carro

in to think about

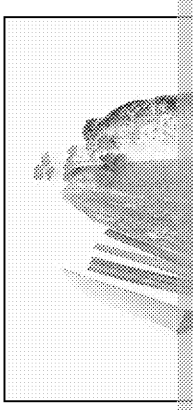
ain why there is more vitamin A in whole milk than in skimmed
milk is fortified by law.

Things to think about

Discuss why eating offal (especially liver) is not recommended duri

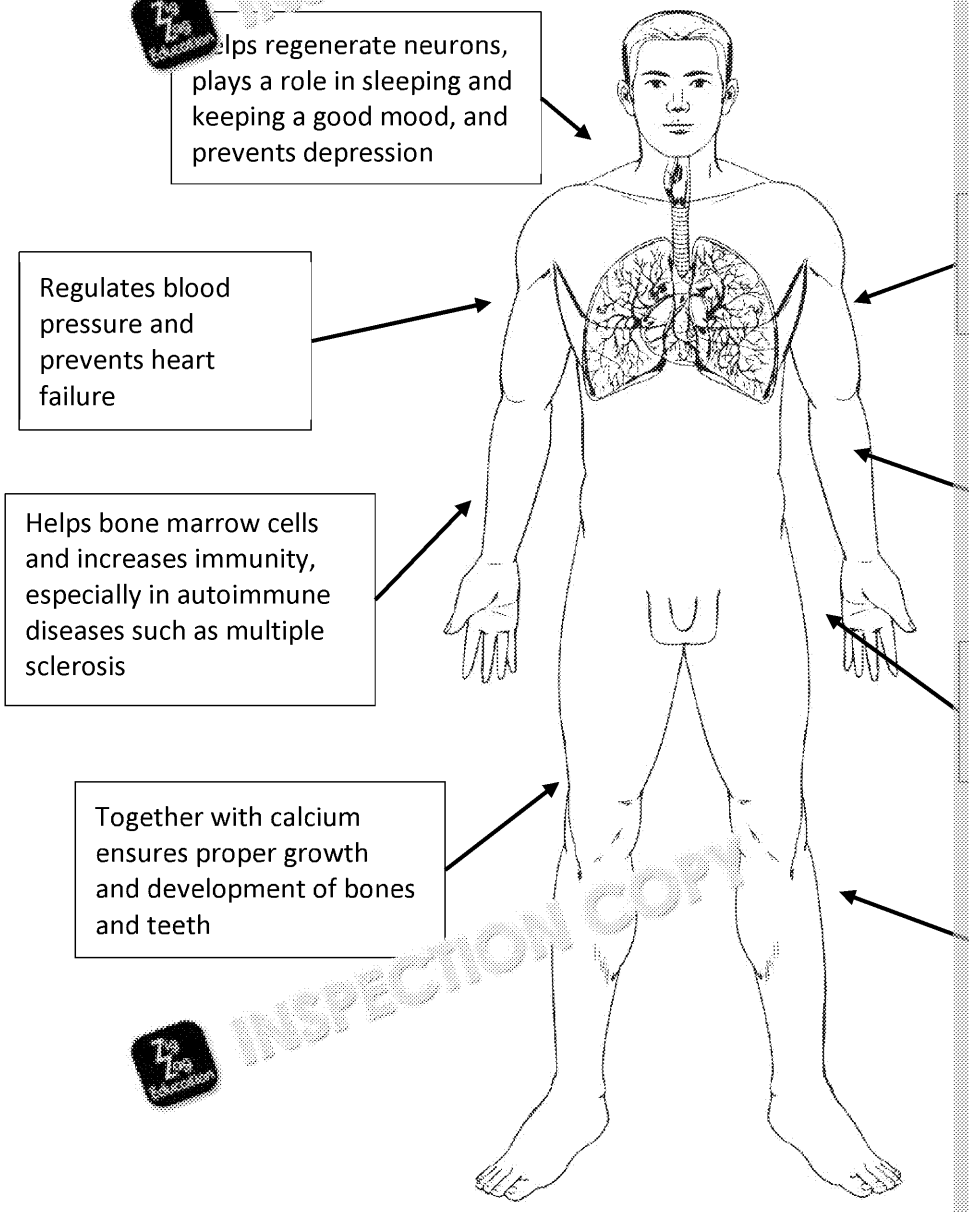
Vitamin D

Vitamin D is also known as cholecalciferol. The foods that are richest in vitamin D are fish such as *salmon*, *cod*, *tuna*, *mackerel* or *herring*, and *fish oil*. Large amounts of this vitamin are also found in *liver*, *cheese* and *egg yolk*. Sometimes synthetic vitamin D is added to certain products to make up the amount after processing – for instance, to breakfast cereals or margarines. What's important, **vitamin D is produced in the skin** as a result of exposure to the sun.



To maintain he

For a long time, it was known to be crucial for the health of bones and teeth, but according to the most recent studies it is essential for a proper performance of nearly all of the body's cells. The function of vitamin D in the human body is shown in the image underneath.



Things to think about

Looking at the image above, discuss the potential effects of vitamin D

Vitamin D deficiency

- rickets and osteoporosis (brittle bone disease)
- soft and easy-to-break bones
- decrease of immunity
- lower mood and depression
- increased risk of autoimmune diseases such as Crohn's disease or multiple sclerosis
- increased risk of cancer

Vitamin D

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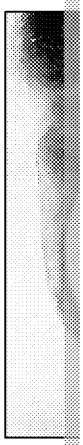
- diarr
- skin i
- feelin

Vitamin D deficiency symptoms are usually caused by not e g vitamin D-rich foods or by avoiding tanning (which ex s is also harmful!).



Did you know?

Vitamin D plays the role of an important hormone.

Crohn's disease is a condition in which the lining of the whole digestive tract is inflamed, causing painful and long-lasting problems with ingestion.

Research

Find out about the effects of Crohn's disease on **zzed.uk/8255-crohns**

Reference nutrient intake for vitamin D

The SACN (Scientific Advisory Committee on Nutrition) **recommends a RNI for vi** However, since there is usually little sun in the United Kingdom, some doctors m increase that dose, either by consuming more fish or by taking supplements (such

Research

Discover more about vitamin D in this SACN report: **zzed.uk/8255-health**

Vitamin E[1]

Vitamin E is also known as tocopherol, due to its unique properties. There are large quantities of tocopherols in vegetable oils and margarines, sunflower seeds and pumpkin seeds, hazelnuts and almonds, as well as in certain fruits and vegetables, such as spinach, kale and blueberries.

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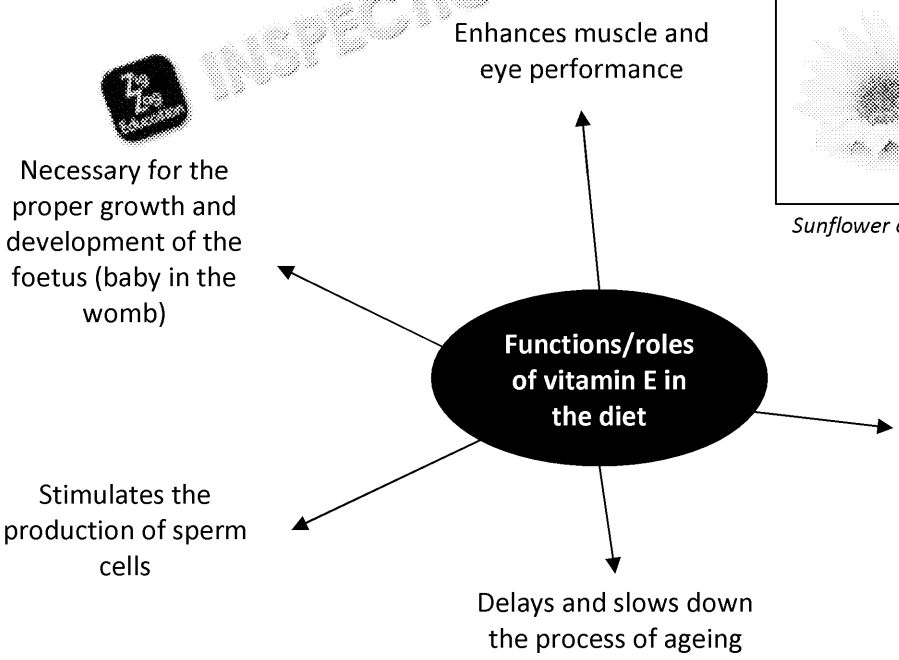
Research

Go to the nearest food store and try to find products that contain vitamin E. Also check the chemist's, since it is a common ingredient of many face creams. Can you tell why?

Sunflower oil



Vitamin E deficiency

- tiredness
- wrinkling and thinning of the skin
- muscle degeneration
- loss of immunity

Vitamin E excess (ve

- headaches
- stomach proble
- sight issues

Like vitamins A and C, vitamin E is also an important **antioxidant**, which means that it prevents or reduces the effects of oxidation. This is advantageous since it prevents ageing and carcinogenesis (the forming of a cancer lump). You can learn more about antioxidants on page 31.

The NHS recommends that men should eat 4 mg and women should eat 3 mg of vitamin E daily.

[1] Vitamin E is not required by the specification, however it is included here as one of the

Vitamin K[2]

Vitamin K is unique, because it is mainly produced by bacteria living in the gut.

Some amounts of vitamin K may be found in vegetables such as kale, sprouts, bro
cabbage, avocado and potatoes. Little amounts are also present in eggs, cheese a

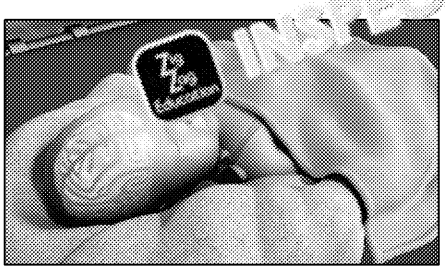
Vitamin K plays vital role in blood clotting, as well as in proper calcium **metaboli**

Vitamin K deficiency

- excessive bleeding
- trouble with healing wounds
- bone demineralisation
- easy-to-break bones

Vitamin K excess (rare)

- degradation of red blood cells
- excessive sweating and feeling hot
- jaundice (ye[illegible]kin) and brain [illegible]mage in newborns



Eating excess vitamin K during pregnancy may cause jaundice in newborns

A person needs approximately 1 mcg of vi
can usually be provided as part of a balan
i.e. blood clotting troubles – should that v
by shots or tablets.

Things to think about

Discuss why vitamin K shots are recommended for newborns.

Skills

1. Choose two kinds of fish – one oily and one lean, and try to fillet them.
2. Choose three kinds of vegetables or fru
– such as avocado, apple and banana. Cu
each one into even pieces – either cube
or slices.

SI, s

[2] Vitamin K is not required by the specification, however it is included here as one of the

Water-soluble vitamins, their functions and sources

Water-soluble vitamins include group B vitamins and vitamin C. In the group B vitamins there are around 12 different substances. Since all water-soluble vitamins dissolve easily in water, they are not stored in the body and are excreted with urine or sweat. For this reason, their regular intake in appropriate amounts is highly recommended. Luckily, they are present in large amounts in a large variety of foods.

Name	Function	Effects of deficiency	Effects of e
Vitamin B1 (Thiamine)	Takes part in the **metabolism** of carbohydrates; is an important part of numerous enzymes	Beri-beri disease, which shows as the degeneration [illegible] nerve and muscle [illegible]s	Practically impossible t overdose, u taking exces amounts of vitamin sho
Vitamin B2 (Riboflavin)	Important part of enzymes; takes part in creating haemoglobin	Cracked and dry lips (especially in the corners of the mouth), dry skin	No known s effects
Vitamin B3 (Niacin)	Helps release energy from food; takes part in the production of red blood cells; has a positive effect on the performance of the nervous system; extends blood vessels, which helps deliver oxygen to the tissues	4D syndrome – Dermatitis (inflammation of skin), Diarrhoea, Dementia (loss of memory), Death; low concentration (inability to focus); irritability; increased sensitivity of the skin to sunlight	Reddening, itchiness an dryness of s nausea
Folate/folic acid (Vitamin B9)	Important in the process of DNA synthesis; takes part in creating red blood cells; reduces the risk of spinal cord diseases in newborns	A disease called *spina bifida* in newborns; anaemia (lack of red blood cells)	No known s effects
Vitamin B12 (Cobalamine)	Together with folic acid, takes part in creating red blood cells	[illegible]a (lack of red blood cells); might occur in vegans if not supplemented	No known s effects

Name	Function	Effects of deficiency	Effects of e
Vitamin C (Ascorbic acid)	Takes part in colagen synthesis; helps absorb iron; increases immunity; strengthens blood vessels; acts as an antioxidant	Decrease in **immunity**; a disease called scurvy, which shows as bleeding, receding, weak gums leading to loss of the teeth; anaemia (due to the impaired iron ingestion); slow wound h[illegible]ng; excessive b[illegible]ding	Occurs very rarely, but m show as na and diarrho

Water-soluble vitar[illegible] functions, sources, effects of excess and

Things to think about

Discuss why it is beneficial to eat meat along with a salad (or a burg pickle).

Loss of water-soluble vitamins

Water-soluble vitamins are usually very sensitive to such external factors as high temperature, oxygen, high pressure or light. This means that during preparation (storing, cleaning, peeling, cutting, etc.) and cooking (baking, boiling, roasting, grilling…) the amount of vitamins in the food decreases. Find ways of preventing vitamin loss in the table below.

Factor causing vitamin loss	How to prevent i
High temperature	Try to cook your meal as quickly as possible; for e potatoes, boil the water first and then add potato potatoes to cold water, since they will take longe
Oxygen	Cut fresh vegetables and fruit into bigger pieces O them immediately into ice-cold water OR, if prepa immediately with dressing to prevent contact wit
High pressure	Try the lowest pressure possible OR reduce the te
Light	Store your food and ingredients in dark, possibly c
Water	Since group B vitamins and vitamin C are soluble i possible when cooking and try not to waste it whe reusing it, e.g. to prep[illegible]ou or soup)

Factors that de[illegible] vitamin loss and ways of preventing the

Research

Find and compare the amount of vitamin C in fresh oranges, freshly squeezed juice from concentrate. Do they differ? Why / why not?

Things to think about

Try to explain which of the following has more vitamins: frozen veg

Dietary reference values

As you already know, vitamins are needed by the body in very small amounts. Us
part of a healthy, balanced diet, but sometimes it is necessary to supplement the
tablets, shots, etc. The reference nutrient intake for water-soluble vitamins is sh

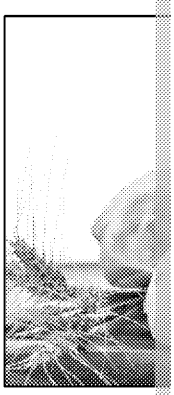
Age	Thiamine (vit. B1) (mg)		Riboflavin (vit. B2) (mg)		Niacin (vit. B3) (mg)		Folic acid (mcg)	
	male	female	male	female	male	female	male	female
10 y	0.7		1.0		12		150	
14–18 y	1.1	0.8	1.2	1.1	18	14	200	
18–50 y	1.0	0.8	1.3	1.1	17		200	
50+ y	1.0	0.8	1.3	1.1	16	12	200	

Reference nutrient intake for water-soluble vitamins with regard to age and sex, Britis

Water-soluble vitamins are present in a variety of food products, such as vegetables
best source of group B vitamins is yeast – you can find it in baked products as well
below shows the quantities of group B vitamins provided with a single portion (8

	per 100 g	per portion
Thiamine	5.8 mg	0.23 mg
	(572% NRV)	(21% NRV)
Riboflavin	7.0 mg	0.28 mg
	(500% NRV)	(20% NRV)
Niacin	160 mg	6.4 mg
	(1000% NRV)	(40% NRV)
Folic acid	2500 µg	100 µg
	(1250%)	(50% NRV)
Vitamin B12	15 µg	0.6 µg
	(600% NRV)	(24% NRV)

Marmite® is a source of B-group vitamins (source: marmite.co.uk); NRV = nutritional reference value



*Yeast is a rich s
bought fresh o
of bread,*

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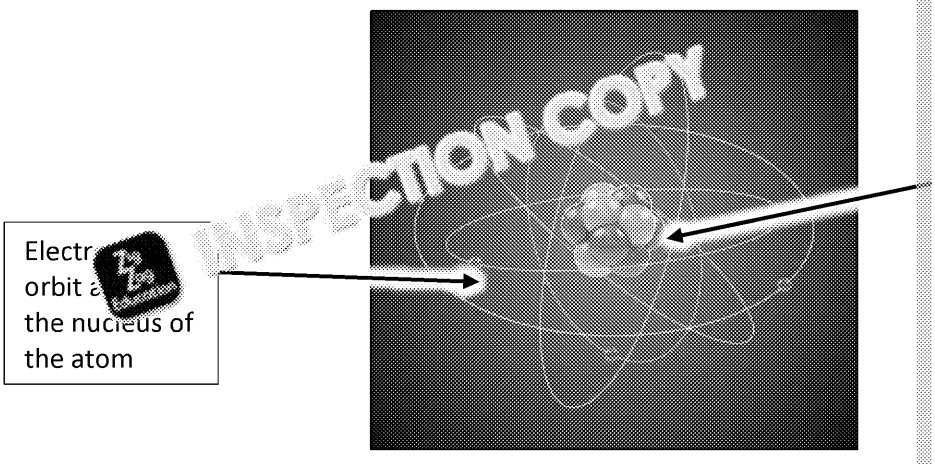
potato. M
which of t
2. Cut an ap
pieces. Le
Write do

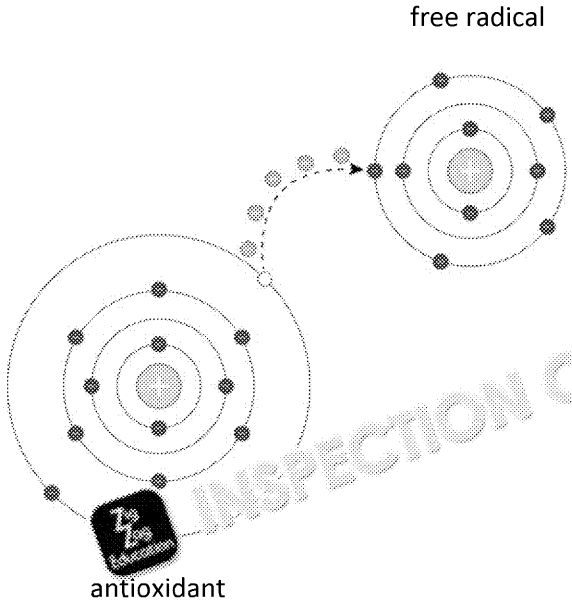
Additional Reading: Antioxidants

Some of the vitamins play an important role in preventing certain substances in the body from oxidation. That includes **vitamin A, vitamin E and vitamin C**. **Antioxidants** are natural substances that help protect the cells from damage caused by **free radicals** (oxygen molecules that lack one of the electrons).

An atom, or a group of atoms (a molecule), has protons, neutrons and electrons. While protons and neutrons are packed tightly an atoms nucleus, the electrons o



Electrons can exist in different orbits – the one closest to the core always has tw eight. If the outermost orbit isn't full, the molecule will strain to fill the orbital. F electron on their second orbit, and so they try to 'steal' electrons from other mo can affect the electric charge of biological molecules, leading to an accelerated a carcinogenesis (formation of cancer lumps). Vitamins A, C and E, together with o prevent that from happening, and, therefore, help maintain youth and health.



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Skills

1. Prepare a f
ingredients
browning?
2. Prepare a f
antioxidant

Check your understanding: V

1. Which of the following is the best source of fat-soluble vitamins? (*1 ma*

a.	banana ☐	c.	bread ☐
b.	milk ☐	d.	avocado ☐

2. Lack of which of the following vitamins can cause tooth decay and oste

a.	vitamin A ☐	c.	vitamin D ☐
b.	vitamin E ☐	d.	vitamin K ☐

3. Which one of the following vitamin helps proper blood clotting? (*1*

a.	vitamin A ☐	c.	vitamin E ☐
b.	vitamin D ☐	d.	vitamin K ☐

4. Which one of the following vitamins is an antioxidant? (*1 mark*)

a.	vitamin B1 ☐	c.	vitamin C ☐
b.	vitamin B3 ☐	d.	vitamin B12 ☐

5. Which of the following vitamins is crucial for proper spinal cord develo

a.	thiamine ☐	c.	niacin ☐
b.	ascorbic acid ☐	d.	folic acid ☐

6. Identify three water-soluble vitamins and indicate one source of each. (

Vitamin	

7. Explain why a lack of iron may lead to vitamin deficiency. *(2 marks)*

.....

.....

.....

.....

Minerals

Minerals are inorganic substances needed by the organism in small amounts. They
functions, since they are part of important proteins, enzymes and other active mo
be produced by the body and, therefore, have to be provided through food and w
bones or hair), activate or build enzymes (such as iron in haemoglobin), maintain s
potassium in cells, magnesium in nerves) and maintain proper structure of certain
Minerals can be divided into quantity minerals, which are needed in larger amoun
elements, which are needed in minute amounts only (such as iodine).

Calcium and phosphorus[3]

Calcium (Ca) and phosphorus (P) are minerals which, together with vitamin D, are crucial for the health of bones and teeth. For ure proper absorption, they need to be provided through the diet in the right proportion – ideally 1:1.

In Ch
calci
phos

The best source of calcium and phosphorus is milk – also because it contains lact absorption. Other sources include yogurt, buttermilk, cheese and cottage c eaten toget h the bones (such as sardines). Large amounts of Ca and P are seeds, but their digestibility is not very good due to large amounts of fibre. Calciu present in water – especially 'hard' water.

Other functions of calcium include:

- conducting stimuli along nerves and muscles
- ensuring proper muscle performance, including heartbeat
- maintaining healthy blood pressure

Skills

1. Prepare wh
rich meal o
ingredients
What can y
layering?

Other functions of phosphorus include:

- taking part in cell metabolism (try to remember the NADPH molecule from Chemistry – the P stands for phosphorus)
- building DNA strands

Calcium and phosphorus deficiency may occur if there is lack of dairy products in lactose intolerance or is a vegan). Prolonged deficiency of these minerals may lea disease – conditions in which bones become soft and fracture-prone. Lack of cal problems (e.g. heart problems).

Excess calcium in the diet may cause constipation, nausea and lack of appetite, b such as kidney stones.

Excess phosphorus slows down the absorption of calcium, which may lead to bon it is important to keep the balance between the two minerals.

Research

Compar ent types of cheese (e.g. soft cheese, cottage cheese, mozzarel regard to calcium content. Try to explain possible differences.

[3]Phosphorus is not required by the specification but is covered here as it is an important functions of calcium.

Dietary reference intake

Age	Calcium		
	male	female	
11–18 yrs	1000	800	
19–50 yrs	700		

Reference nutrient intake for calcium and phosphorus with regard to age and sex, Briti

Apply

Read the labels of products which you have in your fridge and try to prepare a sandwich which will contain balanc amounts of calciu phosphc

Study tip

Remember th er, along with **milk** a products, is an tant source of calcium and phosphorus.

Skills

1. Prepare a salad, soup or other
   What ingredients will you use?

Things to think about

1. Looking at the table above, try to explain why girls aged 14 to and phosphorus than boys the same age.
2. Try to think why there is a lot of phosphorus in ham and saus

Iron

Iron is a mineral necessary for efficient transportation of oxygen by the blood. It i
haemoglobin – the substance which makes blood cells red. Without it, the red bl
and oxygen cannot be transported from lungs to tissues.

FUNCTIONS

- necessary to build haemoglobin which transports oxygen to the cells
- increases immunity
- reduces tiredness

S

- red meat, poultry
- egg yolk
- legumes, nuts an
- green vegetables
- beetroot

DEFICIENCY

- anaemia (lack of red blood
- tiredness, lack of
- decre in
- pale

(apathy)

- constipation
- hormonal disorde
- joint pains
- heart problems

Dietary reference intake

Age	Reference Nutrient Intake for Iron (mg)	
	male	female
11–18 yrs	11.3	14.8
19–50 yrs	8.7	14.8
50+ yrs	8.7	

Reference nutrient intake for iron with regard to sex and age, British Nutrition Foundation 2016

Things to think about

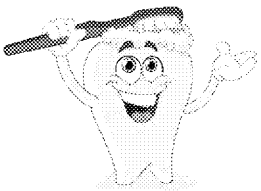
Discuss why girls and women need more iron than boys and men t
why their need for iron drops after their 50th birthday.

Fluoride

Fluoride is a chemical element necessary for the proper growth and development
enamel creation, making it the strongest natural substance found in the human b
the prevention of tooth decay, and, therefore, it is the main active ingredient of

FUNCTIONS	
• necessary to build tooth enamel • shields the teeth from bacteria and acid • helps build healthy bones	• water • fish and seafood • black tea
DEFICIENCY	
• increased risk of tooth decay • osteoporosis (brittle bone disease)	• improper enamel • stomach ache, di • heart and kidney

Did you know?



The main source of fluoride is toothpaste and mouthwash. It can easily be absorbed into the enamel, so you don't have to swallow it.

Research

Try to find whether your local tap water contains fluoride. Start by checking yo

Sodium[4]

Sodium is among the most important minerals for the human body. It is necessary for controlling the amount of liquid in body cells and between them (i.e. in blood and lymph vessels). It is also crucial for nerve impulse conduction and muscle contractions.

The
for s
from

It can be easily removed from the body – i.e. with urine, sweat and tears. That is

Its main source is kitchen salt, but it is also present in large amounts in ham, saus
and meats, bread, and savoury snacks such as crackers.

Therefore, it is extremely rare to observe sodium deficien evertheless, if it happens (e.g. as a result of excessive sweating aft g a marathon), it causes such symptoms as headaches, deh or d a drop in blood pressure.

Much more important – s us – is its excessive use, which can lead to h te creased blood pressure), circulatory system dise cluding heart failure) and kidney diseases.

Healthy people should eat no more than 1600 mg of sodium daily, which is equivalent to around 4.0 g of kitchen salt (the maximum safe level of salt consumption has been set at 6.0 g a day).

A

Thin
to d
salt i

Research

Read the labels of chosen products (such as ham, Cheddar, hotdogs, sauerkrau and try to assess how many of them you can eat without exceeding the daily i

Apply

Salt is very important for the taste of a meal, but did you know that you can replace it by using herbs and spices? Try to find out which of them will help you obtain a low-salt, healthy and tasty meal.

Did yo

Salt can be acquire as well as from the Pink salt is source sites in the world Poland.

[4] Sodium is not required by specification but is discussed here as improper intake of Sodi public health in the UK.

Iodine

Iodine is a chemical element necessary for the proper performance of the thyroid gland. It occurs in some quantities in sea water. A lack of iodine can have major health consequences (see table below) and, therefore, in many countries it is obligatory to fortify salt with iodine to prevent the problems of deficiency.

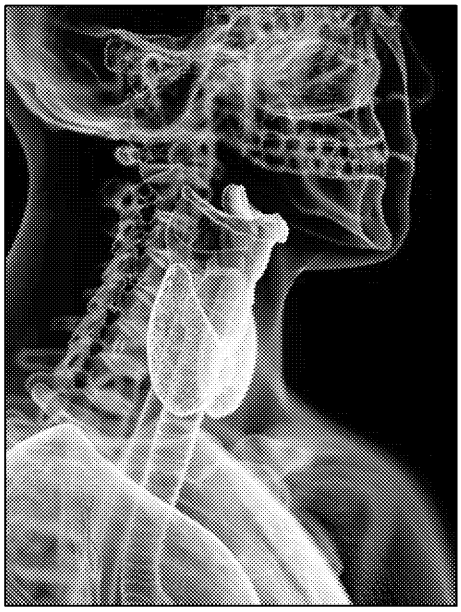
Did you k

Iodine was supplen
countries affected
to prevent thyroid
degeneration. It is

FUNCTIONS	
• necessary for the thyroid gland • regulates growth and development • regulates metabolism • regulates body temperature	• fortified salt and • sea fish and seafo • can be inhaled (e seaside)
• lack of ce and difficulty rem ng things • during pregnancy, immaturity of the brain in the baby	• nausea, diarrhoe • goitre (enlarged t • cancer • heart failure

Study tip

You can easily provide your body with iodine by simply breathing in the air at the seaside.



The thyroid gland lies at the front of the neck

Potassium

Potassium, along with calcium, sodium, chloride and magnesium, is an important electrolyte, which means it helps to conduct electrical impulses in the body. Together with sodium it controls the blood pressure – although, while sodium increases it, potassium helps to lower it. It is also crucial for the proper contraction of muscles, including the heart.

D

Potass
memb
allowi
tastes

FUNCTIONS

- controls blood pressure
- necessary for muscle contractions
- controls heart activity
- supports production of proteins

S

- potatoes, yams
- milk, chocolate
- bananas, avocado
- nuts, dried fruit

DEF

- weak
- abnc eart rate and arrhythmia
- paraly of the respiratory system
- hypertension

- nausea and vomi
- breathing difficul
- chest pain
- irregular heartbea
- paralysis and hea
have excess potas

All people over 15 years old should consume up to 3500 mg of potassium a day with their diet.

M
el
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wi
ric

Magnesium

Magnesium is a mineral necessary for carrying out hundreds of live functions in the body, including formation of the DNA strands. Magnesium absorption in the intestines is affected by high protein intake.

FUNCTIONS

- synthesis of energy
- building DNA
- muscle contractions
- increases bowel movements

S

- vegetables, espe
(e.g. spinach)
- nuts and cereals,
- mineral water

DEFICIENCY

- painful muscle contractions
- abnormal heart rate
- increased blood pressure

- nausea and vomi
- diarrhoea
- very low blood p
- slow heartbeat

Reference Nutrient Int agnesium in mg/day

		Women
11–14	280	
15–18	300	
19+	300	270

Di

Magnesiu
Epsom s
through

Research

Go to **zzed.uk/8255-nutrition-data** and list the five foods with the highest m
the five foods with the lowest magnesium content.

Check your understanding: M

1. Which statement about minerals is UNTRUE? (*1 mark*)
   a. They are usually needed in smaller amounts than vitamins.
   b. They are usually needed in bigger amounts than vitamins.
   c. They are necessary for a number of bodily functions.
   d. They are usually present in food and water.

2. What may be the effect of iron deficiency? *(1 mark)*
   a. loss of teeth ☐ c. loss of immunity
   b. increased growth of hair ☐ d. darkening of the sk

3. Which of the foll… contains the most magnesium? *(1 mark)*
   a. …in… ☐ c. bacon
   …eberries ☐ d. cream cheese

4. Potassium excess can cause… *(1 mark)*
   a. decreased blood pressure ☐ c. hypertension
   b. tooth decay ☐ d. brittle bone disease

5. Cereals are a rich source of minerals. Identify two minerals found in c…

   1. .....

   2. .....

6. For one of the minerals given in Q5, state two of its functions in the b…

   Mineral 1 .....

   .....

   .....

   Mineral 2 .....

   .....

   .....

7. Explain how deficiency or exces… …nerals can lead to hypertension

   .....

   .....

   .....

   .....

   .....

   .....

Water

Water (**hydrogen oxide**) is a chemical compound made of one atom of oxygen an
occurs in nature in three physical states – solid (ice), liquid (water) and gas (vapo
substance on Earth – oceans cover 70% of the planet's surface!

Water is an important solvent for many different substances, such as minerals an

It also has many applications: it is used to drink, to wash and clean, to water plan
goods (from food to steel), to heat our houses and to extinguish fire.

Why is hydration important?

Water is necessary for survival – there is no questioni g t No living organism ca
present in every cell – and beyond it (think of blo d a lymph).

What exactly do we need w er?

- It dissolv sub e (such as vitamins and minerals) and transports them a th body.
- It helps ve waste and toxins (think about urine).
- It is necessary in many chemical processes – both as an ingredient and as the environment in which to perform them.
- It helps maintain stable body heat (remember how you sweat on hot days).
- It keeps our tissues nice and moist (dry eye syndrome is not pleasant).
- It provides us with a number of minerals, including calcium and magnesium.
- It helps to swallow food.
- It ensures proper working of the colon and helps avoid constipation.

How do we lose water?	How d
With sweat	Drinking water,
With body waste (stool and urine)	E
While breathing (think about that white cloud you breathe out on a cold day)	Eating fr

It is necessary to keep the balance between water loss and water intake. Ideally, t
teenager or adult should consume at least 1.5 litres of water a day – including all
the meals.

Sometimes extra fluid is needed – especially on hot da s to counteract the effects of excessive sweating. Extra doses of wate ar also recommended if you have a fever and/or diarrhoea. Larger a ou t of water (up to 2.5 litres) also help lose weight, so remembe drin k more while on a diet.

Deficiency of water is called *dehydration*. When dehydrated, you can observe that your skin is dry and wrinkled, you have dark patches around the eyes, your eyes are sunken, you use the toilet less often and the urine is very dark. Dehydration occurs as an effect of insufficient water supply and in response to excessive sweating.

Did

Wate
75% o
newb
50% i

Sources of water

You already know that water can be derived not only from drinks (liquids), but also from food. The table below shows how much water is present in chosen food commodities.

Ne
are
deh

Ingredient	% of water	Ingredient
White bre	36.1	Milk, whole
Chicken br aked	51.6	Cheddar cheese
White pasta, cooked	61.5	Eggs, whole, boiled
Carrots, raw	89.0	Chickpeas, boiled
Green peas, boiled	75.6	Potatoes, boiled
Cucumber, raw	96.5	Salmon, baked
Lettuce, raw	96.1	Parsnips, boiled

Different types of water

When shopping, you may have noticed that there are different brands and types of water. But do they really differ? UK legislation differentiates between bottled water, tap water and soft drinks with 'water' in the name. Bottled water can be further divided into mineral water, spring water and table water. Natural mineral water has to come from a natural source and be suitable for drinking without any treatment (except for adding CO_2 to make it sparkle). Spring waters must come from natural underground sources and can undergo some treatment, e.g. removal of some minerals or undesirable substanc water and bottled. Each type of water has a different mineral composition, and, t bring additional benefits to certain people. For example, water which is high in ca teenagers and sportsmen, but it is best avoided by somebody with kidney stones

Did

Hard
and n
residu
limes

There is a variety of bottled waters, and each of them brings different health benefits

Research

Go to a food store and try to find m
low (up to 500 mg), medium (from 5
(above 1501 mg) mineral content. Y
whether they taste different.

Check your understanding:

1. Which one of the following allows the biggest water loss? *(1 mark)*

   a. spitting ☐ c. urinating
   b. crying ☐ d. bleeding from a

2. Which ingredients are usually found in water? *(1 mark)*

   a. calcium and magnesium ☐ c. magnesium and
   b. calcium and sugar ☐ d. calcium and se

3. Which is the best way of providing water to the body? *(1 mark)*

   a. eating vegetables ☐ c. drinking soda
   b. drinking water ☐ d. eating fruit

4. List three functions of water for the human organism. (6 *marks*)

   1 .....

   .....

   2 .....

   .....

   3 .....

   .....

5. Explain how running a marathon on a hot day will affect water balance and offer advice on how to improve that balance. *(4 marks)*

   .....

   .....

   .....

   .....

Complementary actions of n

Various nutrients are present in different amounts in foods. In the human digesti
changes, so that they can be broken down and absorbed into the bloodstream. H
action of nutrients can be affected by other nutrients. We already discussed thes
Course Companion, so use this as a reminder when thinking about complementa
preparing for your exams.

Protein complementation

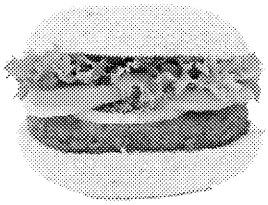
In many cultures and cuisines, different foods are often eaten together. This is no
diet or a pleasant taste, but is also based on principles of n tion. Eating grains t
helps to deliver essential amino acids. Amino acid essary to synthesise p
However, a protein is not built of one typ amino acid only – instead, it is nece
almost all amino acids to build a p , working protein. For that reason, if the
amino acid, a protein can d – even if there is an abundance of other ar

An exampl te complementation is Mexican tortilla, where the bread, wh
maize), is se ith pulses (red kidney beans), which are high in lysine.

Vitamin D, phosphorus and calcium

Vitamin D, phosphorus and calcium are necessary for maintaining bone health. Vitamin D is necessary for absorbing calcium and phosphorus from food in the intestines. In fact, a high-calcium diet will be useless if it is too low in vitamin D! Phosphorus combines with calcium to build the strong structure which forms the bones. If there is excess phosphorus, it binds with calcium and lowers the calcium level in the blood – resulting in high blood pressure and other health issues. To restore the correct level of cal the bones – and, therefore, they become brittle and easy to break. In addition, p can form plaque, which sticks to the walls of blood vessels and can increase the r

R
Res
cal
bal



Meat is often served accompanied by a salad. Vitamin C from vegetables significantly increases the absorption of iron from meat.

Iron and vitamin C

Iron is necessary for building haemoglob
Without it, oxygen cannot be transporte
affects many live processes. Iron is usual
amounts – usually only 20% to 35% of iro
in the intestine. This amount can be incre
C. Moreover, vitamin C is also needed to
blood vessels – so if there is not enough
absorbed, and the red blood cells cannot

Dietary fibre and water

Dietary fibre has the ability to absorb water – as a res it can bulk up in the stomach, giving the feeling of sati ro ger, and it can pass easily through the intestines. Lack of w ter will cause constipation, as the fibre will not bulk up properly, the muscles in the bowels will struggle to push it forward. Additionally, water also provides certain amounts of magnesium and calcium, absorption of which can be affected in high-fibre diets.

Dietary fibre and minerals

High consumption of dietary fibre can affect absorption of certain minerals, such
zinc in the intestine.

Vitamins and fats

Vitamins such as A, D, E and K are fat-soluble. This means that they can only be abso
they are often present in plant foods, such as leafy green vegetables, it is advisable t
dressing or a sauce containing fat (e.g. vegetable oil), as otherwise the vitamins may

Folic acid and vitamin B12

Folate and vitamin B12 are both involved in production of red blood cells. What'
absorbed without vitamin B12 (so a deficiency may occur even if your diet is very
hand, vitamin B12 can only be absorbed in the presence of a special protein proc
this protein will cause vitamin B12 deficiency in the body even if your diet is rich
anaemia develops as a result of vitamin B12 deficiency (usually because the imm
cells which enable vitamin B12 absorption), and megaloblastic anaemia develops

Sodium and potassium

Sodium and potassium are necessary to maintain liquid levels in the body and cont
between the two can result in very high or very low blood pressure, which can have
stroke, loss of consciousness). This is because sodium has the ability to retain wate
removed with urine and, therefore, the volume of blood increases. On the other ha
to remove sodium from the body (together with water), so the blood volume decr

Niacin and tryptophan

Tryptophan is one of the essential amino acids – this means that it cannot be bui
body and has to be provided as a part of a healthy diet. However, once absorbed
niacin (vitamin B3). So even if your diet is low in niacin, it is still possible that you
using the tryptophan from food to make it!

Calcium and magnesium

You already know that calcium works with vitamin D and phosphorus to ensure b
friendly mineral – it also cooperates with magnesium to ensure that your muscles
minerals are involved in a number of physiological processes:

- contraction and relaxation of muscle fibres
- contraction and relaxation of blood vessels (which help to control blood pre
- regulation of heart contractions
- conduction of nerve impulses

It is important to keep the balance between the two, as increased magnesium wi
blood, which will then be taken from the bones, weakening them. A low level of
amount of calcium in the blood, and that can result in the painful cramps in your

Omega-6 and omega-3 fatty acids

Omega-6 and omega-3 are essential fatty acids – this means that they cannot be
built from scratch by your body and you need to provide them as a part of a
healthy diet. The two types of fatty acids are processed in the body by the same
enzymes, and it is necessary to consume them in the correct proportion so that
metabolism of one is not affected by the other. Ideally, they should come from
the diet in a ratio of 3:1 respectively. This means that for every three grams of
omega-6 fatty acids you should consume one gram of omega-3 fatty acids. An
excess of omega-6 is associated with an increased risk of arthritis (inflammation
of joints) and some cancers (e.g. breast cancer and prostate cancer). A typical
British diet is very rich in omega-6 fatty acids, and it is necessary to modify
eating habits to incorporate more omega-3 fatty acids into the diet.

As you can see above, a balanced diet is key for maintaining he
of a nutrient can result in health issues. When planning a diet,
good thing is a bad thing!

Check your understandi
Complementary actions of n

1. Which one of the following inhibits iron absorption? (*1 mark*)

   a. dietary fibre ☐ c. vitamin C
   b. calcium ☐ d. vitamin D

2. Which mineral works with calcium to enable muscle contractions? (*1 m*

   a. iodine ☐ c. vitamin D
   b. phosphorus ☐ d. magnesium

3. Which is the correct proportion of omega-6 and omega-3 fatty acids i

   a. 5:1 ☐ c. 3:1
   b. ☐ d. 10:1

4. Identify two dietary causes of anaemia. (*2 marks*)

   1. .....

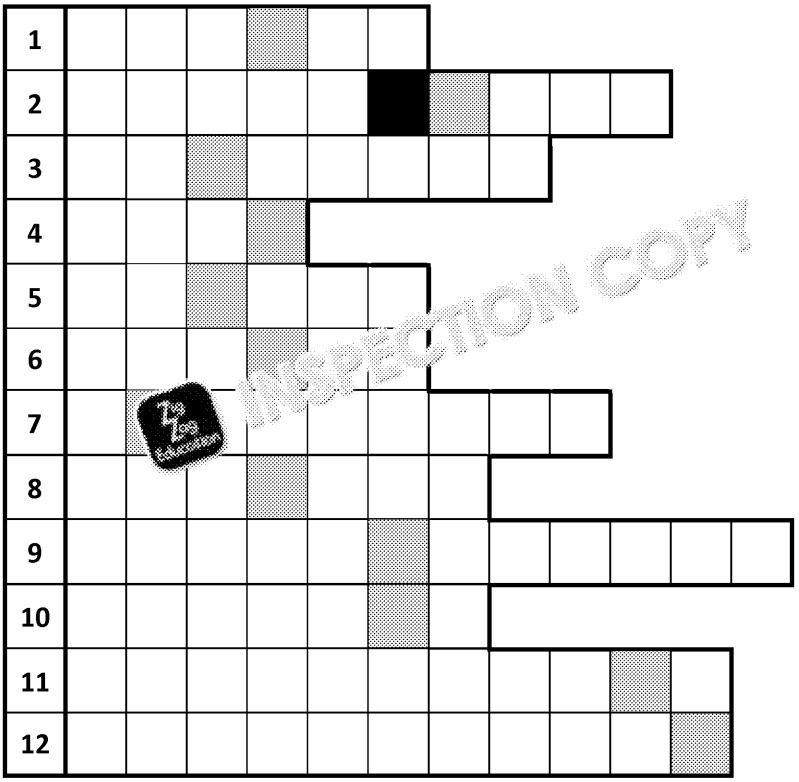
   2. .....

5. Identify two negative effects of high fibre consumption for health. (*4 m*

   1. .....

   2. .....

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



1. The hardest natural substance in the human body (6)
2. Its deficiency can cause spina bifida disease in newborns (5, 4)
3. Caused by niacin deficiency, its symptoms are known as 4D syndrome (8)
4. Where vitamin D is produced in the body (4)
5. Effect of vitamin C deficiency, in which gums are receding and bleeding (6)
6. Swelling of the thyroid gland caused by iodine deficiency (6)
7. Irregular heartbeat caused by magnesium and calcium imbalance (9)
8. Form of vitamin A present in animal-derived foods (7)
9. Cardiac condition caused by low potassium and high sodium levels (12)
10. Gland which uses iodine to control metabolism (7)
11. Term used to describe the lack of water in the body (11)
12. Red pigment in the red blood cells, built from iron (11)

The shaded squares reveal this word:

_ _

Protein

Things to think about: (p. 5)
You can replace the beef in the steak pie and the lamb in the shepherd's pie with eith
soy and its derivatives (such as soy chunks, tempeh or tofu).

Things to think about: (p.5)
Quorn is not suitable for vegans because it contains egg white. It is suitable for veget

Things to think about: (p. 6)
People at the highest risk of developing protein deficiency a [illegible]se who do not eat e
value, either because of food shortages (e.g. in poor [illegible]or during war) or beca
badly managed vegetarian/vegan diet).

Things to think about: (p. 7)
The need for protein g[illegible] in periods of active growth, e.g. during adolescen
protein bec[illegible] are bigger, heavier and contain more muscles. On the o
protein whi[illegible]ant and during breastfeeding because of the growth and develop
sportspeople [illegible]as bodybuilders) require more protein to build the desired musc

Check your understanding
1) B **2)** B **3)** D **4)** C (1 mark for each correct, max. 4 mark

5) Soya and quinoa. Accept other suitable answers. (1 mark for each correct, max.

6) 1 mark for each correct statement, max. 2 marks:
- essential amino acids cannot be made by the human body from scratch, wh
- essential amino acids have to be provided through the diet, while non-esse
substances

7) 2 marks for a detailed description, 1 mark for a basic description (max. 2 marks)
Answers could include reference to:
- proteins are built of thousands of amino acids bonded together, and acid (l
destroy the chemical bonds within protein molecules
- once the chemical bonds are damaged, the protein molecules begin to unco
protein molecule begins to be damaged
- acid and heat cause denaturation, and the process is irreversible
- concentration of the acid plays an important role: the higher the concentra
the faster the process will occur
- the time of cooking/heating is also important: the longer the protein is hea
becomes
- if protein is overcooked/overheated, it shrinks and pushes out water; this i

Fats, Oils and Lipids

Things to think about: (p. 13)

High fat	
Pork, beef, lamb, duck or goose	Chicken, turkey
Salmon, eel, trout, herrin[illegible] pilchard	Cod, halibut, plaice, car
Cheese, wh[illegible]lk, [illegible], butter	Cottage cheese, low-fat buttermilk

Check your understanding
1) C **2)** C **3)** B **4)** C (1 mark for each correct, max. 4 mark

5) Any two from: (1 mark for each correct, max. 2 marks)
- palm oil
- palm kernel oil
- cocoa butter
- coconut oil

6) 1 mark for correct identification of a preparation or cooking method (max. 2 ma
1 mark for correct description/explanation of how it helps to reduce the fat con
Answers could include:

- **Removing skin from chicken breast or thighs –** the fat usually accumulat
skin we also remove the excess fat, and only the lean meat is left
- **Grilling, baking –** excess fat will melt and drip off the food, so the final dish
- **Skimming fat off a liquid –** this can be applied to, e.g. chicken broth, where
off the surface of the broth; another example is skimmed milk, from which f
and butter
- **Trimming –** cutting off the visible fat, e.g. from ham or pork chops will help
- **Using egg whites only –** in eggs, fat is accumulated in the yolk only, so usin
possible) will help to lower the total amount of fat in the dish
- Or any other suitable example

7) 1 mark for each correct effect of deficiency (max. 2 m
1 mark for each correct explanation (max. 2 ma rks

Effect of deficiency	Explanation
Loss of b dy w t	s fat is accumulated in the body in the form of adi eficient, the body will use the reserve, and this will lea adipose tissue).
Vitamin deficiency	Fat is a solvent for vitamins such as vitamins A and D. L these vitamins cannot dissolve and cannot be absorbed to deficiencies.
Dry skin and keratosis	Fat, together with proteins, is used to build cell membra cell membranes cannot be built, and, therefore, the cond
Decrease of immunity	Fat stimulates production of antibodies. Lack of fat me built, leading to a decrease in immunity.
Growth disorders	Fat is used to build growth hormones. Fat deficiency m be built, and, therefore, growth may be arrested.
Infertility	Fat is used to build sex hormones. Fat deficiency mean built, which may result in infertility (due to arrest in th Also, fat-soluble vitamin E is necessary for production o lead to deficiency of this vitamin, leading to infertility.

Other correct answers may be accepted.

Carbohydrates and dietary fibre

Things to think about: (p. 17)
Although fruits are usually rich in sugars, they also contain fibre, which slows down
blood sugar level does not rise as dramatically as after eating sugar alone (or sweets).

Things to think about: (p. 18)
It is possible to increase the amount of fibre in many ways; for example, by replacing
bread and using brown or red rice instead of white rice. It is also possible by using w
preparing a dough, as well as by choosing fibre-rich produc with the bread (e.g.
jam) or rice (e.g. adding more vegetables to a curry or

Check your understanding
1) A **2)** C **3)** B **4)** D (1 mark for each correct, max. 4 mark

5) 1 mark for ach max. 2 marks
Any tw

- reg bowel movements
- prevents constipation
- prevents diarrhoea
- helps to prevent bowel cancer
- helps to prevent diverticulitis
- lowers blood cholesterol levels
- lowers blood sugar levels
- helps to prevent type 2 diabetes
- helps to maintain healthy body weight
- gives the feeling of satiety
- or any other suitable answer

6) 1 mark for identifying whether the juice can be drunk instead of eating fresh fru
1 mark for the relevant explanation (max. 1 mark)
Indicative content:

- Fruit juice should NOT be drunk instead of eating fresh fruit.
- This is because juice is deprived of dietary fibre, and is a source of free suga to increased blood sugar levels, and increases the risk of obesity, type 2 dia

7) 1 mark for each correct reason (max. 2 marks)
1 mark for each relevant explanation (max. 2 marks)
Indicative content:

Reason	Explanation
Wholemeal bread has more dietary fibre	Dietary fibre is necessary for a number of funct movements, slows down ab sorption of sugars a For these reasons, e holemeal bread ma type 2 diabete an b ercholesterolemia / ath dise
Wholemeal bread has sug	h consumption of sugar is linked to increase and tooth decay. Eating wholemeal bread mea sugars, and that the risk of developing these co
Whole read is naturally rich in minerals and vitamins	During milling, the bran is mixed together with wholemeal bread contains high levels of iron, c wholemeal bread can be used in the preventio anaemia, osteoporosis or beriberi.

Other suitable answers may be accepted.

Quiz-ine

1. Sparer
2. Quinoa
3. Insoluble
4. Triglyceride
5. Trans
6. Avocado
7. Lactose
8. Hypoglycaemia
9. Cholesterol
10. Amino acids
11. Energy
12. High
13. Double
14. Vegan
15. Lysine

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

Vitamins

Things to think about: (p. 23)
Whole milk has more fat than skimmed milk, and fat is necessary for vitamin A to dis
law to make up for this change and restore its nutritional value lost during processin
of vitamin A in the population.

Things to think about: (p. 23)
Offal (such as liver) is usually very rich in vitamin A. It is not recommended during p
of vitamin A may be harmful for the baby, resulting in congenital defects of various b
the skull).

Things to think about: (p. 24)

Functi… f vi… in D	Pote…
Helps regenerate neur… …ay a role in sleeping and keeping a good moo… …re … depression	Insomnia; lo…
Regulates b… …pressure and prevents heart failure	High blood p… attack
Helps bone marrow cells and increases immunity, especially in autoimmune diseases such as multiple sclerosis	Low immun… diseases
Together with calcium, ensures proper growth and development of bones and teeth	Rickets; brit…
Increases muscle weight and power	Decrease in …
Improves insulin secretion and glucose tolerance, preventing type 2 diabetes	Increased ri…
Increases production of sperm cells and, therefore, ameliorates fertility	Increased ri…
Is an important antioxidant, lowers the risk of cancer	Increased ri…

Things to think about: (p. 27)
Vitamin K helps maintain proper blood clotting. Newborns have very delicate blood v
greater risk of haemorrhages. Vitamin K shots prevent this from happening.

Things to think about: (p. 29)
Meat (especially red meat) is rich in iron. Vegetables are usually rich in vitamin C. V…
meat along with a salad increases the amount of iron ingested.

Things to think about: (p. 29)
Vitamins are usually not sensitive to low temperatures, but are destroyed at high ten…
will maintain almost all of the vitamins. Preparing a preserve involves cooking, and l…
process will destroy some of the vitamins. Therefore, there are more vitamins in fro…

Check your understanding
1) D **2)** D **3)** D **4)** C **5)** … (1 mark for each correct…

6) 1 mark for each correct row, only one source for each vitamin needs to be provi

Vitamin	Source
Vitamin B1 (thiamine)	• whole grains • yeast (including Marmite®) • liver • lean meat
Vitamin B2 (riboflavin)	• yeast • liver • cheese • green leafy vegetables, such as spinach o
Vitamin B3 (niacin)	• meat • nuts and see • whole g ain • f d cereals and flour • ish (e.g. tuna and mackerel) • eggs • cottage cheese • yeast • broccoli
Vitamin B9 (folic acid)	• yeast • whole grains • fortified cereals and flour • spinach • broccoli
Vitamin B12 (cobalamin)	• liver • milk • meat • eggs • cheese • fish (e.g. salmon and cod)
Vitamin C (ascorbic acid)	Fruits and vegetables, such as: • potatoes • bell peppers • tomatoes • strawberries • blackcurrants • citrus fruits (oranges, lemons, etc.) • parsley • cabbage

Other suitable answers may be accepted.

7) 1 mark for a reason (max. 1 mark)
1 mark for the relevant explanation (max. 1 mark)
Indicative content:

- Reason: because some vitami [illegible] are fat-soluble
- Explanation: if there is [illegible] fat [illegible] vitamins cannot dissolve, hence they are e
  cannot be abso [illegible] properly; as the vitamins cannot be absorbed, the body
  to [illegible]

*Vitam [illegible] d K are also fat-soluble and can be referred to in the answer (hov
specifica [illegible]

Things to think about: (p. 34)

1. Girls are usually smaller and shorter and have thinner bones than boys so they ne

2. During ham and sausage preparation, phosphorus solutions are used as stabilisers phosphorus in meat preserves but lower amounts are found in fresh/unprocesse

Things to think about: (p. 35)

Girls and women menstruate and lose some of their blood every month; therefore, th it. Their need for iron drops after their 50th birthday (approximately) due to the me bleeding stops and a woman loses her ability to conceive (get pregnant)).

Check your understanding

1) A **2)** C **3)** A **4)** A (1 ma[illegible] r [illegible]h correct, max. 4 mark

5) 1 mark for each correct, max. 2 mark

Any two from:

- phosphorus
- iron
- ma[illegible]n
- also [illegible] amounts of calcium and sodium

6) 1 mark for each correct function; students need to provide one function for eac

Phosphorus	• Strengthens bones and teeth • Takes part in metabolism and energy transfer • Builds DNA strands
Iron	• Builds haemoglobin and helps to transport oxygen aroun • Increases immunity • Reduces tiredness
Magnesium	• Supports production of energy in cells • Helps to build DNA strands • Necessary for muscle contractions • Increases bowel movements
Calcium	• Builds strong bones and teeth • Helps to control blood pressure • Important electrolyte • Conducts impulses in the muscles
Sodium	• Important electrolyte • Conducts impulses to and from the cells • Maintains blood pressure

Other suitable answers may be accepted.

7) 1 mark for each correct statement, max. 2 marks

Indicative content:

- high levels of sodium increase water rete[illegible]ti[illegible]n the body, and the increas higher blood pressure
- low levels of potassium i[illegible]s[illegible]ter retention in the body, and the incre higher blood pres[illegible]
- low [illegible]ne[illegible] high calcium levels will cause high blood pressure

*Sodiu[illegible]t r[illegible]aired by the specification; however, we mention it as a crucia which l[illegible] hypertension and increases the risk of heart attack / stroke – the Chapter 1 of this resource

Water

Check your understanding

1) C **2)** A **3)** B (1 mark for each correct, max. 3 marks)

4) 1 mark for each correct function (max. 3 marks)
1 mark for each relevant explanation (max. 3 marks)

Function	Explanati
Helps eliminate waste	• Water is a solvent for many substance metabolism. These are removed from • Water also softens the stool, making it the body.
Helps eliminate toxins	Water dissolves toxin and helps to remov
Helps cool down	During physical activity or hot weather, w sweat. By evaporating from the skin's sur to cool and prevents heat stroke.
Helps swallow foods	Water makes food easier to swallow by ma amount of friction between the food and t
Dissolves minerals and vitamins	Water is a solvent for vitamins (B group vita as a result, they can be absorbed in the intes
Facilitates digestion	Water forms part of saliva and gastric juic responsible for breaking down nutrients. amounts of these liquids can be produced allowing for proper digestion.

Other suitable answers may be accepted.

5) Any four from:
- Hot weather and physical activity increase sweating.
- With sweat, a person loses water and micronutrients such as sodium.
- This can lead to dehydration.
- To prevent this, the runner should drink plenty of water.
- Isotonic beverages are also advisable.
- It is also advisable to add a little salt to the water to balance the sodium lev

Complementary actions of nutrients

Check your understanding

1) A **2)** D **3)** C (1 mark for each correct, max. 3 marks)

4) 1 mark for each correct, with or without description, max. 2 marks
Any two from:
- Lack of folic acid in the diet
- Impaired absorption of folic acid in the intestines, e.g. as a result of a diseas disease)
- Lack of vitamin B12, which affects folic acid absorption and metabolism
- Lack of iron in the diet
- Impaired absorption of iron from food, e.g. due to lack of vitamin C, high am form of iron
- Lack of vitamin C in the diet to improve absorption of iron
- Or any other suitable answer

5) 1 mark for each correct, max. 2 marks
Any two from:
- Constipation
- Impaired absorption of calcium
- Impaired absorption of iron
- Impaired absorption of zinc
- Impaired absorption of magnesium
- Or any other suitable answer

Quiz-ine

1. Enamel
2. Folic acid
3. Pellagra
4. Skin
5. Scurvy
6. Goitre
7. Arrhythmia
8. Retinol
9. Hypertension
10. Thyroid
11. Dehydration
12. Haemoglobin

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