Carbohydrate —as a macro nutrient

Key Words

Photosynthesis: The process by which green plants trap energy from the sun and form carbohydrates
Sugars: a group of carbohydrates that taste sweet
Monosaccharides: a group of sugars made up of one sugar molecule
Disaccharides: a group of sugars made up of two sugar molecules
Polysaccharides: (Complex carbohydrates): a group of carbohydrates made up of many sugar molecules joined together but do not taste sweet
Glucose: the carbohydrate the body uses for energy production during respiration
Non starch polysaccharide: also known as dietary fibre. Bulks to the digestive system so that waste food moves along and is removed easily
Insoluble fibre: dietary fibre which helps prevent constipation
Soluble fibre: dietary fibre which helps reduce cholesterol

What they are and what they are made of:

•A macronutrient found in plant foods. The process by which plants make carbohydrates is photosynthesis
•Carbohydrates are classified into two main groups: sugars and complex carbohydrates
•Sugars: a group of carbohydrates tasting sweet. Plants produce 2 types during photosynthesis:
-Monosaccharides: one sugar molecule. Fructose, glucose, galactose
-Disaccharides: two sugar molecules. Sucrose, maltose, lactose
Complex carbohydrates: Do not taste sweet. Plants produce several types called **Polysaccharides**: Starch, pectin, dextrin, dietary fibre (also called non starch polysaccharide NSP) Also glycogen (made in mammals and humans) from the foods eaten.

Functions in the body (what they do in the body)

•Main energy source
•NSP (insoluble fibre) helps the body get rid of waste products: NSP helps to produce soft, bulky faeces (solid waste) which are easy to pass out of our body when we go to the toilet. Keeps digestive system healthy; controls weight; helps us feel fuller for longer. Soluble fibre (oats, nuts, peas, beans, lentils, prunes, bananas, pears, sweet potatoes + carrots slows down digestion and absorption of carbs. So helps to control blood sugar levels, which helps you stop feeling hungry. Could help reduce cholesterol levels.

Effects of deficiency: This is rare in the U.K.

•Lack of weight, tiredness
•Severe weakness
•Not enough NSP = constipation. May lead to cancer of the bowel

Sources:
Sugar: monosaccharides
Glucose: ripe fruit + veg. Available in drinks, tablets + powders.
Fructose: fruits, veg. + honey. Sweetener (HFCS) High Fructose Corn Syrup used as a sweetener in processed foods)
Galactose: milk from mammals.
Sugar: Disaccharides
Maltose: Cereals e.g. barley
Sucrose: extracted from sugar cane. AKA sugar.
Lactose: milk from mammals and products made from it e.g. yogurt, cheese)
Complex carbohydrates:
Starch: cereals e.g. wheat, oats, barley + maize and cereal products e.g. breakfast cereals, pasta, bread); starchy veg. e.g. potatoes, yams, parsnip, peas + butternut squash
NSP: wholegrain cereal + cereal products e.g. breakfast cereal + pasta. Veg. fruit, pulses
Pectin: some fruits e.g. oranges, apples, plums + apricots + some root veg. e.g. carrots

Amount needed for different life stages Is calculated as a percentage of total daily energy intake. Rather than by weight (except NSP). The energy value of carbohydrate is 3.75g/16kJ of energy.

From 2 years+ this is the recommended intake:

Type of carbohydrate	% of food energy per day
Total carbohydrate	50%
Free sugars	No more than 5% of total carb. intake. Meaning no more than: (tsp. = teaspoons) 19g/day (4 tsp.) free sugars children 4 – 6 years 24g/day (5 tsp) children 7 – 10 years 30g/day (6 tsp) for children11 **and** adults
Non Starch Polysaccharide (NSP) dietary fibre	**Adults:** at least 30g each day **Children**: each day **2 – 5**: 15g **5 – 11**: 20g **11 – 16**: 25g **16 – 18**: 30g

Effects of excess: If the diet has more energy (carbs) than it needs, the body converts and stores as fat.
Refined and processed:
•Refined carbohydrates are quickly broken down + absorbed by the body. = rapid rise in the blood sugar level. If eaten frequently throughout the day, over a period of time, = stress on the pancreas (produces hormone – insulin). Insulin allows glucose to enter body cells to use it for energy. Eventually the pancreas may stop working or its cells may become resistant to insulin so Type 2 diabetes may result.
•Too much NSP could result in the body not being able to absorb iron and calcium.
•Sugar might = tooth decay. Sugars released from foods or commercially added are set free. (Inside unprocessed foods they are intrinsic)

Watch out for: Hidden sugars mainly in processed foods: Look for these names – Molasses, Glucose syrup, Glucose-fructose syrup, treacle, maltose, fructose, sugar cane, sucrose, granulated sugar.

Carbohydrates —Functional and chemical properties

Key words:

Caramelisation: The breaking up of sucrose (sugar) molecules when heated = a change in colour, flavour + texture of the sugar as it turns into a caramel.

Dextrinisation: The breaking up of starch molecules into smaller groups of glucose molecules when they are exposed to dry heat

Gelatinisation: the swelling of starch granules when they are cooked with a liquid to the point where they burst and release starch molecules

Dextrinisation:

when foods containing starch e.g. bread, cakes, biscuits, scones and pastries are cooked using dry heat e.g. baking = grilling, they change to a brown colour on the outside.
Dry heat (oven/grill) causes starch to change colour, texture and flavour.

The starch molecules break down to change to dextrin (a smaller group of glucose molecules)

Caramelisation

Sugar (sucrose) used for cooking (disaccharide made from glucose + fructose) is heated and melts to a syrup. The syrup boils. It is important **not to stir** the syrup as it caramelises.
The sucrose molecules break up and water molecules are formed.
As heating continues, water evaporates, the syrup gets thicker and changes from a colourless and clear syrup to a golden brown
caramel. If you stir, the sugar will **crystallise** into large, hard lumps. The ideal temperature of caramelising sugar is 160°C to 170°C.
It will eventually burn and become bitter if cooked for too long
because too much water is driven off and carbon is left behind, which makes the caramel dark and bitter.

Foods that contain natural (intrinsic) sugar e.g. onions (glucose, fructose) which they store during growth will caramelise. When sautéing (means frying them gently in oil for several minutes (the
structure of the onion softens and breaks down and the sugars are released. The heat changes the sugars in the onions and caramelises them, so that they turn a golden -brown colour and develop a characteristic flavour.

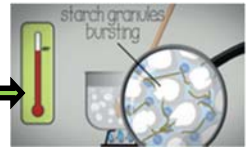
Gelatinisation—What happens:

Starch is found in small packets (granules).

Starch molecules are made of thousands of glucose molecules joined in **long straight** chains or **short chains with branches.** They sink to the bottom of cold liquids. If not stirred = lumps.

When **heated** to 60°C starch granules absorb water and swell up = the sauce starts to **thicken**, because there is less room for the starch granules to move around

At 80°C starch granules are very swollen and start to burst, letting starch out into the liquid.



At 100C the starch molecules form a 3D network that traps water stopping them moving around so much. At 100°C the liquid completely thickens – it has gelatinised.

As it cools the starch molecules form longer chains and the water molecules stay trapped so it becomes a solid gel.

Sauces must be stirred all the time to prevent starch granules sticking together at bottom of pan where they will swell up, stick together and make lumps

As the sauce cools down the starch molecules start to form longer chains and the water molecules stay trapped inside them so the sauce gradually becomes a **solid gel.**

If the sauce is not stirred, the starch granules will stay at the bottom of the pan whilst this is happening and will stick together and to the bottom of the pan, where some of them may burn. The sauce will have an unpleasant texture because the starch granules will have formed lumps as they swelled and they will not be distributed throughout the sauce.

Key Words

Hydrated: the body has enough water

Dehydrated: the body does not have enough water

Functions in the body:

- All cells, bodily fluids (e.g. saliva, blood, urine, digestive juices) and body tissues contain water
- Controls body temperature.
- Needed for chemical reactions in body.
- Keeps skin moist and healthy
- Removes waste products from body.

Sources:

- Drinking water (tap water).
- Naturally found in many foods (e.g. milk, milk products, fruit, vegetables, meat, fish, eggs).
- Added to many foods during preparation, cooking and processing(e.g. soup, sauces, pastries, breads, boiled rice, pasta, beans, pulses etc.).

Effects of excess:

- Substances in the blood become over-diluted.
- Vital organs in the body start to fail, e.g. heart, kidneys.
- May cause death.

Effects of deficiency:

- Thirst—the brain detects when the body is thirsty + sends a message to the mouth
- Headache—blood pressure is concentrated so as it passes through the brain results in a headache
- Dehydration – urine becomes very dark. Should be very pale yellow in colour
- Feeling weak and sick as the body's normal chemical reactions are affected
- Body overheats as it cannot cool itself down
- Confusion as dehydration affects how the brain works
- Blood pressure and heart rate change as volume of blood is reduced

Water

Amount needed for different life stages

In the U.K it is recommended people drink 1—2 litres of water or other fluids a day (6—8 medium glasses) but needs to be increased in hot weather or if a lot of physical exercise takes place.

The Eatwell Guide limits fruit juice and/or smoothies to a total of 150ml per day. This is because they are both high in sugar and acids. The sugar is 'free' sugar because it has been released from the fruit during processing and can be concentrated. This is not good for the teeth meaning the enamel can be damaged by bacteria in the mouth producing acids from the sugar and acids in the fruit. If you drink more than 150ml you would also be getting more sugar than is recommended.

Bottled or tap water. Which source is better for environmental sustainability?

- Bottled water is sold in plastic bottles. These use a lot of energy and non-renewable resource (oil to make plastics) and they are bad for the environment because they have to be disposed of, often in landfill sites. Some, but not all, of the plastics used are recyclable.
- Tap water has to be cleaned to make it safe to drink, which uses energy, but it does not have the same effects on environmental sustainability as the plastic bottles used for bottled water.

Ways to encourage young children to drink more water:

Provide more watery foods such as fruits, vegetables, salads.

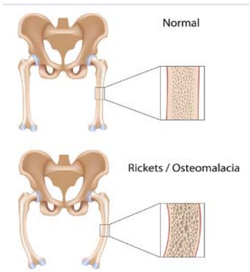
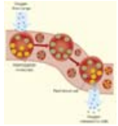
- Add slices of fresh orange, lemon or lime, or fresh mint to tap water.
- Add fun-shaped ice cubes to tap water.
- Serve water with every meal as a regular habit.
- Adults should set an example and drink water with the child so it becomes normal behaviour.

Urine colour chart

1		Good
2		Good
3		Fair
4		Dehydrated
5		Dehydrated
6		Very dehydrated
7		Severe dehydration

Micronutrients needed in small amounts by the body

Minerals

Mineral	Functions	Sources	Deficiency and excess
Calcium	Strong bones and teeth; makes nerves and muscles work; helps blood clot after injury. 	Milk, cheese, yogurt, green leafy veg., canned fish with soft bones that are eaten e.g. salmon. Enriched soya drinks, wheat flour (added by law to plain white flour)	Rickets: caused by insufficient vitamin D in children meaning calcium cannot be absorbed Osteomalacia: adult form of rickets Peak bone mass: may not be reached. Osteoporosis: after peak bone mass is reached, bones naturally lose minerals and weaken. Minerals are not replaced and may become fragile and easily break. Excess: Too much salt leads to high blood pressure and cardiovascular disease.
Iron	Makes haemoglobin in red blood cells to carry oxygen to produce energy in body cells. 	Red meat, kidneys, liver, wholemeal bread added by law to wheat flour (except wholemeal), green leafy veg. e.g. watercress, spinach, cabbage), egg yolk, dried apricots, lentils, cocoa, plain chocolate, curry powder, fortified breakfast cereals.	Iron deficiency anaemia; tiredness, lack of energy, weakness, pale skin complexion, weak and spilt nails. Excess: Poisonous if too much taken e.g. in supplements.
Sodium	Controls water in body, nerves and muscles.	Salt (sodium chloride), salted foods, cheese, yeast extract, stock cubes, gravy, and seasonings, snack foods e.g. crisps, canned fish, bacon ham, dried fish, soy sauce, salted butter, fast foods, many ready meals and take away. Baking powder used in baked goods.	Muscle cramps. **Excess:** high blood pressure which can put a strain on the heart + kidneys which affects how efficiently they work 
Fluoride	Strengthens tooth enamel and bones.	Seafood, fish, tea and some water supplies.	Weak enamel – more chance of tooth decay. Excess: May lead to discoloured teeth.
Iodine	Produces thyroxin in thyroid gland to control metabolic rate of body.	Seafood, vegetables and dairy foods.	Swelling in neck (goitre).
Phosphorus	With calcium for strong bones and teeth; energy release; makes cell membranes especially in the brain.	Wide range of foods. 	This is rare. 

Key words:

Peak bone mass: the age at which the bones should contain the maximum amount of minerals and are at their strongest and most dense (30—35 years old)

Amounts needed for different life stages:

Teenage girls and women: need iron and vitamin C to replace iron lost in menstruation.

Boys and girls still growing: need calcium and vitamin D to enable bone growth and bone density to occur

Salt intake:

People should eat no more than 6g of salt each day. There is a concern about the amount consumed because:

• Too much sodium causes a rise in blood pressure which can lead to hypertension. • Hypertension can lead to a risk of CVD, blood clots and strokes. •Salt is added to many foods, e.g. cheese and salt fish, to preserve. Added as a flavouring in foods such as fried snacks, crisps, chips, ready meals. • Sodium also found in baking powder (sodium bicarbonate) and monosodium glutamate, which is used as a flavour enhancer in many processed and fast foods.• Because it is in so many different foods, it is easy to eat more salt (sodium) than people realise.

Protein—as a macro nutrient

Key Words

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

Essential amino acids—amino acids the body cannot make by itself and must get ready made from foods

Biological value—the number of essential amino acids that a protein food has

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

Protein alternatives - manufactured food products, with a high protein content

What is it and what is it made of? - a macronutrient found in animal and plant food. Made up of 'building blocks' called amino acids

Amino acids: there are 20 in total. 10 are essential for the growth of children; 8 are essential for adults

High Biological Value (HBV) proteins contain all the 10 essential amino acids (EAA).

Low Biological Value (LBV) proteins are missing one or more essential amino acids (EAAs).

Functions in the body.

- Growth and repair
- Repair of the body when it is injured
- Giving the body energy (if it does not have enough carbohydrate and fats)
- Also needed for hormones (for growth and reproduction), enzymes (e.g. to digest food) and antibodies (to fight infection)

Sources:

HBV foods: meat, poultry, cheese, soya beans, milk, quinoa, eggs, fish., yogurt, quark, soya beans, quinoa.

LBV foods: peas, beans, nuts, lentils, cereals (rice, oats, barley, rye, millet, sorghum) and cereal products (bread, pasta), seeds and gelatine.

Protein alternatives are manufactured food products, with a high protein content, e.g. mycoprotein (Quorn), tofu, TVP and tempeh. They are used instead of meat in meals.

Useful to people who have decided to change from eating meat to a vegetarian diet as often made to look like meat or chicken, so they can help someone get used to not eating meat as they become fully vegetarian. Can be made into similar meals such as stir fries, pies, curries and burgers. They do not have much flavour on their own but easily take up the flavours of other ingredients.

LBV proteins do not contain all the essential amino acids we need but if you eat a mixture of them the missing essential amino acids in one may be provided by one of the others. This is called

Protein complementation. If you put two LBV foods together in a meal, the EAAs missing in one will be provided by the other – they complement each other. Beans and bread are both LBV protein foods so, as beans on toast, they are a good example of protein complementation. Other examples are: Pitta bread and hummus, baked beans on toast, bean and rice salad (not with soya beans), peanut butter on toast, bulgur and bean salad (not with soya beans) and vegetable satay and rice.



Effects of deficiency

Children will not grow properly and may never reach full height

Hair loss (hair is made of protein. People can live without hair so if protein is deficient the body will use it for more important body needs.

Nails and skin in poor condition

Easily develop infections due to weakened immune system

Not able to digest food properly

Specific groups:

Pre-school children need protein for rapid growth.

Children ages 5—12 are growing in 'spurts'

Vegetarians

Need to make sure they mix their LBV protein foods

Vegans—eat no animals or animal products and rely on plant based protein foods

Convalescing from illness or injury —need protein to repair damaged cells, repair wounds

Effects of excess: Too much nitrogen in the body is dangerous. The liver and kidneys have to work harder to remove it. This puts them under stress and could harm them.

Amount needed for different life stages

0.75g of protein is needed per 1 kg of body weight. Some groups need more than others e.g. teenagers (boys in particular) and breastfeeding women.

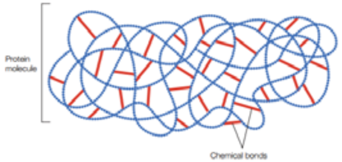
All **teenagers** need protein for growth, repair of body and energy. • Hormones (for growth and reproduction), enzymes and antibodies (to fight infection) are made from protein – teenagers need more of these as their body changes from a child to an adult. • Muscles made of protein – males are usually more muscular and taller than females, so need more protein.

Breast feeding women:• Protein is essential for growth and development of baby. • Breast milk provides protein. • Mother needs enough protein for her own body plus extra for the baby.

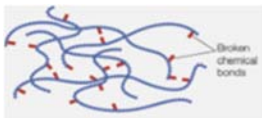
Protein—The functional and chemical properties

Key words:
Amino acids: individual building block for protein molecules
Chemical bonds: bonds that hold large protein molecules together in compact, folded bundles
Denaturation: the chemical bonds have broken and the protein molecule has unfolded and changed shape
Coagulation: the joining together of lots of denatured protein molecules, which changes the appearance and texture of the food
Gluten: a protein that is formed from two separate proteins called glutenin and gliadin when liquid is added to flour to make a dough

Chemical structure: • Protein molecules are very big. • Made up of long chains of amino acids and formed into long bundles held together with chemical bonds.

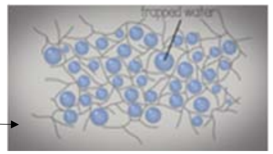


Denaturation: Protein molecules can easily be denatured. This means that the chemical bonds holding the protein molecule bundle together can be broken, which makes the protein molecule bundle unfold and change shape like this:
These can be broken by:



- Heating e.g. frying an egg
- Mechanical agitation e.g. whisking egg whites for meringue. This happens because egg-white protein can stretch and hold approximately 7 times its own volume of air when whisked. Whisking produces a gas-in-liquid foam, which becomes more stable as sugar is added. When baked, the proteins denature and water from them is driven out so the foam sets.
- Adding acid e.g. lemon juice/tomato juice added to raw meat to tenderise (marinate it) Lemons contain acids. Acids • •Adding acid e.g. lemon juice to milk proteins: the acids denature proteins in the condensed milk and cream and make them coagulate, which thickens and sets the mixture.
- Air bubbles e.g. formed in meringue
- Salt, for example, adding salt to poached eggs.

Coagulation →



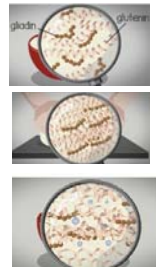
Coagulation:
- Denatured protein molecules unfold and start to join other denatured protein molecules nearby until they form a large mass. The denatured protein molecules are larger and take up more space than they used to. Because of this, they knock into other denatured protein molecules and start to join together in large groups – this is called coagulation.
- As protein foods are prepared and cooked, they change texture + become more **solid** (set) e.g. meat, fish, and eggs.
- Denatured protein molecules unfold and join up with other ones to form big groups – they **coagulate**
- As they coagulate, they trap air and water and this changes the colour, texture and flavour of the food.

Eggs

• The egg white change from transparent to opaque white and the whole egg has changed from a liquid food to a solid food when heated. • Egg white proteins begin to coagulate at 60°C; the egg yolk coagulates at 70°C. • Due to their ability to coagulate, the proteins in eggs are used in some recipes to hold and bind together other ingredients, for example, vegetables in a quiche flan, a breadcrumb or batter coating on the outside of some fried fish, the ingredients of a fish cake or beef burger. • If a food containing protein is overcooked, the coagulated protein molecules tighten up and squeeze out the water they were holding. This is called syneresis and is why overcooked meat or fish is dry and chewy, and why overcooked scrambled egg becomes rubbery and watery.

How foams are formed: Egg-white protein can stretch and hold approximately 7 times its own volume of air when whisked. The action of whisking denatures the protein. Whisking produces a gas-in-liquid foam, which becomes more stable as sugar is added. The denatured proteins coagulate and surround air bubble. When baked, the proteins denature and water from them is driven out so the foam sets

How gluten is formed: Gluten (in wheat flour) gives the right texture for bread making. **Gluten** is a protein that is formed from two separate proteins called glutenin and gliadin when liquid is added to make a dough. A gluten network is formed. The dough is kneaded and gluten gives bread dough elasticity = shrinking back when you stop stretching and shaping. This is because, long gluten molecules are coiled and bend in different places along their length. The gluten stretches and traps CO2 bubbles produced by yeast and then sets (or coagulates) when baked.



Fault finding:
Scrambled egg has become rubbery and watery: Egg contains protein and water. If cooked at too high a temperature or too quickly, the proteins will denature and coagulate too quickly so that instead of trapping the water molecules, they will squeeze the water out, and the coagulated protein will become tough and rubbery in texture.
Grilled meat is hard and dry: • The meat contains protein in the form of muscle fibres. It contains fat and water. If grilled at too high a temperature, or too close to grill elements or flames, or for too long, the proteins will denature and coagulate very quickly. The coagulated protein molecules will tighten up and the water will be squeezed out as this happens. If too much is lost through evaporation, the meat will become dry and the tightened protein will make the meat hard.

Cooking Food

Key words:
Conduction: transferring heat through a solid object into food
Convection: transferring heat through a liquid or air into food
Radiation: transferring heat by infra-red waves which heat up what they come into contact with food

Conduction:
Atoms in metal pans and baking trays start vibrating as heat energy from cooker goes into metal. Vibrations transfer heat energy to other metal atoms.
Metal gradually heats up and passes heat energy to food. Metals are good conductors of heat .

Convection
When a pan of water is heated, heat is conducted through the metal pan to water molecules. These move upwards then downwards in circular motion (convection currents) taking heat energy with them and passing it into the food. The more heat energy, the faster the water molecules move in circular convection currents. Also happens in oven with hot air currents. Gas oven/ordinary electric oven have zones of heat: hotter at top than bottom shelf due to convection. Electric fan ovens – heat evenly distributed by fan – same temperature on each shelf.

Radiation
Grilled/barbecued food heated by radiant heat. Infrared heat rays heat the surface of the food and are absorbed. Food must be no more than 3.5cm

Why is food cooked?

• **To make food safe to eat** – Some foods must be thoroughly cooked to destroy the food poisoning bacteria they could contain. – Some foods contain natural toxins (poisons) which would be harmful if the food was eaten raw e.g. raw red kidney beans. Cooking destroys the toxins and makes the food safe to eat.

• **To** develop flavours in the food – Cooking develops flavour by causing chemical reactions to take place in the food e.g. gelatinisation. – Cooking concentrates and intensifies flavour by causing water to evaporate

To improve the texture and appearance of food, and make it easier to eat, swallow and digest. Cooking causes starch granules to swell, gelatinise and thicken or soften a food . Cooking softens the structure of the cells in vegetables to make them less bulky and easier to eat – Cooking tenderises meat. This means the cooking process softens the meat so that it is easy to chew and digest.

• **To improve the shelf life** of food – Cooking destroys harmful micro-organisms such as bacteria and moulds, which preserves the food (makes the food last longer)

•**To** give **people a variety of foods in their diet** – Foods can be cooked in different ways to give variety, for example, potatoes

Dry heat	**Moist (in liquid)**	**In oil**
Baking in oven	Boiling: Cooking food in water at 100°C	Roasting: In oven in hot fat
Grilling/toasting	Simmering: Cooking food in small quantities of liquid at just under boiling point.	Sautéing: Pan frying in hot fat
Dry frying in no added oil	Stewing: slow-cooking on hob or in slow-cooker with liquid	Stir frying in little fat over high heat
	Poaching: Cooking in water	Deep fat frying
	Steaming: Cooking food	Shallow frying: Frying in a small amount of oil
	Braising: Slow-cooking **pre-sealed** meat + veg. in oven with liquid	
Other		
Induction cooking	Micro waving	

Heat Insulators
These are used to protect us from burning ourselves when cooking. E.g.
• Pan handles are plastic or wood making them comfortable to hold
• Hollowed metal pan handles allow the air to protect them from becoming too hot
• Wooden and silicone utensils protect us.
•Use insulated pan stands made from wood, cork, ceramics or metal to protect work surfaces
•Wearing oven gloves because these are made of thick, insulating material so the hands are protected from the heat

Retaining water soluble vitamins: B and C
• Do not prepare veg too far in advance; vitamin C will be exposed to oxygen and lost when it is cut or peeled. • Put veg. into a small amount of boiling water so they cook quickly; vitamin C and B vitamins will be lost in the water. • Cook all veg. for the minimum amount of time to minimise the damage by heat to vitamin C and B vitamins. • Steaming veg will reduce the loss of vitamin C and B vitamins to cooking water. • Serve the vegetable cooking water in the gravy to conserve some of the vitamins that have gone into it. • Do not prepare fruit too far in advance, to preserve the vitamin C. Add lemon juice to prevent enzymic browning and add acid to help stabilise vitamin C (ascorbic acid). • Keep the fruit cold and in a box to minimise its exposure to oxygen and conserve the vitamin C

Fat —as a macro nutrient

Key Words

Fat: a macro nutrient supplying the body with a concentrated energy source

Oils: Fats liquid at room temperature e.g. sunflower oil

Solid fats: Fats solid at room temperature e.g. butter + lard

Visible fat: Fat in food seen easily e.g. fat on bacon

Invisible fat: Fat in food that cannot easily be seen e.g. butter in cooked pastry, oils in fried foods I.e. doughnuts and crisps

Fatty acid: part of a fat molecule

Triglyceride: fat molecule made up of 1 part glycerol + 3 fatty acids

What is it and what is it made of? - a macronutrient found in animal and plant foods. Fat is solid at room (ambient) temperature/oil is liquid. Exactly the same energy value: 9kcal/37kJ per gram

Functions in the body. (what it does in the body):

- Provides an energy store (in the adipose tissue under the skin)
- Insulates to keep the body warm
- Protects bones and kidneys from damage providing a cushion layer
- Provide fat soluble vitamins A, D, E and K.

Similarities and differences between a fat and an oil

- **Similarities**: – Both: are made of triglyceride molecules: 3 fatty acids + 1 glycerol. Have exactly the same energy value: 9kcal/37kJ per gram. Are made of a mixture of fatty acids.

- **Differences**: Fat is solid at room (ambient) temperature/oil is liquid. Fats can be spread (they are plastic), creamed, rubbed in/oils are poured. Fats contain a lot of saturated fatty acids/ oils contain a lot of monounsaturated and polyunsaturated fatty acids.

Sources of solid animal fats: — **Visible** fat in meat, cheese, butter, lard, suet
Invisible: cheese; butter in cakes, pastries and desserts. Meat products e.g. sausages + burgers. Marbling in meat. Processed meals and take away.

Sources of solid plant fats: — **Visible:** white vegetable fats, veg. fat spreads, (margarines), coconut cream, cocoa butter
Invisible: Processed foods. Chocolate + pastries, cakes, biscuits, dougnuts and breads made with hydrogenated white veg. spreads. oils in tuna, block vegetable fat, ghee, plant oils e.g. palm, olive and sunflower

Sources of liquid animal oils: — **Visible:** animal oils, cod liver oil, oily fish, e.g. mackerel + sardines
Invisible: milk, cream, egg yolk, oily fish

Sources of liquid plant oils — **Visible:** plant oils, nuts and seed oils (e.g. sunflower, sesame, rapeseed, corn, olive, almond)
Invisible: many processed foods, ready meals + take away foods

What are fatty acids?

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

Saturated fatty acids: fatty acids found mainly in solid fats e.g. butter, lard, suet, block margarine, ghee, fat on meat, palm oil, coconut and chocolate

Unsaturated fatty acids: fatty acids found mainly in liquid plant oils e.g. olive, rapeseed, sunflower, + corn; oily fish, avocado pears, nuts, seeds + some veg. fat spreads

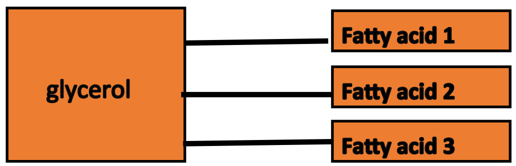
Essential fatty acids: when we eat food, our body breaks up (digests) the fat molecules they contain to make new fatty acids and fat molecules for our body to use. The two essential fatty acids needed by adults and children that cannot be made by the body and have to be eaten in the form of food are found in oily fish, plant and seed oils, eggs and fresh meat.

Effects of deficiency

- If carbohydrate intake is also reduced, body weight will be lost because the body uses its energy store from its fat cells + it will not be replaced
- The body will chill quickly because there is not enough fat to insulate
- The body will easily bruise as there is not a thick enough cushion of fat for protection
- Body will not receive enough vitamins A, D, E and K as these are found in foods containing fat

Effects of excess: Fat is energy dense – 9kcal per gram. Eating too much can lead to weight gain. Could contribute to developing cardio vascular disease (CVD) and coronary heart disease (CHD)

Chemical structure of fats:



Amount needed for different life stages

The amount needed is calculated as a percentage of our total daily energy intake. The recommended healthy adult amount is:

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

Fats —Functional and chemical properties

Remember: All fats and oils are all made of triglycerides – three fatty acids and one part glycerol.

Key words:

Aeration: fat can trap lots of air bubbles when beaten together with sugar e.g. cakes

Emulsification: Prevents oil in water or water in oil colloidal structures from separating out due to its hydrophilic and hydrophobic ability.

Plasticity: fat can be softened over a range of different temperatures so that it can be shaped and spread with light pressure

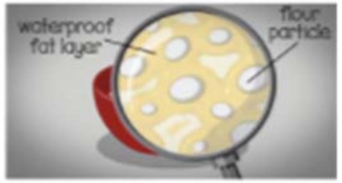
Shortening: fats shorten the length of the gluten molecules in pastries and cookies making a 'melt in the mouth texture'

Plasticity:

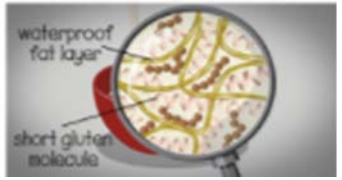
Fat can be spread on bread and crackers due to the plasticity of the fat. Plasticity means: the ability to be shaped and spread with light pressure. The plasticity of fats is due to their chemical structure. All fats are a mixture of triglycerides, containing different fatty acids. The triglycerides all have different melting temperatures. This is why fat will soften and melt over a range of temperatures, for example, chilled butter is very hard and so difficult to spread. When chilled the butter has little plasticity. At room temperature, the butter softens and becomes more plastic and which means it can spread easily. Saturated fats, such as butter, ghee and solid coconut oil tend to be more solid at room temperature and so have less plasticity. The more unsaturated fatty acids a fat contains the less solid it is and the more plasticity it has. Some vegetable fat spreads are made using triglycerides with a low melting temperature, which means we can spread them as soon as they come out of the refrigerator. A recipe that demonstrates plasticity is chocolate mousse, made with butter and plain chocolate.

Shortening:

Shortcrust pastry, shortbread and biscuits rely on fat to give them their characteristic crumbly texture. The fat coats the flour particles and prevents them from absorbing water giving them a waterproof layer. This reduces the formation of gluten development, which would cause the dough to become elastic. When water is added, the gluten strands can only form short lengths because of the waterproofing of the fat. The texture of pastry and rubbed in biscuit mixtures is therefore 'short' and tender. When rolled, the pastry does not spring back like a bread dough does due to the **short gluten molecules.**



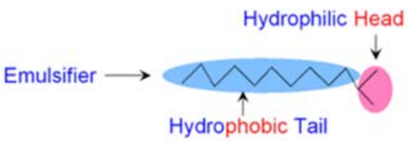
Fats such as pure vegetable fats are suitable for shortening because of their low water content. There are distinctive colours associated with the type of fat used, for example, butter produces a golden colour. Fats are also best used chilled because butter will soften in warm conditions due to plasticity. If it is too warm, it will quickly become oily when rubbed in and the pastry will be hard to handle. If it is chilled, it can be rubbed in more effectively.



Emulsification:

Food products e.g. mayonnaise, milk, butter and Hollandaise sauce are emulsions of either oil-in-water or water-in-oil.

- Oil and water will not mix together permanently. If shaken together the oil will eventually rise to the top (less dense)
- Oil and water can be made to mix together by adding an emulsifier. The emulsifier used in mayonnaise is called lecithin, which is found in egg yolk.
- Emulsifiers are molecules with two ends. One end is attracted to water (it is hydrophilic) and the other end is attracted to oil (it is hydrophobic – it doesn't 'like' water).
- When an emulsifier is added to a mixture of oil and water, its molecules arrange themselves so that they prevent the oil and water from separating. The mixture is now an **emulsion.** This is why mayonnaise does not separate when it is stored.



Aeration:

- Fats such as butter and vegetable fat spreads are able to trap air bubbles when they are beaten together with sugar for a cake mixture.
- They can do this because they have plasticity, which means they can be beaten, spread and mixed easily with a wooden spoon or whisk.
- Cooking oils do not trap air as effectively.

Mixing fat and sugar together is called **creaming** because, as the air bubbles are trapped, the mixture becomes lighter in colour and texture and its volume increases.

- The ability of the fats to aerate the mixture in this way is really important for producing a light, spongy texture in the baked cake

- Raw cake mixture consists of flour, fat, protein, sugar crystals and water (from egg white). These are interspersed with trapped air bubble, egg protein molecules (which are in tight coils) and starch granules (in the flour). As the mixture bakes, the fat melts; sugar crystals dissolve; egg protein molecules uncurl; as the y star to coagulate; starch granules in the flour swell and absorb melted fat and water from eggs; baking powder releases CO2; the air and CO2 bubbles expand with heat causing mixture to rise up and outwards. The mixture sets **as** the egg proteins become solid **(coagulate)** and the starch granules completely expand as it sets and the gases escape from the mixture.

Nutritional Information and Data

Key Words

Nutrition Profile: the type and amount of different nutrients a food product contains.

Nutritional requirement: The amount of each nutrient needed daily for individuals and different life stages

Nutritional analysis: finding out how much of each nutrient is in a portion of food (e.g. 100g), or a whole recipe, or a food product you make or buy.

Dietary Reference Value: The amount of a nutrient that is enough to ensure that the needs of nearly all the adult population (97.5%) are being met. By definition, many within the group will need less.

GDA (Guideline Daily Amounts): guide to the amounts of calories (kcal/Kj) sugar, fat, saturated fat and salt an average adult should aim to eat (and not exceed) to have a healthy, balanced diet).

What are nutritional requirements?

People need many different nutrients if they are to maintain health and reduce the risk of diet-related diseases. These are different for each nutrient and also vary between individuals and life stages, e.g. women of childbearing age need more iron than men.

Why do nutritional requirements vary?

Each nutrient has a particular series of functions in the body and some nutrients are needed in larger quantities than others. For example, protein is needed in gram (g) quantities. Vitamin C is needed in milligram (mg) quantities (1/1000 gram) and vitamin B_{12} is needed in microgram (µg) quantities (1/1000000 gram). Individual requirements of each nutrient are related to a person's age, gender, level of physical activity and state of health. Also, some people absorb or utilise nutrients less efficiently than others and so will have higher than average nutritional requirements, e.g. among older people, vitamin B_{12} absorption can be relatively poor.

The food label must show **per 100g or 100ml** and **per serving.** Per 100g. This helps consumers work out the percentage of each nutrient for comparison with similar products of the **identical** weight or volume. The amount of nutrients **per portion** of the food product. This helps consumers understand how much energy and nutrients are supplied by a whole portion of the product.

How is nutritional information shown as a food label?

Nutrient	Per 100g	**Per serving (150 g)**
Energy	586kj/140 kcal	879kj/210kcal
Fat:	1.5g	2.25g
Of which:		
Saturates	0.2g	0.3g
Monounsaturates	0.9g	1.35g
Polyunsaturates	0.4g	0.6g
Carbohydrate	50.0g	75.0g
Of which:		
Sugars	2.5g	3.25g
Starch	42.0g	63.0g
Fibre	5.5g	8.25g
Protein	8.0g	12.0g
Salt	0.2g	0.3g

How to read and understand nutrition needs on a food label:

It is used to inform customers about the nutritional profile of a food product.

The nutrients that are required by law to be included are:

Energy value: kilojoules (kj) and kilocalories (kcal)
Protein grams (g)
Fat (total): (g)
Saturated fats: (g)
Carbohydrate (total: (g)
Sugars: (g)
Salt (**NOT**) **sodium** because the word salt is known to consumers (g)

Other nutrients that, if included, **must** be written in **100g/100ml serving (**this is **voluntary):**

Monounsaturated fats (monounsaturates) (g)
Polyunsaturated fats (polyunsaturates) (g)
Polyols (sugar free sweeteners): (g)
Starch: (g)
Fibre: (g)
Fibre: (g)
Any vitamin or mineral present in significant amounts: Micrograms (ųg) or Milligrams (mg)

If a health claim is made about a food product e.g. *'This product is high in Iron'* the amount that is present must be shown near the nutritional value table

The **Food Standards Agency** have designed a simple visual way called the **Traffic Light Labelling System'** to enable consumers to identify if food products have high, medium or low amounts of fat, saturates, sugar or salt using the traffic light labelling system.

RED means that the food product contains a HIGH amount of fat, saturates, sugar or salt.

AMBER means that the food product contains a MEDIUM amount of fat, saturates, sugar or salt.

GREEN means that the food product contains a LOW

The colours explained when thinking about fat, saturated fat, sugars and **salt:**

Red = high danger level, poor choice for healthy eating, e.g. butter in fried products.
Amber = caution in quantities eaten e.g. sugar in fruit.
Green = free to go low levels. Healthiest choice, e.g. vegetables

Nutritional Information and Data

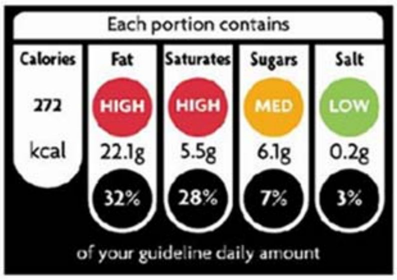
For the average adult, this is the **Guideline** to **Daily Amounts** (GDA)

Per 100g of food			
	Low	**Medium**	**High**
Fat	Less than 3g	3g - 20g	More than 20g
Saturated fat	Less than 1.5g	1.5g - 5g	More than 5g
Salt	Less than 0.3g	0.3g - 1.5g	More than 1.5g
Sugars	Less than 5g	5g - 15g	More than 15g

The traffic light labelling system helps the consumer with food choices because it:
*Increases consumer awareness of suitability of foods for them and their age, gender and Physical Activity Level (PAL).
*Allows consumer to make **informed** choices
*Allows consumer to make comparisons between products/work out health benefits of food products.
*Presents accurate up to date information on salt, fats, sugar content for their RNI (Reference Nutrient intake)
*The information is linked to the %GDA (guided daily amounts) the person is recommended to eat.
*Quickly identifies nutritional content levels of the food
*Instant, visual information allowing quick access to nutrient content especially for people who do not have English as a first language.
*Easy to read/interpret because it uses the traffic light colour where red is linked to stop or danger.

Consumers should aim for more green, less red and moderate amounts of amber foods.
Where red or amber are used, the consumer can adjust the other foods eaten in the day to balance out the ambers and reds.

So, why do the following appear on nutritional labels on food products:
The amount of different types of fat: So that consumers can manage their consumption of saturates (linked to CHD) and polyunsaturates.
The amount of sugars: So that consumers who are managing their intake of sugar for a kilocalorie reduced or diabetic diet can manage the amount of sugar per portion/100g or ml.
The amount of fibre: Consumers requiring a high or low fibre diet van see the amount they are consuming



Factors to consider when planning meals:
• Healthy eating: How to produce balanced meals which meet the dietary guidelines, for example, DRV or the Eatwell Guide for different life stages.
• Physical activity level (PAL): Whether physically active or mostly sedentary (inactive), which will affect how much energy different people need from food every day.
• Income/cost of food: How much families have to spend on food. Having a food budget will help families to plan meals.
• Eating habits: Meal times, eating with others or eating alone, snacking or grazing. Each family member's likes and dislikes for different foods.
• Celebration/occasion/religion: Different religious and cultural factors may affect what food is purchased, for example, Muslims buy halal meat.
• Preferences/enjoyment: The family's likes and dislikes will be important in what food should be purchased.
• Food availability/seasonality: Many families prefer to buy food in season – this can improve sensory characteristics and reduction in food miles.

Food spoilage and contamination.

Key Words

Micro-organisms—tiny microscopic forms of life both plant and animal

Food Spoilage—Making food unfit and unsafe to eat

Contaminate—making a food unsafe to eat by allowing it to come into contact with micro-organisms that will grow and multiply.

Pathogenic—capable of causing illness

High-risk food—foods containing a lot of moisture and nutrients (especially protein) e.g. meat + fish) that easily support the growth of pathogenic micro-organisms, particularly bacteria. Also called **perishable foods**

Catalyst—a substance that speeds up the rate of a chemical reaction

Types of microorganism that can spoil foods: **Bacteria, moulds, yeasts.**

Micro-organisms make food unfit and unsafe to eat: Because they contaminate it with their waste products, their physical presence (being in the food) and the toxins (poisons) that they produce.

Conditions needed for micro-organisms to grow and multiply: The right temperature, food, moisture, time, the right amount of acidity/alkalinity (pH).

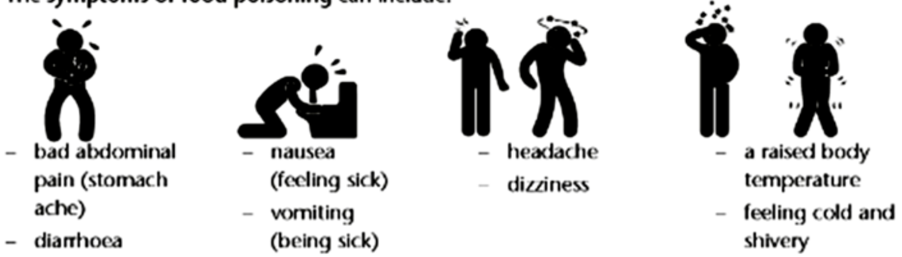
Pathogenic micro-organisms, e.g. bacteria/moulds cause food poisoning. • Non-pathogenic micro-organisms do not cause food poisoning.

Yeasts are tiny plants in the air which settle on food.

High risk foods are foods that will spoil quickly and are most likely to cause food poisoning because bacteria and other micro-organisms can grow and multiply very easily and quickly in it. • They have the right conditions for growth: nutrients (especially protein) and water/moisture. • These types of foods spoil very quickly and must be refrigerated, cooked thoroughly and eaten within a few days. • Examples: meat, poultry, fish, shellfish, cream, milk, cheese, eggs, yogurt.

Pathogenic bacteria examples are: Campylobacter, E. coli, Salmonella, Listeria.

- The symptoms of food poisoning can include:



Enzymes are • Natural substances (mostly proteins) found in foods and all living things. • Called biological catalysts, which means they have the ability to speed up chemical reactions.

Enzymes affect fruits and vegetables when they have been harvested they ripen and eventually break down the cells and tissues in them. They change colour and any starch they contain is broken down and converted to sugar so they soften and sweeten.

Some fruits, such as apples + bananas, go brown when exposed to air because enzymes and natural substances in them react with oxygen when they are cut or peeled. Enzymes are proteins. Proteins are denatured by acids. Lemon juice contains citric and other acids, which stop the enzymic browning process from happening because it denatures the protein. Salt, submerging in water or vinegar also delay enzymic browning

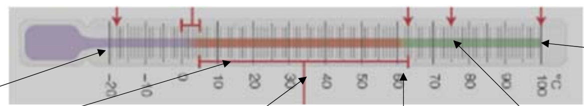
Moulds are air bourne spores. Lots of types exist. In right conditions when mould spores land on food they germinate and send down a root system (mycelium) into food. Invisible waste products from the mould come out through the mycelium and into the food. They may be harmful (toxic), so even if the visible mould is scraped off, there may still be waste products present

Some micro-organisms do not cause food poisoning but are used in food production

Blue-veined cheese: A special culture containing non-pathogenic bacteria and the spores of a non-pathogenic mould is added to the milk.• The bacteria set the milk into a semi-solid by turning the lactose sugar (in the milk) into lactic acid, which coagulates the protein, adds flavour and texture and helps to preserve the cheese. • The moulds germinate as the cheese ripens which adds blue veins and a particular flavour.

Bread: A special baker's yeast is used. If given the right conditions of warmth, moisture, food (sugar or starch) and time, it breaks down the starch in the flour and produces CO_2 gas bubbles, which make the dough rise. It also produces alcohol, which adds flavour, but evaporates in the oven. The yeast adds flavour to the baked bread.

Yogurt: made from milk fermented by two types of non-pathogenic bacteria. • The bacteria ferment the lactose sugar in the milk producing lactic acid. The lactic acid denatures and coagulates the milk proteins, which makes the milk become semi-solid. • The lactic acid and other natural substances that are produced give the yogurt its distinct, traditional flavour.



-18°C to –24°C Freezer. Bacteria dormant

Chilled food 0°C to 5°C. Bacteria multiply slowly

5°C to 63°C **Danger zone.** Bacteria multiply rapidly = ideal conditions for growth

63+°C keep cooked food hot

75°C. Cooked from raw food Reheat cooked food once

100°C. water boils. Bacteria cells are dead. Bacteria spores can survive

GCSE Food preparation & Nutrition West Somerset College

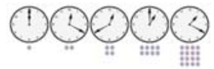
Steps to prevent food poisoning when buying, storing and cooking food:

Buying foods: •Food should be bought from a reputable supplier and the shop should be clean. •The foods should be stored correctly in the shop, e.g., perishable foods at the correct temperature in fridges or freezers • The food should be in good condition, e.g. there should be no bruising on fruit or veg •The foods should be within the use-by date for high-risk foods (such as chicken, dips, burgers and cream) and best-before date for ambient foods, such as breads. The packaging needs to be checked to ensure that it is intact and there is no contamination from rodents.

Storing food: •Follow the instructions on packaging. •High-risk foods need to be stored in a fridge at a temperature to slow down the growth of micro-organisms. Frozen foods should be stored in a freezer so that micro-organisms are dormant. •It is important to rotate the stock within a fridge and freezer so that foods are eaten within their use-by dates. This also helps to avoid throwing food away which is out of date. •Raw meats stored on the bottom shelf of the fridge to avoid any drip from the raw meat touching the cooked foods and causing cross-contamination. •All foods should be stored in the correct containers or sealed packages to avoid cross-contamination or damage to the food during storage.

Cooking food: The person cooking is following personal hygiene rules e.g. wearing a clean apron, cleaning hands before handling food, making sure long hair is tied back. •The area where food is being prepared should also be clean e.g. wiping surfaces with antibacterial spray, ensuring all equipment is clean. Any frozen foods should be thoroughly defrosted before cooking to ensure that the centre of the food is cooked thoroughly. •High-risk foods should be cooked to 75°C to ensure that harmful micro-organisms, such as Salmonella, are destroyed and to help prevent food poisoning. •A food probe could be used to ensure that this temperature is reached in the centre of food e.g. chicken.

Key words: Buying and storing food



- **Ambient storage:** The food is stored at ordinary room temperature – usually about 20–21°C.
- **Shelf-life:** This is how long a food product will last before it becomes unsafe or unpalatable [not nice] to eat.
- **Use-by date:** It is not safe to eat the food after its use-by date.
- **Best-before date:** This tells you that after this date, a non-high-risk food will still be safe to eat, but may have begun to go stale (changed in texture and flavour). After the best-before date the food may not be at its best quality.
- **Temperature danger zone**: The danger zone is from 5 to 63°C. This is the temperature range in which bacteria grow rapidly.
- **Core temperature:** This is the internal temperature food must be heated to which to ensure it is cooked properly. A minimum core temperature of 70°C for 2 minutes (or an immediate reading of 75°C).

Points to look for when buying:

Fresh Fruit and vegetables • A good, bright colour • A firm, crisp texture (not wilted or soft) • An unblemished smooth skin • No mould growth • Not too much soil on the skin of root vegetables • No damage • Stored so air can circulate freely • Buy only when you can see the quality of the fresh produce • Buy food in season.

Fresh meat • Not too much fat • A bright red or pink colour for beef, lamb or offal • Creamy-white to pink clean flesh for poultry • A fresh smell • Moist flesh, but not wet, slimy or dried out • A firm, springy texture • No risk of cross-contamination • Stored at the correct temperature of less than 5°C • Do not buy more than you need as it can deteriorate quickly.

Fresh fish: • Bright red gills • Firm flesh • A fresh smell, no fi shy smell • Clear, shiny eyes that are not sunken • Scales firmly attached, not loose and flaking off • Moist (but not slimy) skin • Bright, natural colouring • White fish should be a pearly colour • Shellfish should be intact; shells should not be broken

Personal hygiene rules when preparing + cooking food. Wash hands, wear clean apron, tie back or cover hair, do not spit, sneeze or cough over or near food, wash hands after using toilet, handling raw eggs, meat, poultry, fish, shellfish or rubbish, don't wear jewellery, never smoke when cooking, don't put finger in food and lick fingers, don't double dip.

Campylobacter Found in dirty water, raw poultry + meat. Milk. Incubation 48—60 hours. Diarrhoea, abdominal pain, nausea, fever

E.coli—beef (minced), raw milk, dirty water. Incubation = 12—24 hours. Diarrhoea, abdominal pain, vomit, fever + kidney damage

Salmonella—raw + undercooked poultry, eggs + meat, raw milk. 12—36 hours. Diarrhoea, abdominal pain, vomiting, fever

Listeria—soft cheese + made from unpasteurised milk; salad veg., pates. 1—70 days. Flu-like symptoms.

Staphylococcus aureus—people Hands, nose, mouth, skin. 1—6 hours. Abdominal pain, vomiting, low body temperature

Avoiding Cross contamination—Bacteria can spread. Occurs when juices from raw meats or germs from unclean objects touch cooked or ready-to-eat foods. • **Supermarket,** check food stored separately; keep apart in shopping trolley + bags. • If using reusable bags, place raw foods in plastic bag to prevent juices leaking. • Keep raw meat, poultry and seafood on the bottom shelf of fridge in a sealed container or bag to ensure juices don't drip and cause contamination. • Keep eggs in the original carton and store on shelves of the refrigerator. • Store reusable bags in a clean, dry place + and often with hot, soapy water. Avoid leaving reusable shopping bags in the boot of vehicle. • **Preparing food:** Wash hands thoroughly with warm, soapy water for 20 seconds before, during and after handling raw meats + foods or other high-risk foods. • Wash plates between uses or use separate plates: for raw and another for cooked foods. • Place washed produce into clean storage containers, not back into original ones. • Never use the knife or preparation tool for raw meat, poultry or seafood to chop produce or ready-to-eat foods. • Use one cutting board for meat, poultry and seafood, and a separate cutting board for produce and ready-to-eat foods. • Use separate work surfaces for raw and cooked foods or be sure to wash the surfaces thoroughly between preparing raw and cooked food. • Cover prepared food to protect it from pests + dust. • Defrost frozen foods e.g. chicken thoroughly, in bottom of refrigerator on a tray to catch liquid that leaks.