Sir john Colfox Academy - Fats Knowledge Organiser

FATS

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

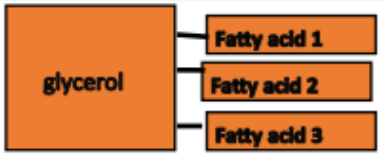
Invisible fat: Fat in food that cannot easily be seen e.g. butter in cooked pastry, oils in fried foods I.e. doughnuts and crisps

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

Fatty acid: part of a fat molecule

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

What is it an 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

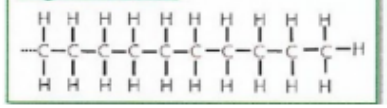


Fats contain **Saturated** and **unsaturated fatty acids.**

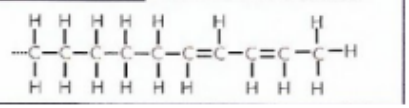
Fats and oils are made up of **fatty acids and glycerols** in the form of **triglycerides** which look like this:

Fatty acid chains are made up of **carbon** and **hydrogen.** They can be **saturated** or **unsaturated** – the difference is in how **carbon atoms** bond with hydrogen atoms:

Saturated fatty acids only have single C-C bonds:



Unsaturated fatty acids contain at least one C=C double bond in their carbon chains:



Our body breaks down **fatty acids** during digestion. The ratio of saturated to unsaturated fatty acids decides whether it's a **saturated** or **unsaturated fat.**

Monounsaturated fats contain **one C=C double bond** in their carbon chains. Found in olive oil, almonds, peanut butter **and** avocadoes, **for example.**

Polyunsaturated fats contain **more than one C=C double bond** in their carbon chains. Found in **sesame oil, soybean oil, sees** and **oily fish.**

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

- Gives a **concentrated** source of energy (9kcal per gram) which is stored in the body. It is stored in the adipose tissue under the skin.
- Insulates to keep the body **warm** because the adipose tissue **insulates** the body from the cold and **protects** bones and kidneys from damage providing a cushion layer
- Provide fat soluble vitamins A, D, E and K.
- Our bodies use fat to make **cholesterol** which is essential for cell membranes.

Effects of excess:

Government guidelines say **fat** should make up **no more than 35%** of our food energy per day, with **no more than 11%** coming from **saturated fat.** Eating too much can lead to **weight gain.** Excess fat is stored under the skin and around our organs. **Excess** leads to **obesity.** This can lead to diet-related health issues e.g. **type-2 diabetes** (our bodies struggle to control blood sugar levels); increased **blood cholesterol levels.** (Cholesterol builds up in blood vessels which restricts blood flow around the body. This increases the risk of **high blood pressure,** a **stroke,** a **heart attack** and **coronary heart disease (CHD).**

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 and it will not be replaced
- The body will **chill** quickly because there is not enough fat to insulate
- Fat deficiency in babies and children could affect normal growth
- The body will **easily bruise** as there is not a thick enough cushion of fat for protection
- Body will **not receive enough fat soluble vitamins** A, D, E and K as these are found in foods containing fat.

Saturated fats are **bad** for your health

Saturated fats classed as unhealthy fat, especially if eaten in large amounts.

- They are generally **solid** at **room temperature** and tend to come form **animal sources.** But they can also come form **plant sources** like **coconut butter** and **palm oil.**
- Found in both **visible** and **invisible** forms.

Unsaturated fats are generally **healthier.**

- They are generally **soft** or **liquid** at **room temperature** and tend to come from **vegetable sources** that are high in fat e.g. seeds and peanuts and vegetable **oils** e.g. sunflower , rapeseed and olive oils.
- Replacing the saturated fats in the diet with **unsaturated fats** has been shown to **lower blood cholesterol**.

Sources of fats:

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.

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

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

Liquid plant oils: Visible: plant oils, nuts and seed oils (e.g. sunflower, sesame, rapeseed,

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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

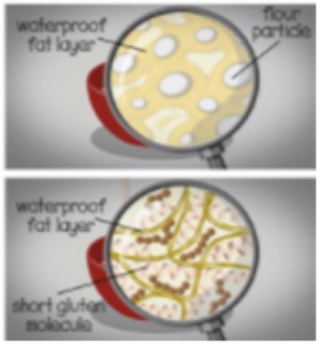
Shortening: fats shorten the length of the gluten molecules in pastries and cookies making a 'melt in the mouth texture'

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. **Plasticity** is useful for **decorating cakes** with **butter cream, spreading butter** on sandwiches and toast, for example.

Shortening:

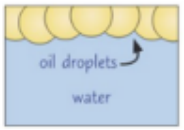
Shortcrust pastry, shortbread and biscuits rely on fat to give them their characteristic crumbly texture. The fat coats the flour particles and prevents them from absorbing water giving them a **waterproof** layer. This reduces the formation of **long gluten molecules** , which would cause the dough 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.**



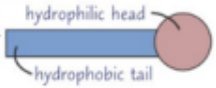
Fats such as pure vegetable fats are suitable for shortening because of their **low water content**. There are distinctive colours associated with the type of fat used, for example, butter produces a golden colour. Fats are also best used chilled because butter will soften in warm conditions due to plasticity. 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:

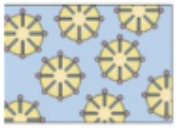
Food products e.g. mayonnaise, milk, butter and Hollandaise sauce are **emulsions** of either oil-in-water or water-in-oil.



- Oil and water will not mix together permanently—they **separate**. If shaken together the oil will eventually rise to the top as it is **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.
- The molecules in an emulsifier have **two different 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 **water molecules** bond to the **hydrophilic side** and the **oil molecules** bond to the **hydrophobic side.** This holds the oil and water together in a **stable emulsion,** preventing them from separating. The mixture is now an **emulsion.** This is why mayonnaise does not separate when it is stored.

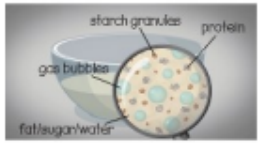


Aeration:

- 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 CO_2; the air and CO_2 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.