



This Food Science Fact Sheet is one of a series compiled by Institute of Food Science and Technology, providing clear, concise and scientifically reliable information on key food science topics for consumers.

## Fats and Oils

### What are fats and oils?

Macronutrients required by the body as part of a healthy diet which should form about a third of our daily energy source. In most cases, fats are solid at room temperature whilst oils are liquid. Chemically they are made up of saturated and unsaturated (monounsaturated and polyunsaturated) fatty acids, linked together in groups of 3 (triglycerides). Trans fatty acids (trans fats) can be produced by an industrial process, called hydrogenation, where oils are converted into solid fats e.g. to be used in margarine or to prevent separation in peanut butter. They are unsaturated with the functional properties of saturated fats.

### Composition and sources:

<p><b>POLYUNSATURATED FATS</b></p> <p>Hemp Seeds, Chia Seeds, Flaxseed Oil, Walnuts</p> <p>Chemical structure: <math>\text{HO}-\text{C}(\text{O})-\text{C}(\text{H})=\text{C}(\text{H})-\text{C}(\text{H})=\text{C}(\text{H})-\text{C}(\text{H})=\text{C}(\text{H})-\dots</math></p> <ul style="list-style-type: none"> <li>more than one double bond</li> <li>cis-orientation (H on same side!)</li> </ul>
<p><b>MONOUNSATURATED FATS</b></p> <p>Generally liquid at room temperatures</p> <p>Olive Oil, Avocado, Almonds, Cashews</p> <p>Chemical structure: <math>\text{HO}-\text{C}(\text{O})-\text{C}(\text{H})=\text{C}(\text{H})-\text{C}(\text{H})-\text{C}(\text{H})-\text{C}(\text{H})-\dots</math></p> <ul style="list-style-type: none"> <li>"mono" means one double bond</li> <li>cis-orientation (H on same side!)</li> </ul>
<p><b>SATURATED FATS</b></p> <p>Solid at room temperatures</p> <p>Coconut Oil, Butter, Cheese, Milk</p> <p>Chemical structure: <math>\text{HO}-\text{C}(\text{O})-\text{C}(\text{H})-\text{C}(\text{H})-\text{C}(\text{H})-\text{C}(\text{H})-\text{C}(\text{H})-\text{C}(\text{H})-\dots</math></p> <ul style="list-style-type: none"> <li>NO double bonds! It's saturated with hydrogen atoms</li> </ul>
<p><b>TRANS FATS</b></p> <p>Functional properties of unsaturated and saturated fats</p> <p>Chemical structure: <math>\text{HO}-\text{C}(\text{O})-\text{C}(\text{H})-\text{C}(\text{H})=\text{C}(\text{H})-\text{C}(\text{H})-\text{C}(\text{H})-\text{C}(\text{H})-\dots</math></p> <ul style="list-style-type: none"> <li>Has double bond(s), BUT it has trans-configuration</li> </ul>

Fats and oils are mixtures of triglycerides made of different types of fatty acids. A saturated fat contains a high percentage of saturated fatty acids, e.g. more than 50% (palm oil), while an unsaturated oil contains lower amounts of saturated fatty acids, e.g. 16% (soybean oil).

### Summary of differences:

Saturated Fat	Unsaturated Fat
Consist of higher percentages of saturated fatty acids with <b>no double bonds</b> between the carbon atoms of the fatty acid chains	Consist of higher percentages of unsaturated fatty acids which have <b>one or more double bonds</b> in the fatty acid chains
Higher melting point	Lower melting point
Solid at room temperature	Liquid at room temperature

### What is cholesterol?

A 'fat-like' substance which is produced mostly by the liver. It is present in all body cells and needed for many essential body processes such as digestion of fat and the skin's production of vitamin D. It is grouped into 'bad' low-density lipoprotein (LDL) and 'good' high-density lipoprotein (HDL) cholesterol. Eating too much saturated and trans fats can raise the 'bad' cholesterol in your blood, which can increase the risk of heart disease and stroke. HDL has a positive effect by taking cholesterol from parts of the body where there is an excess, to the liver where it is disposed of. There is extensive evidence that replacing some saturated fats with unsaturated fats can help lower the 'bad' and increase the 'good' blood cholesterol levels, thereby reducing the risk of heart disease.

### Why are fats and oils important?

#### Functions in the body:

**Energy** - through metabolism they are broken down to release the energy (9 calories/gram) needed to carry out bodily function

**Transportation** - carry fat soluble vitamins (A, D, E and K) to where they are needed

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**Essential fatty acids** - provide those the body cannot make (omega-3 and 6) and are involved in the regulation of many crucial body functions

**Structure** - crucial component of all cell membranes

**Protection** - layers of fat surround vital organs to give a cushioning effect

**Insulation** - help to regulate temperature and keep the body warm when needed

**Cholesterol** - influence its level in the body

## Functions in food:

**Heat transfer** - for example when frying eggs or sautéing potatoes, and helps in crust formation and gives crispness

**Flavour** - they can absorb, preserve or improve flavours

**Structure** - influences texture in foods with a fat continuous phase, such as chocolate

**Shortening** - fats make baked goods tender, crunchy or flaky by impeding the formation of gluten strands such as in biscuits and pie crusts

**Appearance** - they make baked and fried foods shiny and give an appealing golden-brown colour

**Emulsification** - the mixture of oils and water creates a unique, creamy texture, as in salad dressings, mayonnaise, ice cream, yogurt and other sauces.

## What is plasticity?

It is the property of fats that can be spread, manipulated and shaped due to the presence of triglycerides which have different melting points, with some staying solid for longer than others. However, heating causes triglycerides to break down into their component parts and decompose. Some fats are easier to spread than others, for example margarine can be spread straight from the fridge unlike butter. Also, the unique melting behaviour of cocoa butter makes chocolate melt on your tongue.



## Common food sources

**Saturated fat** - mostly found in meats, meat products and dairy products, such as butter, milk and cheese. However, some fats derived from plants are high in saturates such as cocoa butter, coconut oil, palm and palm kernel (referred to as tropical oils). They are widely used in foods such as cakes, biscuits and pastries.

**Unsaturated fat** - Monounsaturated fat is found in avocado, olive and rapeseed oils and spreads. There are two main types of polyunsaturated fats:

- omega-6 fats found in vegetable oils, such as maize (corn) and sunflower. Also, in some nuts such as walnuts, almonds and cashews

- omega-3 fats found in oily fish such as sardines, salmon and mackerel. Sources suitable for vegetarians include flaxseed (linseed) oil, rapeseed oil, walnuts and eggs enriched with omega-3.

**Trans fat** - as well as being present in hydrogenated and refined vegetable oils, they are naturally found in some dairy foods and meats.

## What are government recommendations?

Most people in the UK eat too much saturated fat. Government recommendations and nutritional guidelines advise cutting down on all fats and replacing some saturated fat with unsaturated oils. Regarding trans fats, due to their recommendations to food manufacturers to reduce the amount used in products, intake of trans fats in the population is now very low. The current UK guidelines are:

- saturated fat - not more than 30g/day for an adult male; 20g/day for an adult female and children should have even less
- unsaturated fat - approximately 90g/day for an adult male; 70g/day for an adult female
- trans fat - not more than 5g/day for adults

Most people have enough omega-6 in their diet, but it is recommended to consume more omega-3 by eating at least two portions of fish each week, with one portion being an oily fish.

All packaged food products must provide nutrition labelling which contains information that helps make healthier choices. They provide figures per 100g and/or per portion, helping you compare similar products.

Some have a traffic light summary on front of pack:

	Low	Medium	High
Fat	3g or less	3g to 17.5g	17.5g or more
Saturated Fat	1.5g or less	1.5g to 5g	5g or more

Products which are 'red' should be eaten less often, and we should rather aim to eat more 'green' and 'amber' products.

Guidance for nutritional claims include:

- **Low in fat:** 3g or less per 100g of food
- **Low in saturated fat:** 1.5g or less per 100g
- **Fat free:** 0.5g or less per 100g
- **Saturated fat free:** 0.1g per 100g.

## References

[Fat | British Nutrition Foundation](#)

[Fat: the facts | NHS](#)

[Fat facts: Food Fact Sheet | BDA](#)

[Check the label | Food Standards Agency](#)