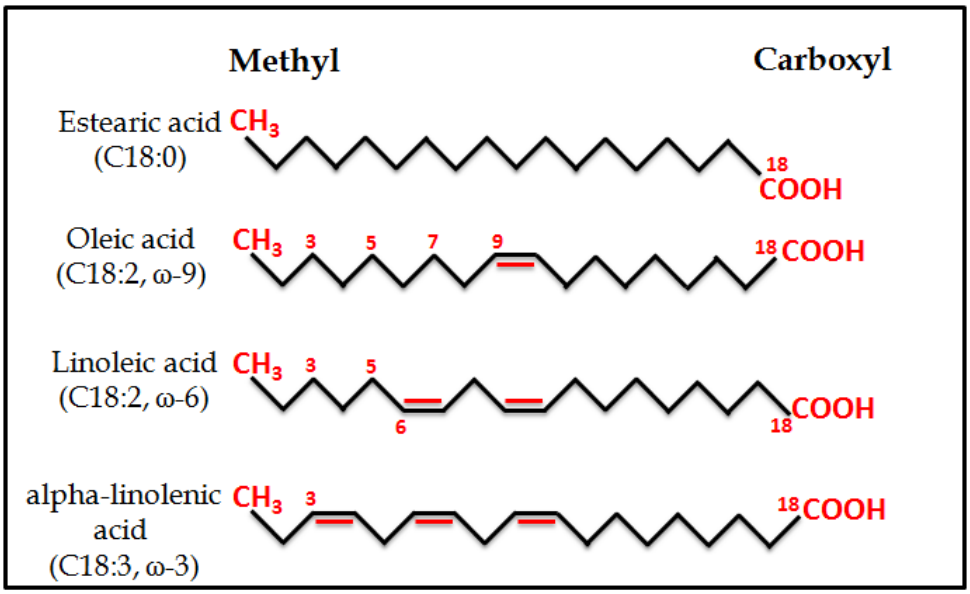
2. Unsaturated fatty acids:

Unsaturated fatty acids are the fatty acids that contain one or more double bonds between the carbon atoms and are more reactive than saturated fatty acids. They are liquid at room temperature. These may either be Monounsaturated fatty acids or Polyunsaturated fatty acids. Abundant in fish and vegetable oils and reduce the risk of coronary heart diseases. E.g., Oleic acid, Linoleic acid, and Linolenic acid.

Unsaturated fatty acids may further be divided as follows:

A: Monounsaturated fatty acids (MUFA):

A type of unsaturated fat that contains only one double bond which is found in the 9th carbon atom at the methyl end (omega). The most frequently met is oleic acid (18: 1n-9), which represents 70-72% of the olive oil and avocado fats and about 50% in the rapeseed oil. Animals and humans can synthesize monounsaturated fatty acids, so it needs no input from outside; in other words, are not essentials. At room temperature, the monounsaturated fatty acids have a liquid or semisolid consistency.
Monounsaturated fatty acids have the best protecting effects on health against chronic disease, lowering the LDL (low density lipoproteins or "bad" cholesterol), increasing the HDL (high density lipoproteins or "good" cholesterol) easy lowering the blood pressure, improving the blood flow, helping to normalize the glucose in diabetics without lowering the triglycerides, and reducing the cancer diseases risk.



B. Polyunsaturated fatty acids (PUFA):

Another type of unsaturated fat, also known as n-6 fatty acids (Omega-6 fatty acids), that contains two or more double bonds in their structure. PUFAs are found in all-natural foods in varying amounts, but fatty foods contain the most. In general, vegetable oils are the most concentrated sources of PUFAs in the American diet and include sunflower oil, safflower oil, corn oil, flax oil, sesame seed oil, pumpkin seed oil, and canola (or rapeseed) oil.

Studies have shown that replacing saturated fats in the diet with foods containing polyunsaturated fats reduced LDL cholesterol levels and lowered cardiovascular disease risk.

Differences between saturated and unsaturated fats

Saturated Fatty Acids	***Unsaturated Fatty Acids***
1. The fatty acid chain is straight.	1. The fatty acid chains are bent in some places.
2. Contain only single bonds no double bond between the carbon atoms.	2. Contain one or more double bonds between the carbon atoms.
3. They are solid at room temperature.	3. hey are liquid at room temperature.
4. Increase levels of "bad" cholesterol (LDL). (Low-density lipoprotein).	4. Increase the level of "good" cholesterol (HDL). (High-density lipoprotein).
5. The human body makes saturated fatty acids; no need to provide an external source.	5. Unsaturated fatty acids other than monounsaturated fatty acids are not made by the human body so that need to be supplied as a daily amount of daily fat.
6. Found mostly in animals, such as in meats, butter, dairy product, coconut oil. For example, Palmitic acid, Stearic acid, etc.	6. Found mostly in vegetable oil plant, such as Sunflower oil, sesame oil, rapeseed oil. For example, Oleic acid, linoleic acid, and linolenic acid.

Essential Fatty Acids:

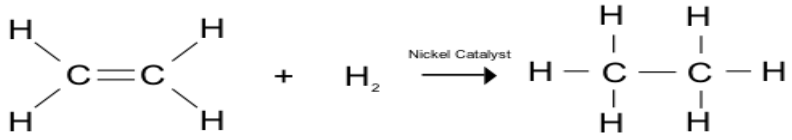
They are essential fatty acids that cannot be synthesized (manufacture) in the human body and must be taken in adequate amounts in the diet. They are required for normal growth, various hormones production, and metabolism. Two essential fatty acids, linoleic, and linolenic acid are both polyunsaturated acids. They are found in the natural oils of plants, seeds, and fish.

Hydrogenation of edible oils or Trans Fat:

Hydrogenation converts liquid oils, or double bonds in oils into solid or semi-solid fats, or single bonds (Unsaturated to saturated). Hydrogenation is a process by which hydrogen added directly to points of unsaturated in the fatty acids.

Mechanisms of hydrogenation:

In the process of hydrogenation, **vegetable oils** are reacted with hydrogen gas at about 60ºC. A nickel catalyst is used to speed up the reaction. This removes double bonds from unsaturated fats, converting them into single bonds-saturated fats, they are hardened. Some of the most commonly consumed foods, which use hydrogenated oils (or trans fats) are margarine, shortening, salad dressing, cake mix, and cookies.



The advantage of hydrogenation:

1. Hydrogenation increases the melting point.
2. Decrease the rate of oxidation (longer shelf-life).
3. Increases hardness.
4. The form is more convenient for some cooking techniques.

Disadvantages of hydrogenation oils:

1. Unsaturated oils are healthier for the heart than saturated fat.
2. Increase the level of LDL, cholesterol in your blood.
3. Trans fats are hard to metabolize, accumulate in fatty tissue, and are difficult to excrete from the body.

Oils and Fats Oxidation:

Oxygen is eight times more soluble in fats than in water, and it is the oxidation resulting from this exposure that is the primary cause of rancidity. The more polyunsaturated a fat is, the faster it will go rancid. This may not, at first, be readily apparent because vegetable oils have to become several times more rancid than animal fats before our noses can detect it. An extreme example of rancidity is the linseed oil (flaxseed) that we use as a wood finish and a base for oil paints. In just a matter of hours, the oil oxidizes into a solid polymer. This is very desirable for woods and paint, but very undesirable for food.
Smell and taste the oil before use if it smells like oil paint or leaves a scratchy sensation in the back of your throat, it is rancid and should be discarded.
The double bonds found in fats and oils play a role in autoxidation. Oils with a high degree of unsaturated are most susceptible to autoxidation. The best test for autoxidation (oxidative rancidity) is the determination of the peroxide value. Peroxides are intermediates in the autoxidation reaction.

Rancidity

Rancidity is the natural process of decomposition of fats or oils by either hydrolysis or oxidation, or both.
Rancidity is the development of unpleasant smells in fats and oils, which are often accompanied by changes in their texture and appearance.

Types of Rancidity

Oxidative rancidity is a condition caused by fat oxidation

Hydrolytic rancidity is a condition caused by fat hydrolysis.

Oxidative rancidity of fats such as lard, shortenings, salad, and cooking oils refer to the undesirable odors and flavors which develop when such products are exposed to the oxygen in the air.
Hydrolytic rancidity refers to the oil, caused by a breakdown of the fat into glycerol and fatty acid. This reaction of lipid with water sometimes requires a catalyst but results in the formation of free fatty acids and salts from free fatty acids (soaps). In particular, short-chain fatty acids, such as common butter fats, are odorous.

Factors causing rancidity

Temperature, moisture, the amount of air in contact with the fat, light, and presence or absence of antioxidants influence the reaction, trace elements (iron & zinc), salt, water bacteria, and mold.

How to Stop Rancidity

- Keep fats free from oxygen and air.
- Sugar in cookies and biscuits appears to have a marked inhibiting effect on the onset of rancidity.
- Sugar slows down rancidity.
- Do not store oil in iron container use glass!
- Keep metals and light away from fats.
- Salt speeds up rancidity.