**LIPIDS**

The term ‘lipids’ is derived from the Greek word ‘lipos’ for fat, therefore the term lipid is used to describe a chemically heterogeneous group of organic compounds which have in common the general property of insolubility in water but soluble in organic solvents such as hydrocarbons (e.g. hexane and toluene), chloroform and alcohols. Water insolubility is conferred by lipid molecular structure having large regions of their surface composed of hydrocarbons with very few polar groups. This analytical property used as a basis to differ lipids from carbohydrates and proteins.

They are derivate of fatty acids. Many lipids are surface active/amphipathic in nature; contain both hydrophobic and hydrophilic parts which make them easily interact with other molecules and aqueous solvents via hydrogen bonding and electrostatic interactions.

There are important functions of lipids. They are stored in adipose tissue (triglycerides) and are one of the major energy source. Some lipids are essential nutrients like fat-soluble vitamins A, D, E, K. They are utilized as “bricks” for construction of biological membranes. Many hormones are lipids, act as regulators of intracellular processes, reducing the loss of body heat. Lipids are also important components for food industry. They affect the texture and flavor of food and so its palatability. Because of their surface active property, emulsions can be produced.

**Classification of Lipids**

They may be classified based on their physical properties at room temperature (solid or liquid, respectively fats and oils), on polarity, or on their essentiality for humans, but the preferable classification is based on their structure. Based on structure, they can be classified in three major groups; simple lipids, complex lipids, derived lipids.

Simple lipids have two different groups. Neutral lipids (fats and oils) and waxes. *Neutral lipids*; these are esters of fatty acids and glycerol. Nearly all of the lipids on our diet is in this group. Triacylglycerols (triglycerides) are the products of a reaction in which three OH groups of glycerol are esterified with fatty acids. A simple triglyceride is a triacylglycerol with three of the same fatty acid components. A mixed triacylglycerol is a triglyceride that contains two or three different fatty acid components and are more common than simple triacylglycerols. Fat is the name given to a class of triglycerides that appear as solid or semisolid at room temperature, fats are mainly present in animals. Oil is the name given to class triglycerides that appear as a liquid at room temperature, oils are mainly present in plants and sometimes in fish. Fats usually consist of saturated fatty acids while oils usually consist of unsaturated fatty acids. *Waxes* are esters formed from long-chain carboxylic acids and long-alcohols. Waxes are seen all over in nature; the leaves and fruits of many plants have waxy coatings, bee wax, lanolin, ear secretion. They are important in industry and human medicine.

Complex lipids are consisting of more than two types of structural moieties. Esters of fatty acids, alcohol and another group. Based on the group present they are further classified into phospholipids, glycolipids, proteolipids. *Phospholipids*, containing in addition to fatty acids and an alcohol, a phosphoric acid residue. They frequently have nitrogen-containing bases and other substituents. Based on the type of alcohol present they are again divided into; glycerphospholipids contain glycerol as alcohol, eg: lecithin and cephalin, sphingophospholipids contain sphingosine as alcohol, eg: sphingomyelin. *Glycolipids*, lipids containing a fatty acid, sphingosine, and carbohydrate. Because they contain sphingosine as alcohol they are also known as glycosphingolipids. Cerebrosides and gangliosides are the examples for this group. *Proteolipids,* macromolecular complexes of lipids with proteins. They can exist in nervous system and brain. Typical examples of them are LDL, VLDL, and HDL.

Derived lipids, are the building blocks of simple and complex lipids and they are released from these major groups by hydrolysis. Fatty acids and alcohols, fat soluble vitamins A, D, E and K, hydrocarbons and sterols are in this group.

**Fatty Acids**

Fatty acids are carbon chains with a methyl group at one end of the molecule and a carboxyl group at the other end. Carbon chain skeleton of fatty acids have variable length, generally with an even number of atoms. Fatty acids from 2 to 30 carbons or more occur, but the most common and important ones contain between 12 and 22 carbon atoms and are found in many different animal and plant fats. They are rarely free in nature and are the main components of; triglycerides, diacylglycerols, monoacylglycerols, phospholipids of cell membranes, sterol esters.

 

 CH3- (CH2)n-COOH

The most common saturated fatty acid in animals, plants and microorganisms is palmitic acid (16:0). Stearic acid (18:0) is a major fatty acid in animals and some fungi, and a minor component in most plants. Myristic acid (14:0) has also a widespread occurrence.

**Nomenclature of fatty acids**

Fatty acids may be named according to systematic or trivial nomenclature. Fatty acids called by their systematic names according to the IUPAC (International Union of Pure and Applied Chemistry). Trivial names are used much more frequently than systematic names. Another systematic way of naming fatty acids would be a shorthand nomenclature which has evolved over decades where their number of carbon atoms, and their number of double bonds after a colon, e.g., 16:0. For unsaturated fatty acids contains the positioning of the first double bond from the omega end written in parenthesis, e.g., 18:3(n-3).

Trivial names are typically deriving from a common source of the compound or the source from which it was first isolated. Trivial names contain no clues to the structures. Palmitic acid is found in palm oil; oleic acid is a major constituent of olive oil (oleum).

IUPAC names describe the structure of the fatty acid in detail. In this nomenclature, basically number of carbon atoms Greek name and oic (for saturated) or enoic (for unsaturated) affixes are used. Number of double bonds and the number(s) of the carbon, carrying the double bond also added to the affix part e.g.; decanoic acid, octadeca-9,12-dienoic acid.

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| **Trivial name** | **IUPAC name** | **Shortand** |
| Butyric acid | Butanoic acid | 4:0 |
| Myristic acid | Tetradecanoic acid | 14:0 |
| Palmitic acid | Hexadecanoic acid | 16:0 |
| Stearic acid | Octadecanoic acid | 18:0 |
| Linoleic acid | Octadeca-9,12-dienoic acid | 18:2n-6 |
| Arachidonic acid | Icosa-5,8,11,14-tetraenoic acid | 20:4n-6 |
| Eicosapentaenoic acid | Icosa-5,8,11,14,17-pentaenoic acid | 20:5n-3 |