

Unit - (IV) -  
Subunit - 4.4.

## Fatty Acids

Date / /  
Page



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All fats are lipids, but all lipids are not the fats. Fatty acids are carboxylic acids with hydrocarbon side chain. They are the simplest form of lipids. These acids contain even number of carbon atoms linked together in long chains which are generally unbranched. In plants generally, a fatty acid consists of a straight chain of an even number of carbon atoms, with hydrogen atoms along the length of the chain and a carboxyl group ( $-COOH$ ) at the other end. It is that carboxyl group that makes it an acid (carboxylic acid). If the carbon to carbon bonds are all single, the acid is saturated; if any of the bonds is double or triple, the acid is unsaturated and is more reactive. A few fatty acids have branched chains, others contain ring str. (e.g. prostaglandins). Fatty acids are not found in a free state in nature; commonly they exist in combination with glycerol (an alcohol) in the form of triglyceride.



## Structure of Fatty acid:

A fat molecule consists of two kind of parts:

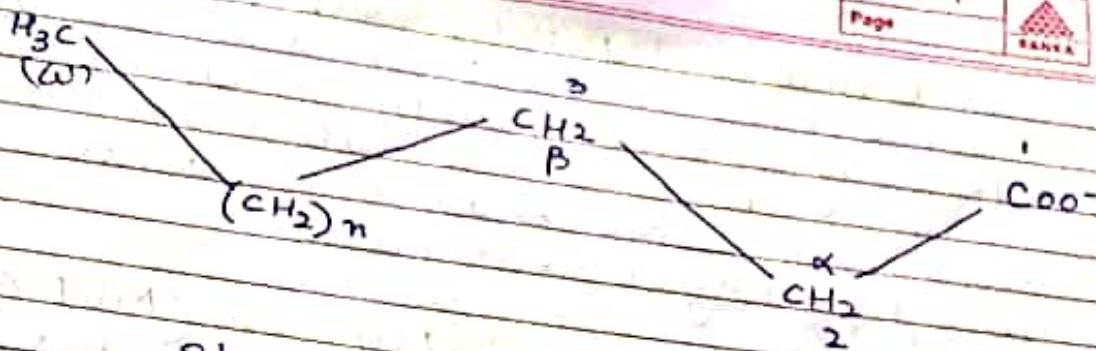
- (i) A Glycerol backbone (ii) 3-fatty acid tail.

Glycerol is a small organic molecule with three hydroxyl (OH) groups, while a fatty acid consists of a long hydrocarbon chain attached to a carboxyl group. A typical fatty acid contains 12-18 carbons, though some may have as few as 4 or as many as 36. These molecules are also known as ~~by~~ triacylglycerols.

Fatty acids are composed of carbon chains containing a methyl group at one end and a carboxyl group at the other. The methyl group is termed as ( $\omega$ ) carbon, followed by the ' $\beta$ ' carbons, omega and the carbon atom situated next to the carboxyl group is termed as ' $\alpha$ ' carbon, followed by the ' $\beta$ ' carbon, etc. fatty acid molecules also have two chemically distinct regions:

- (i) a long hydrophobic hydrocarbon chain
- (ii) a carboxy - (COOH) group.





Structure of fatty acid.

Classification of fatty acids:

fatty acids are classified according to the presence and number of double bonds in their carbon chain.

- (1) **Saturated fatty acids:** The fatty acids which are saturated with hydrogen and have only single bonds in the hydrocarbon chain are known as saturated fatty acids. The general formula of saturated fatty acid is  $RCOOH$ , where R is the hydrocarbon chain. They have maximum possible number of attached hydrogens. They vary from  $C_3$  to  $C_{30}$ . These acids with 10 carbon or less number of carbon atoms are k/a lower fatty acids e.g. acetic acid and butyric acid and acids with more than 10 carbon atoms are called higher fatty acids e.g. palmitic acid and stearic acid.



### (ii) Unsaturated Fatty Acids:

These have double bond and its general formula is  $C_n H_{2n-1} COOH$ . Acids with only one double bond are called mono-unsaturated and with more than one double bond are called poly-unsaturated.

#### Monounsaturated fatty acid (MUFA)

Contains single double bond in their structure

e.g. palmitoleic acid and Oleic acid

**Polyunsaturated fatty acids (PUFA)** contain more than one double bond in their str. Their general formulae vary and depend upon the number of double bonds.

(iii) **Cyclic fatty Acids**: These are of rare occurrence and named so because they contain cyclic str.

(iv) **Substituted Fatty Acids**: In these acids, one or more of the hydrogen atoms have been replaced by  $-OH$  group or  $-CH_3$  group respec.

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