LIPIDS

Lipids contain fats and oils. They are insoluble in water but soluble in fat solvents. They are mainly made up of carbon, hydrogen and oxygen. They contain much smaller proportions of O_2 than CHO and larger proportions of C and H hence they are more concentrated source of energy providing 2.5 times more energy than carbohydrates and proteins.

Basic chemical structure of fats and oils

Glycerol+ 3 Fatty acids ⟶ Triglyceride +3 H_20

Basic chemical structure of fats and oils is a molecule of glycerol to which 3 fatty acids are attached. Such a fat is called a simple triglyceride. Triglycerides constitutes of 90% of all food fats.

Fatty acids consist of chains of carbon atoms with a methyl group at one end and a carboxyl group at the other end. Fatty acids may have short chains or they may have long chains.

Classification of lipids :

Glycerol+ Fatty acid

Saturated fat Unsaturated fat

Monounsaturated Polyunsaturated

Oleic acid Linoleic, Linolenic, Arachidonic acid

Fatty acids can be saturated and unsaturated

- Saturated fats have single bond between carbon atoms.
- Unsaturated fats have one or more double bonds between the carbon atoms.

- Fatty acids with one double bond between carbon atoms is called monounsaturated (MUFA).
- Fatty acids with two or more double bonds is called polyunsaturated (PUFA)

Unsaturated fats are highly reactive to oxygen at the point of unsaturation and turn rancid. Hydrogenation is done to make lipids stable.

Saturated fats

Those fats which contain saturated fatty acids, which have single bonds between their carbon atoms. These are found in animal foods such as meat, butter, cheese, egg yolk and plant food such as coconut oil, palm oil, hydrogenated fats used in bakery products and confections have a high percentage of saturated fatty acids.

Eg. Of SFA- stearic acid (C_{16}), palmitic acid (C_{18}), myristic acid (C_{14}) and bytyric acid(C_4).

Butyric acid- butter Myristic acid- coconut, butter Palmatic acid- soya cotton seed, lard Stearic acid- beef tallow, cocoa butter, lard(hard substance made from animal fat)

Maximum 10% of our total calories should come from saturated fats.

Unsaturated fats

Those fats which contain unsaturated fatty acids- double bonds between the carbon atoms.

Oleic acid- groundnut, olive oil Linoleic acid- sunflower, safflower, soyabean

Linolenic acid- soyabean, olive oil, fish oil Arachidonic acid- animal fats, groundnut

MUFA- helps in lowering blood cholesterol level without lowering HDL

PUFA- helps in lowering blood cholesterol level and prevents artherosclerosis and coroway heart disease.

Functions of fats

1) ENERGY- fats are a concentrated soured of energy in our diet. 1g of fat- 9 kcal. All tissues except those of the CNS and brain can utilise fat as a source of energy.
2) PROTEIN SPARING ACTION- adequate amount of fat in diet allows protein to perform its main functions.
3) THERMAL INSULATION- subcutaneous fat acts as an insulator and help in retaining body heat.
4) PROTECTION TO VITAL ORGANS- fat provides a protective padding to vital organs from mechanical shock.
5) ABSORPTION OF FAT SOLUBLE VITAMINS- vitamins A, D, E, K.
6) To meet body requirements of EFA's.
7) SATIETY VALUE- fats slow down the secretion of gastric juice and speed of digestion.
8) SYNTHESIS OF HORMONES- the lipid cholesterol is necessary for synthesis of some hormones. Eg. Sex hormones.
9) Fats are important constituent of cell membranes.

Essential fatty acids (EFA)

EFA are those which cannot be synthesised by the body and thus need to be provided to body in our diet.

- Two PUFA are EFA they are linoleic and linolenic acid.

  Linoleic is omega 6 fatty acid.

Linolenic is moega 3 fatty acid.

- 6 and 3 indicates the position of end most double bond. For eg. 3 means the end most double bond on the third carbon atom from the methyl group.
- Omega 6 rich oils- safflower, sunflower, cottonseed, corn, seasame and groundnut.
- Omega 3 rich- olive oils, fisg oil, mustard oil, soyabean, rajmah, GLV's.

Correct ratio of omega 6 and omega 3 helps in reducing blood cholesterol level.

An optimum balance between omega 6 and omega 3 is essential for maintaining good health. They are beneficial for the cardiovascular system, for inflammatory reactions and immune response.

For ensuring that body gets required amount of EFA's a blend of different oils should be used for cooking.

Oils recommended for cooking-

1. Seasame + mustard 2) Groundnut + mustard 3)Soyabean + olive 4)Corn + rice bran

Omega 3 fatty acids helps in maintaining cell membranes and prevent free radicals from attacking DNA in the cell.

CHOLESTROL

- It is a fat like substance present in food.
- It has a ring structure.
- It is present in all cells of the body and is present in large amounts in brain and nerve tissue.

The human body gets cholesterol from two sources :

1. Synthesised in liver.

2. Food rich in cholesterol.

The functions of cholesterol are :-

1. It is precursor of all steroidal hormones. Eg. Sex hormone.
2. It is required for formation of bile.
3. It is an essential constituent of cell membrane.
4. Precursor of Vit. D, 7-dehydrocholestrol is present in the skin which is converted to active Vit. D in presence of UV rays of sunlight.

SOURCES OF CHOLESTROL

Cholesterol is present in animal foods like whole milk, butter, ghee, cream, egg yolk, organ meat, etc. These are high cholesterol food.

Butter- 250 mg, Processed cheese- 150 mg, Paneer- 19 mg, Skim milk- 2 mg, Egg yolk- 252 mg, Plant food- 0 egg white- 0

However, fruits, vegetables, cereals and pulses, egg white, low fat fishes, skim milk are very low in cholesterol. These can be used to plan low cholesterol dishes.

Normal blood cholesterol level for adults should be below 200mg/dl of blood. Cholesterol if consumed in excess is responsible for diseases of the cardiovascular system.

- Visible sources of fat- all oils and fats.
- Invisible sources- nuts, milk, eggs.

Deficiency of fats results in

- Eczema and skin lesions, it leads to deficiency of fat soluble vitamins.
- Deficiency of linoleic and linolenic leads to deficiency of arachidonic acid. These are required for healthy cell.
- In infants- dry scaly lesions on the skin.

Excessive fat is stored as adipose tissue.

Excessive consumption of saturated fat can elevate blood cholesterol levels, and is a predisposing factor for cardiovascular diseases.

Reducing content of fat in diet-

- Use skim milk.
- Lean meat.
- Steam, boil, poach instead of frying.
- Avoid salad dressing or use low fat dressing.
- Select fruits and veg instead of pastries and puddings.
- For flavour add herbs, species, lime juice instead of fat