

# LIPIDS

FROM PANKAJA AND PAST PAPERS

- Simple Lipids = Fatty Acids + Alcohol
- Phospholipids = Fatty Acid + Alcohol + Phosphoric acid  
Glycerophospholipids = Fatty Acid + Glycerol + Phosphoric acid  
Sphingophospholipids = Fatty Acid + Sphingosine + Phosphoric acid
- Fatty Acid + Sphingosine is called ceramide
- **Saturated Fatty Acids**  
Having even carbon atoms: Palmitic acid, stearic acid  
Having odd carbon atoms: Propionic acid
- Monounsaturated fatty acid: Oleic acid
- Polyunsaturated fatty acids
  1. Linoleic acid – having two double bonds
  2. Linolenic acid – having three double bonds
  3. Arachidonic acid – having four double bonds
- Essential Fatty acids
  1. Linoleic acid
  2. Linolenic acid
  3. Arachidonic acid

Deficiency of essential fatty acid characterized by dermatitis and poor wound healing

- **Eicosanoids** are a diverse group of hormone like molecules produced in most mammalian tissues. Eicosanoids include:
  1. Prostaglandins
  2. Thromboxane
  3. Prostacyclin
  4. Leukotrienes
- Naturally occurring antioxidants include Vitamin E,  $\beta$ -carotene (pro Vitamin A) and Vitamin C
- **Glycerophospholipids**
  1. Phosphatidic acid = Fatty Acid + Glycerol + Phosphoric acid
  2. Lecithin = Fatty Acid + Glycerol + Phosphoric acid + Choline
  3. Cephalin = Fatty Acid + Glycerol + Phosphoric acid + Ethanolamine/ serine/ inositol
  4. Plasmalogens = Fatty Acid + Glycerol + Phosphoric acid + Ethanolamine

5. Cardiolipin = 2 Phosphatidic acids + Glycerol

- Other names of different glycerophospholipids
  - Lecithin – Phosphatidyl choline
  - Cephalin – phosphatidyl ethanolamine
  - Cardiolipin – diphosphatidyl glycerol
- Cerebrosides = Ceramide + Monosaccharides
- Gangliosides = Ceramides + Hexose + N-acetyl neuraminic acid or N-acetyl hexosamine
- Globoside = Ceramide + Oligosaccharide
- The maturity of fetal lung can be assessed from the **lecithin/sphingomyelin ratio** in amniotic fluid. A ratio of 2 or above is evidence of pulmonary maturity.
- **Thromboplastin** (coagulation Factor III) which is needed to initiate the clotting process, is composed mainly of cephalin
- **Plasmalogens** (platelet activating factor) involved in platelet aggregation and degranulation
- Classification of glycolipids:
  1. Cerebrosides
  2. Sulfatides
  3. Globosides
  4. Gangliosides
- Triacylglycerol is predominant lipid in chylomicrons and VLDL  
Cholesterol is predominant lipid in LDL  
Phospholipid is predominant lipid in HDL
- Eicosanoids are derived from arachidonic acid
- Thromboxane A<sub>2</sub> promote platelet aggregation and vasoconstriction
- **Leukotrienes** are powerful chemotactic agents i.e. they attract immune system cells to damaged tissue  
They also induce vasoconstriction and bronchioconstriction. Over production of leukotrienes cause asthmatic attacks.
- **Niemann-Pick disease** is caused by a rare genetic defect in the lysosomal enzyme sphingomyelinase, which cleaves phosphocholine from sphingomyelin.  
Sphingomyelin accumulates in the brain, spleen and liver. The disease becomes evident in infants and cause mental retardation and early death

- Fatty acids combine with alcohol sphingosine through amide linkage
- Cyclo oxygenase pathway produce prostaglandins and thromboxanes from arachidonic acid  
Lipo oxygenase pathway produce leukotrienes from arachidonic acid.
- In Gaucher disease, glucocerebroside accumulates in brain, liver, spleen and bone marrow due to inherited deficiency of lysosomal enzyme  $\beta$ -glucosidase. This disorder is associated with mental retardation and enlargement of liver and spleen.
- Sphingomyelin contains sphingosine base. It is called sphingol (long chain unsaturated amino alcohol)
- Nitrogenous base in lecithin is choline
- Cerebronic acid is present in galactosyl ceramide
- Chemically lipoic acid is sulfur containing fatty acid
- Cholesterol consist of steroid nucleus, namely cyclopentanoperhydrophenanthrene
- In mammals, the major fat in adipose tissues in phospholipid
- Prostacyclins produce vasodilation
- Lysolecithin is formed from lecithin by removal of fatty acid from position 2
- Predominant constituent of cerebroside is galactose
- Cholesterol is solid at room temperature and melts at around 150°
- Respiratory distress syndrome occurs in infants who lack the production and secretion of surfactant in the lungs  
Surfactant composition:
  - 70 – 80% phospholipid (mainly dipalmitoyl phosphatidyl choline)
  - 10% protein
  - 10% neutral lipids (mainly cholesterol)
- The only human glycerophospholipid with antigenic property is cardiolipin
- Cholesterol is a 27 carbon compound
- PGI<sub>2</sub> prevent blood clotting  
Thromboxane A<sub>2</sub> induce blood clotting

- The three main omega-3 fatty acids are:
  1. Alpha linolenic acid (ALA)
  2. Eicosapentanoic acid (EPA)
  3. Docosahexaenoic acid (DHA)
- Lecithin prevent fatty liver
- In humans, prostaglandins are primarily derived from arachidonic acid
- 1g of lipid yield 9.5 calories of energy
- Fatty acids are obtained from lipids by hydrolysis
- Lipoic acid is chemically sulfur containing fatty acid
- Four double bonds are present arachidonic acid
- Esterification of cholesterol occurs at carbon position 3
- High value of Saponification Number given by short chain fatty acids
- High iodine number indicates a high degree of unsaturation of fatty acids
- Acid number indicates the degree of rancidity of a given fat
- The richest source of poly unsaturated fatty acids in diet is vegetable oil