

Micronutrients in human Nutrition

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Question no. 01

Define:

1. Bile acid:

An acid made by the liver that works with bile to break down fats. On a more technical level, bile acids are steroid carboxylic acids derived from cholesterol. The primary bile acids are cholic and chenodeoxycholic acids. They are conjugated with glycine or taurine before they are secreted into the bile.

2. Hydrogenation of oil:

Hydrogenation is the process that used hydrogen gas to change into a hard spread/ margine .this process stabilizes the oil and prevents spoilage from oxidation.

3. Iodine number:

The number of grams of iodine, which is required to saturate the double bonds present in 100g of fats.

4. Lecithin:

These GPLs are derivatives of alpha-phosphatidic acid in which, choline is joined with H₃PO₄.

- Lecithin, also called Phosphatidyl Choline, any of a group of phospholipids (phosphoglycerides) that are important in cell structure and metabolism. Lecithins are composed of phosphoric acid, cholines, esters of glycerol, and two fatty acids; the chain length, position, and degree of unsaturation of these fatty acids vary, and this variation results in different lecithins with different biological functions.

5. Triglyceride:

A triglyceride is an ester derived from glycerol and three fatty acids. Triglycerides are the main constituents of body fat in humans and other vertebrates, as well as vegetable fat.

Question : 2

What is lipid ?what is the difference between fats and waxes? What is the importance of lipids in our body.

Answer.

Lipids are organic compounds that contain hydrogen, carbon, and oxygen atoms, which forms the framework for the structure and function of living cells.”

Lipids are organic compound made up of fatty acid, Alcohols and may contain other compounds. These organic compounds are nonpolar molecules, which are soluble only in nonpolar solvents like ether and insoluble in water because water is polar molecules. In the human body, these molecules can be synthesized in the liver.

- Lipids are oily or greasy nonpolar molecules, stored in the adipose tissue of the body.
- Lipids are a heterogeneous group of compounds, mainly composed of hydrocarbon chains.
- Lipids are energy-rich organic molecules, which provide energy for different life processes.
- Lipids are a class of compounds distinguished by their insolubility in water and solubility in nonpolar solvents.
- Lipids are important in biological systems because they form the cell membrane.

Examples of Lipids:

There are different types of lipids. Some examples of lipids include butter, ghee, vegetable oil, cheese, cholesterol and other steroids, waxes, phospholipids, and fat-soluble vitamins. All these compounds have similar features, i.e. insoluble in water and soluble in organic solvents, etc.

Difference

Fats:

- Fats are esters of fattyacid with glycerol.
- The fattyacid moiety in lipids esters is called 'acyl' group.
- They are the major and storage and transport form of lipids
- Also known as triglycerides.
- There are four major dietary fats in the foods we eat:

Saturated fats.

Trans fats.

Monounsaturated fats.

Polyunsaturated fats.

Waxes:

- Waxes are esters of fattyacid other than glycerol

They contain one mole of long chain fatty acid esterified with one mole of high molecular weight mono hydroxy alcohol.

Naturally occurring common waxes are beeswax,lanolin,and spermaceti.

Importance of lipids:

- Lipids play a very important role in our body

- They are the structural component of the cell membrane.
- They help in providing energy and produce hormones in our body.
- They help in proper digestion and absorption of food.
- They are a healthy part of our diet if taken in proper amounts.
- They also play an important role in signaling.

Question: 3

What is prostaglandins ? And what are their function?

The prostaglandins are made up of unsaturated fatty acids that contain a cyclopentane (5-carbon) ring and are derived from the 20-carbon, straight-chain, polyunsaturated fatty acid precursor arachidonic acid.

Prostaglandins (PGs) are a family of fatty acid eicosanoids synthesized from arachidonic acid via cyclooxygenase, an enzyme involved in the synthesis of PGs, prostacyclin, and thromboxane, and the target of anti-inflammatory agents such as ibuprofen.

The eicosanoids are considered as local hormones. They have specific effect on target cell close to their sites of formation.

The ability of the same prostaglandin to stimulate a reaction in one tissue and inhibit the same reaction in another tissue is determined by the type of receptor to which the prostaglandin binds. They act as or paracrine factors with their target cells present in the immediate vicinity of the site of their secretion. Prostaglandins differ from endocrine hormones in that they are not produced at a specific site but in many places throughout the human body.

Function:

The prostaglandins are a group of lipids made at sites of tissue damage or infection that are involved in dealing with injury and illness. They control processes such as inflammation, blood flow, the formation of blood clots and the induction of labor preventing needless clot formation, as well as regulating the contraction of smooth muscle tissue.

Question :4

What are fatty acids? How fatty acid are classified.

Fatty Acids:

Definition:

Fatty acids are the building blocks of the fat in our bodies.

- Made of minimum two carbon atoms .
- Chain length of lipid forming fatty acids ranges from 4 to 24 carbon atoms .

Classification of fatty acid:

1.saturated Fatty Acids:

They do not contain double bond e.g butyric, caproic acid, palmitic, stearic acid.

The saturated fatty acids having less than eight carbon atoms are liquid at room temperature and are volatile.

2. Unsaturated Fatty Acid:

These fatty acids contain double bonds.

Unsaturated fatty acids are further classified into:

Monounsaturated Fatty Acid:

Contain only one double bond e.g oleic acid.

Polyunsaturated Fatty Acid:

These contain more than one double bond. e.g olive, Rapeseed oil

Polyunsaturated FAs have biological importance i.e Linoleic acid, Linolenic acid and Arachidonic acid.

Essential F.A:

Polysaturated FA which are not synthesized by our body and taken in diet.

They also called omega or vitamin E.

Question: 5

Write a short notes on

Lipoproteins:

Lipoproteins are substances made of protein and fat that carry cholesterol through your bloodstream.

There are two main types of cholesterol:

- **High-density lipoprotein (HDL), or "good" cholesterol**
- **Low-density lipoprotein (LDL), or "bad" cholesterol.**

A lipoprotein is a biochemical assembly whose primary purpose is to transport hydrophobic lipid (also known as fat) molecules in water, as in blood plasma or other extracellular fluids. They have a single-layer phospholipid and cholesterol outer shell, with the hydrophilic portions oriented outward toward the surrounding water and lipophilic portions oriented inward toward the lipids molecules within the particles. Thus, the complex serves to emulsify the fats in extracellular fluids. A special kind of protein, called apolipoprotein, is embedded in the outer shell, both stabilizing the complex and giving it a functional identity that determines its fat its main function is transfer lipid such as cholesterol via blood stream, transfer energy to the muscles, help the body to sustain its Nerve cells.

Example:

Many enzymes, transporters, structural proteins, antigens, adhesions, and toxins are lipoproteins.

B. Cholesterol:

Cholesterol is waxy like substance, found only in animal source foods. Triglycerides, LDL, HDL, VLDL are different types of cholesterol found in the blood cells.

Cholesterol is an important lipid found in the cell membrane. It is a sterol, which means that cholesterol is a combination of steroid and alcohol. In the human body, cholesterol is synthesized in the liver.

These compounds are biosynthesized by all living cells and are essential for the structural component of the cell membrane.

In the cell membrane, the steroid ring structure of cholesterol provides a rigid hydrophobic structure that helps boost the rigidity of the cell membrane. Without cholesterol, the cell membrane would be too fluid.

It is an important component of cell membranes and is also the basis for the synthesis of other steroids, including the sex hormones estradiol and testosterone, as well as other steroids such as cortisone and vitamin D.