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**ROLL NO: 16929**

**ANSWER NO: 1**

1. **BILE ACIDS**

Bile acids are steroid acids found largely in bile of mammals. Different bile acids are synthesized in the liver. Bile acids are conjugated with residues of taurine or glycine to give anions called bile salts. Bile contains bile acids, which are critical for digestion and absorption of fats and fat-soluble vitamins in the small intestine. Many waste products, including bilirubin, are eliminated from the body by secretion into bile and elimination from the body.

1. **HYDROGENATION OF OIL**

Hydrogenation literally means to treat with hydrogen.

Hydrogenation is a process in which hydrogen gas is used to change a liquid vegetable oil into a hard spread. Nickel is used as a catalyst. This process stabilizes the oil and prevents its spoilage from oxidation. Changing the degree of saturation of the fat also changes some important physical properties like melting range. That’s why liquid oils become semi-solid. Hydrogenated oils are found in foods that also have saturated fat like margarine, vegetable shortening and packaged snacks. The process of hydrogenation is used in the fat and oils industry.

1. **IODINE NUMBER**

The iodine number is the mass of iodine in grams that is consumed by 100 grams of a chemical substance. Iodine numbers are used to determine the amount of unsaturation in fatty acids. This unsaturation is in the form of double bonds, which react with iodine compounds. The higher the iodine value, the more unsaturated fatty acid bonds are present in a fat.

1. **LECITHIN**

Lecithin is a fat that is essential in the cells of the body. It is found in many foods like soybeans and egg yolks. Lecithin is taken as a medicine and it is also used in the manufacturing of medicines. Lecithin is used for treating memory disorders such as dementia and Alzheimer's disease. It is essential for proper biological function. Lecithin supplements can also be used to treat high cholesterol and digestive issues and to prevent clogged milk ducts, during breast-feeding.

1. **TRIGLYCERIDES**

Triglyceride is an ester which is derived from glycerol and three fatty acids. Triglycerides are the main constituents of body fat in our body. They are the most common type of fat in your body. They come from foods like butter, oils, and other fats you eat. Triglycerides also come from extra calories. These are the calories that you eat but your body does not need them right away so they get stored in your fat cells. Later they are released by hormones for energy.

**Answer No: 2**

Lipids are organic compounds that are fatty acids or derivatives of fatty acids. They are insoluble in water because they are non-polar but soluble in organic solvents.

Lipids contain hydrocarbons and they make up the building blocks of the structure and function of living cells. Examples of lipids are fats, oils, waxes, vitamins like A, D, E and K and hormones.

**Difference between Fats and Waxes**

|  |  |
| --- | --- |
| **FATS**   1. Fats are esters of fatty acids with glycerol. 2. Types of fatty acids are long and short chains. 3. Fats are saponified either by aqueous or alcoholic alkali. 4. Fats are rancidible. 5. Fats are Nutritious. 6. Fats are digestible and they can be hydrolysed by lipase. 7. These are soft solid or liquids at room temperature. 8. Acrolein Test is Positive. 9. Examples: Butter and vegetable oil. | **WAXES**   1. Waxes are esters of fatty acids other than glycerol. 2. Types of fatty acids are palmitic or stearic acid. 3. Waxes are only saponified by alcoholic alkali. 4. Waxes never get rancid. 5. Waxes have no nutritional value. 6. Waxes are indigestible. They are not hydrolysed by lipase. 7. These are hard solid at room temperature. 8. Acrolein Test is Negative. 9. Examples: Bee and carnuba waxes. |

**Importance of Lipids**

Lipids have many important roles in our body. Some of them are as follows:

1. **Stores of energy**

Our body’s fat stores contain triglycerides which are an important source of energy. They provide our body with energy when we have not eaten for several hours, and can also supply our energy needs directly during prolonged workouts.

1. **Important part of the Cell membrane**

Cholesterol is a lipid which is present in every cell of the body and forms an important part of the cell membrane which surrounds every cell.

1. **Building blocks of Hormones**

Lipids are the building blocks of many hormones. They play an important role in the growth and development of our body.

Following are some important hormones which are made using cholesterol:

1. **Oestrogens and progestogens**

These hormones are produced by the ovaries and are responsible for female sexual characteristics and the menstrual cycle.

1. **Testosterone**

This hormone is produced by the testes and is responsible for male sexual characteristics and sperm production.

1. **Cortisol**

Cortisol is produced by the adrenal glands. It regulates our body’s response to stress.

1. **Aldosterone**

Aldosterone is also produced by the adrenal glands. It regulates the levels of salt and potassium in our body.

1. **Role of lipids in Digestion**

Lipids also play an important role in digestion. Bile acids are also made from cholesterol in the liver. It helps dissolve fats from our food. It is important for digestion and absorption of lipids and fat-soluble vitamins.

1. **Brain and heart health**

Lipids play an important role in our brain and heart health. People who have a high intake of olive oil or fish have a lower risk of heart disease than those who take high intake of saturated fats.

**Answer No: 3**

The prostaglandins are a group of physiologically active lipid compounds called eicosanoids. Which have diverse hormone-like effects in animals. Prostaglandins have been found in almost every tissue in humans and other animals.

**Structure**

Every prostaglandin contains 20 carbon atoms, including a 5-carbon ring. Prostaglandins are different in their structure due to substituent group and double bond on cyclo-pentane ring. There are currently ten known prostaglandin receptors on various cell types. The most importanat prostaglandins are:

1. **PGF**
2. **PGL2 prostacyclins**
3. **TXA2 thromboxanes**
4. **LTA4 leukotrienes.**

**Synthesis**

Prostaglandin is derived enzymatically from the fatty acid Arachidonic acid. It occurs in endoplasmic reticulum. Arachidonic acid is released from membrane bound phospholipids by phospholipase. It happens due to specific stimuli by hormones epinephrine or bradykinin. Then the oxidation and cyclization of arachidonic acid occurs to PGG2 which is then converted into PGH2 by peroxidase. PFH2 serves as the immediate precursor for the synthesis of many prostaglandins like prostacyclin and thromboxane. This is the cyclic pathway of arachidonic acid.

**Inhibition of PG synthesis**

Prostaglandin synthesis can be controlled by suicidal activity of cyclooxygenase. It is a suicidal enzyme and is capable of undergoing self-catalysed destruction to switch off PG synthesis.

Corticosteroids prevent the formation of arachidonic acid by inhibiting the enzyme phospholipase A2. Anti-inflammatory drugs inhibit the synthesis of prostaglandins. They block the action of cyclooxygenase. Aspirin irreversibly inhibits cyclooxygenase.

**Degradation of PG**

All the eicosanoids are metabolized rapidly and the degradation occurs in lungs and liver. Enzyme convert hydroxyl group at C15 to keto group and then C13 and C14 dihydroderivative.

**FUNCTIONS OF PROSTAGLANDIN**

1. **Prostaglandins act as local hormones**

PG’s are produced in almost all the tissues. PG’s are not stored and they are degraded to inactive products at the site of their production. PG’s are produced in very small amounts and have no half-lives.

1. **Regulation of blood pressure:**

* The prostaglandins (PEG, PGA and PGI2) are vasodilators in function. This result in an increased blood flow and decreased peripheral resistance to lower the blood pressure.
* PG service agents in the treatment of hypertension.

1. **Regulation of gastric secretion**

* Prostaglandins (PGE) inhibit gastric secretion.
* PG’s are used for the treatment of gastric ulcers.
* PGs stimulate pancreatic secretion and increase the motility of intestine which often causes diarrhea.

1. **Influence on immune system**

* Macrophages secrete (PGE) which decreases the immunological functions of B&T lymphocytes.

1. **Effects on respiratory functions**

* PGE is a bronchodilator whereas PGF acts as a constrictor of bronchial smooth muscles.
* PGE and PGF oppose the actions of each other in the lungs.
* PGEI and PGE 2 are used in the treatment of asthma.

1. **Inflammation**

* PGE and PGE 2 induce the symptoms of inflammation (redness swelling and edema etc.) due to arteriolar vasodilation.
* PGs Are natural mediators of Inflammatory reactions of rheumatoid arthritis, psoriasis conjunctivitis etc.
* Corticosteroids are used to treat these inflammatory reactions, since they inhibit prostaglandins synthesis.

1. **Reproduction**

* PGE2 and PGF2 are used for the medical termination of pregnancy and induction of Labor.

1. **Pain and fever**

* Fever producing agents promote prostaglandin synthesis leading to the formation of PGE2 in hypothalamus-regulation of body temperature.

1. **PGE2 along with histamine and bradykinin cause pain**

* Migration due to PGE2.
* Aspirin and other non-steroidal drugs inhibit PG synthesis and thus control fever and relieve pain.

**Answer No: 4**

Fatty acids are the monomers of fat they are the building blocks of the fat in our bodies and in the food we eat. During digestion, the body breaks down fats into fatty acids, which can then be absorbed into the blood. Fatty acid molecules are usually joined together in groups of three, forming a molecule called a triglyceride. Triglycerides are also made in our bodies from carbohydrates which we eat.

**Functions**

Fatty acids have many important functions in the body:

* If enough glucose is not available in our body then fatty acids are used as fuel by the cells for energy.
* Fatty acids have important roles in signal-transduction pathways
* They are important for the composition of hormones and lipids
* Used in the modification of proteins.

**Structure**

Fatty acids are synthesized from linear acetogenins of acetate pathway. Fatty acids are made up of long chains of carbon with methyl group at one end of the molecule and a carboxyl group at the other end and hydrogen atom. Some carbon atoms are linked by single bonds and others by double bonds. These bonds determine which type of fatty acid the molecule is classified as.

**Classification of Fatty Acids**

Fatty acids are classified depending on the saturation. There are two types of fatty acids:

* Saturated fatty acids
* Unsaturated fatty acids.

**Saturated Fatty Acids**

In saturated fatty acids all of the carbon atoms are saturated with hydrogen atoms and do not contain double bonds between the carbon atoms this gives the molecule a linear formation.

Saturated fats are usually solid at room temperature and have high melting points.

Foods that are high in saturated fat include pork, fatty beef, chees, whole milk, eggs, coconut and palm oils and butter.

**Unsaturated Fatty Acids**

Unsaturated fatty acids have at least one double bonded set of carbon atoms in their structure.

This double bond can take on one of 2 formations. It can be a cis configuration or a trans configuration. In the cis formation the hydrogen atoms are on the same side of the double bonded carbon atoms and in the trans formation the hydrogen atoms are on opposite sides.

**Unsaturated fatty acids are sub-divided into two groups:**

* Monounsaturated fatty acids
* Polyunsaturated fatty acids

**Monounsaturated fatty acids**

Monounsaturated fatty acids have a cis molecular formation. Where the hydrogen atoms are on the same side of the double bonded carbon atoms, this gives it a band, or a Kinked like formation. Monounsaturated fats have only one carbon-carbon double bond in their molecule.

They are usually liquid at room temperature and have lowered melting points than saturated and trans fats. Foods that are high in monounsaturated fat include many plant based oils such as olive oil canola oil and peanut oil.

**Polyunsaturated fatty acids**

Polyunsaturated fatty acid also have a cis molecule are formation. Again, the hydrogen atoms are on the same side of the double bonded carbon atoms also giving it a kinked formation. Polyunsaturated fats have more than one unsaturated carbon double bonded in their molecule.

They are liquid at room temperature but start to turn solid when chilled. Polyunsaturated fats are generally classified by their Omega numbering. The Omega carbon is the carbon atom at the end of the carbon chain. There are four types of Omega fatty acids 3, 6, 7 and 9. These are determined by where the location of the first double bonded carbon atom is located.

**Trans fats**

Trans fats are solid at room temperature and usually have a high melting point. There are natural and artificial trans fats. Natural trans make up to 2 to 5% of their pack in dairy products and 3 to 9% of the fat in beef and lamb. Artificial trans fats are formed when manufacturers turn liquid oils into solid fats through a process called hydrogenation. Some foods that contain trans fats include stick margarines, fried foods and many fast food items.

**Answer No: 5**

**LIPOPROTEINS**

Lipoproteins are special particles made up of droplets of fats surrounded by a single layer of phospholipid molecules. In lipoproteins the polar ends of all the phospholipid molecules face outwards to interact with water. This enables the lipoprotein to be carried in the blood. The non-polar fat is inside the phospholipid layer at the center of the lipoprotein so that it is transported to the place where they are stored through the bloodstream. Lipoproteins are the trucks to carry fats where they are required or stored.

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

**TYPES AND THEIR FUNCTIONS**

Lipoproteins are differentiated based on specific proteins attached to the phospholipid outer layer, called the apolipoprotein.

The types of lipoproteins are as follows:

1. **Chylomicrons**

Chylomicrons are the largest and least dense of the lipoproteins, with the highest triglyceride content. It delivers fats and cholesterol from the intestines to the muscles, fat cells and the liver.

1. **VLDL-very low density lipoprotein**

This is composed of protein, fats and cholesterol synthesized in the liver. They carry newly synthesised triglycerides from the liver to adipose tissue.

1. **IDL- intermediate density lipoprotein**

IDL is created by the metabolism of VLDL. They are intermediate between VLDL and LDL. They are not detectable in the blood when fasting.

1. **LDL-low density lipoprotein**

This is the last VLDL remnant, and contains cholesterol. These forms carry fats and cholesterol produced in the liver to the tissues. LDL particles are sometimes referred to as "bad" lipoproteins.

1. **HDL, high density lipoprotein**

This has the highest protein: lipid ratio so it is the densest. This is also called good cholesterol because it carries cholesterol away from the tissues to the liver, lowering blood cholesterol levels. High HDL levels are associated with lowered risk of cardiovascular disease.

**CHOLESTROL**

Cholesterol is a waxy fat-like substance that is found in all cells. It plays an important part in many processes in the body but having too much cholesterol in the blood is one of the risk factors in the development of coronary heart disease. Cholesterol travels around the body in lipoproteins. Cholesterol in the blood doesn't move through the body on its own. It combines with proteins to travel through the bloodstream. Cholesterol and protein traveling together are called lipoproteins.

Our liver makes cholesterol for our body. We can also get it from the foods like Meat, fish, eggs, butter, cheese, and milk. Fruits, vegetables, and grains like oatmeal don't have any cholesterol.

**FUNCTIONS**

It is the most abundant sterol in humans an d it performs many important functions:

* It is an important component of cell membrane.
* It is a precursor of steroid hormones like placental hormones and sex hormones.
* It also a precursor of bile acids, which helps in digestion.
* Also a precursor of Vitamin D
* It is also required for the nerve transmission.

**TYPES**

There are two main kinds: LDL-cholesterol and HDL-cholesterol.

1. **HDL - good cholesterol**

HDL cholesterol carries cholesterol away from the arteries and back to the liver where it can be broken down.

1. **LDL - bad cholesterol**

LDL carries cholesterol from the liver into the bloodstream where it can stick to the blood vessels. Too much LDL can cause fatty build-ups in the arteries. To maintain a healthy heart it is important to keep LDL cholesterol levels low.

**Risk Factor**

Cholesterol floats around in our blood and can get into the walls of the blood vessels. This can cause the blood vessels to get stiffer, narrower, or clogged. If the clogging gets worse over time, it can cause a heart attack or stroke. So it is important to keep the levels in check.