

**NAME= LAIBA AMIR**

**ID= 17005**

**HND**

**QUESTION 1:**

**Define the following:**

**1- Bile acids**

**2- Hydrogenation of oil**

**3- Iodine number**

**4- Lecithin**

**5- Triglycerides**

**BILE ACIDS:-**

Bile acids are steroid acid which is found predominantly in the bile of mammals and other

vertebrates. Diverse bile acids are synthesized in the liver. Bile acids are conjugated with taurine or glycine residues to give anions called bile salts. Primary bile acids are those which are synthesized by the liver. Secondary bile acids result from bacterial actions in colon. In humans, taurocholic acid and glycocholic acid ( derivatives of chalice

acid) and taurochenodeoxycholic acid are the major bile salts. They are roughly equal in connection. The salts of their 7- $\alpha$ -dehydroxylate derivatives, deoxycholic acid and lithocholic acid are also found with the derivatives of cholic acid, chenodeoxycholic and deoxycholic acids accounting for over 90% of human biliary bile salt. Bile

acids comprise about 80% of the organic compounds in bile ( others are phospholipids and cholesterol ). An increased secretion of bile acids produces an increase in bile flow. Bile acids facilitates digestion of dietary fats and oils. They serves as micelles - forming surfactants, which encapsulate nutrients, facilitating their absorption. These micelles

are suspended in the chyme before further processing. Bile acids also have hormonal actions throughout the body, particularly through the farnesoid X receptor.

## **STRUCTURE:-**

Bile salts constitute a large family of molecules, composed of a steroid structure with four rings, five or eight carbon chain terminating in a carboxylic acid and several

hydroxyl groups, the number and orientation of which is different among the specific bile salt.

## **FUNCTION OF BILE**

### **ACIDS:-**

## **ROLE OF BILE ACID IN FAT DIGESTION AND**

### **ABSORPTION:-**

Bile acids are critical for digestion and absorption of fats and fat soluble vitamins in the small intestine.

# **ELIMINATION OF WASTE PRODUCTS:-**

Many waste products including bilirubin, are eliminated from the body by secretion into bile and elimination in feces.

# **ROLE OF BILE ACID IN CHOLESTEROL HOMEOSTASIS:**

Hepatic synthesis of bile acids accounts for the majority of cholesterol breakdown in the body. In

humans, roughly 500 mg of cholesterol are converted in bile everyday. This route for the elimination of excess cholesterol is probably important in all animals, but particularly in situations of massive cholesterol ingestion. Interestingly, it has recently been demonstrated that bile acids participate in cholesterol metabolism by



functioning as hormones that alter the transcription of the rate-limiting enzyme in cholesterol biosynthesis.

2-

## HYDROGENATION OF OIL:-

Hydrogenation is a process in which a liquid unsaturated fat is turned into a

solid fat by adding hydrogen. During this manufactured partially hydrogenated processing a type of fat called trans fat is made. or

Hydrogenation is a process that uses hydrogen gas to

change a liquid vegetable oil into a hard spread margarine. This process stabilizes the oil and prevents spoilage from oxidation. Hydrogenation reactions are sensitive to a variety of factors that can

negatively impact  
batch time, catalyst  
life, production rate  
and  
sensitivity. Hydrogen  
ation of fats and oil  
is very important  
operation in the  
industrial process of  
producing vegetable  
tallow, vegetable

fats, and starting components for the cosmetic and chemical industry such as soaps, creams, pastes and similar substances. There are two main reasons that hydrogenation is

important to the industry. The first is increasing the stability of the oil. Highly unsaturated oil is susceptible to autoxidation, thermal decomposition and other reactions

affects the  
flavour. Consequently,  
it is desired to  
partially  
hydrogenate the oil  
to improve shelf  
life. The second  
reason to partially  
hydrogenate  
vegetable oil is to  
improve its

utility. Several catalyst for hydrogenation of oils are known in the literature such as Cu/SiO<sub>2</sub> [ 4 ] , Ni/SiO<sub>2</sub> [ 5 ] , Ni/Ru mixture [ 9 ]. since the process of hydrogenation adds hydrogen atoms to



oil it will reduced the number of unsaturated fatty acids and increase the number of saturated fattyacids in the oil. The use of hydrogenated helps to prolong the shelf life of the food and maintain flavour

stability. The process of hydrogenation adds hydrogen atom to oil, it will reduce the number of unsaturated fatty acids and increase the number of saturated fatty acids in the oil. High level of saturated fatty

acids is associated with increasing the level of cholesterol in the blood and this may lead to coronary heart disease. Therefore as a part of healthy diet, consumers are advised try to lower

their intake of saturated fatty acid.

### **3- IODINE**

### **NUMBER:-**

Iodine number is the mass of iodine representing in grams which is exhausted by 100 grams of a chemical substance. It is

generally used to discover the unsaturation amount in fatty acid. The unsaturation can be seen in double bond that react with iodine compounds. The more the iodine attached, the more

the iodine number and C=C bond found. Oil, wax or fats with high values are more reactive, less, softer, stable and more affected by rancidification and oxidation.

Iodine number also known

as iodine value,  
iodine index or  
iodine absorption  
value is the  
measure of  
unsaturation of a  
substance which is  
expressed as gram  
of iodine or similar  
halogen absorbed  
by hundred gram of

substance. The drying oil which are used in varnish and in the paint industry have comparably high iodine number. The semi drying oils which are used in varnish and in the paint industry have comparably



high iodine number. The semi drying oils like soybean oil contain intermediate iodine number while the non drying oils like olive oil which are used in food products and soap making have

comparably low  
iodine number.

#### **4- LECITHIN:-**

Lecithin, also called phosphatidyl choline, any of a group of phospholipids that are important in cell structure and metabolism. Lecithin

are composed of phosphoric acid, choline, esters of glycerol and two fatty acids; the chain length position and the degree of unsaturation of these fatty acids vary and this

variation results in different lecithins with different biological functions. Pure lecithin is white and waxy and darkens when exposed to air. Commercial lecithin is brown to light yellow and its

consistency varies from plastics to liquids. The term lecithin is also used for a mixture of phosphoglycerides containing principally lecithin, cephalin and phosphatidyl inositol. Commercial

lecithin most of which comes from soybean oil, contains this mixture and commonly about 35% neutral oil. It is widely used as a wetting and emulsifying agent and for other purposes. Among

the products in which it is used are animal feeds, baking products and mixes, chocolate, cosmetics and soaps, dyes, insecticides, paints and plastics.

Lecithin is used for making memory disorders such as a

dementia and  
Alzheimer's  
disease. It is also  
used for treating  
gallbladder disease,  
liver disease, certain  
types of  
depression, high  
cholesterol, anxiety  
and a skin disease  
called



eczema. Some people apply lecithin to skin as a moisturizer.

5-

## TRIGLYCERIDES:-

It is the major form of fat stored by the body. A triglycerides consist of three molecules

of fatty acids  
combined with a  
molecule of the  
alcohol  
glycerol. Triglyceride  
s serves as the  
backbone of many  
types of  
lipids. Triglycerides  
comes from the  
food we eat as well

as from being produced by the body. Triglyceride level are influenced by recent fat and alcohol intake and should be measured after fasting for at least 12 hours. A period of abstinence from alcohol is advised

before testing for triglycerides. Elevated triglycerides are considered to be a risk factor for atherosclerosis (hardening of the arteries) because many of the triglycerides contain

lipoproteins that transport fat in the blood stream also transport cholesterol, a known contributor to atherosclerosis. Markedly high triglycerides levels can cause inflammation of the

pancreas. Therefore, these high levels should be treated with low fat diets and medication if needed.

## QUESTION:2

What are lipids?

what is the

difference between

fats and waxes?

**what is the**  
**importance of**  
**lipids in our body?**

**LIPIDS:**

**DEFINITION:-**

Lipids are organic compounds made up of fatty acid, alcohol and many contain other compounds. They

are not soluble in polar solvents like water and soluble in non polar solvents like

ether, chloroform, benzene etc.

## TYPES OF

## LIPIDS:-

The three main types of lipids



are triacylglycerols  
also called  
triglycerides,  
phospholipids. Trigly  
cerols make up mor  
than 95% of lipids in  
the diet and are  
commonly found in  
fried  
foods, vegetables  
oil, better, whole

milk, cheese, cream  
and some  
meats. lipids are  
important fats that  
serves different  
roles in the human  
body. Lipids perform  
three primary  
biological function  
with in the  
body. They serves

as a structural  
components of cell  
membranes ,  
function as energy  
storehouses and  
function as  
important signaling  
molecules. Lipids  
are lighter than  
water i.e they have  
lower density than

water. They leaves greasy marks on paper.

## DIFFERENCE BETWEEN FATS AND WAXES:-

### FATS:-

Fats are the esters of fatty acids with glycerol and are solid at room

temperature. fats are usually derived from animals. Some compounds that are soluble in organic solvents and mostly insoluble in water called fats. It mainly comes from animal food but also through vegetable

oil by process called hydrogenation. Some examples are butter, beef etc.

## **WAXES:-**

Waxes are the esters of fatty acids. They contain one mole of long chain fatty acid and esterified with one

mole of high  
molecular weight  
monohydroxy  
alcohol. Waxes are  
non edible, low  
melting point  
solids. The natural  
waxes that are  
synthesized by  
animal contain  
esters of carboxylic

acids bonded to long chain alcohols. They are saturated.

## IMPORTANCE OF LIPIDS IN OUR BODY:-

Lipids are vital for all forms of life on earth. They are one of the main



molecules needed to maintain proper health of human body. Out of all the important functions it performs include isolation, energy storage, protection and cellular communication. Cells are the building

blocks of all living organism and lipids are the building blocks of cells. Without lipids, cell will not be able to survive.

## **ENERGY**

## **STORAGE:-**

One of the main functions lipids do is

storage energy. If a person eat excessive amount of food, lipids help store the energy in the form of fat molecules in the body to use later.

## CELL

## STRUCTURE:-

Lipids are present

in every cell of human body and are the main part of the cellular membrane. It prevents the cells from being leaky by surrounding them the perfect way.

## **HORMONES:-**

Lipids are also

essential for the human body, as they are a part of many hormones. They play a major role in regulating the growth and the work done of the body on daily basis.

## **DIGESTION:-**

Lipids play an

important part in the digestion of food. It is used to make bile acids the stomach which is essential for dissolving fat from the food. This is essential for the process of normal digestion of food and the absorption

of fat soluble vitamins. They are also essential for the transportation of fatty acid in the body.

## ISOLATION AND PROTECTION:-

Lipids are needed to protect and isolate the

body. To keep the internal body temperature regular, there is a layer of fats just beneath the skin that is made from lipids. Similarly, there is a layer of fats also around the vital organ that



keeps them  
protected from  
injuries.

## QUESTION:3

What are

prostaglandin

( PGs )? And what

are their

functions?

PROSTAGLANDIN:

The

prostaglandin are a group of active lipids compounds called eicosanoid having diverse hormone like effects in animals. Prostaglandins have been found in almost every tissue in humans and other

animals. They are derived enzymatically from the fatty acid arachidonic acid. Every prostaglandin contains 20 carbon atoms, including 5 carbon ring. Unlike most hormones, which are produced by glands and are transported in the bloodstream to act on distant areas of the

body, the prostaglandins are produced at the site where they are needed. Prostaglandins are produced in early all cells and are part of the body's way of dealing with injury and illness.

## **FUNCTION OF PROSTAGLANDINS:-**

Prostaglandins are powerful, locally acting vasodilators and inhibit

the aggregation of blood platelets. Through their role in vasodilation, prostaglandins are also involved in inflammation. They are synthesized in the wall of blood vessels and serve the physiological functions preventing needless clot formation, as well as regulating the contraction of smooth

muscle  
tissues. Prostaglandins  
are also involved in  
regulating, contraction  
and relaxation of the  
muscle in the gut and  
the  
airways. Prostaglandins  
are known to regulate  
the female reproductive  
system and are involved  
in the control of  
ovulation, the menstrual

cycle and the infection of labour. Indeed, manufactured forms of prostaglandins most commonly prostaglandin E2 can be used to induce labour.

### **QUESTION:4**

**What are fatty acids?**

**How fatty acids are classified?**

**FATTY ACIDS:-**

Fatty acids have a backbone made of carbon atoms. They vary in the number of carbon atom and in the number of double bonds between them. Fatty acids is the important component of lipids in plants, animals and micro organism. Generally a fatty acids consist of the a straight



chain of an even number of carbon atoms with hydrogen atom along the length of the chain and at one end of the chain and a carboxyl group (  $-\text{COOH}$  ) 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 bond is double or triple, the acid is unsaturated and is more reactive. A few fatty acids have branched chains; others contain ring structure e.g prostaglandin. 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. Among the most widely distributed fatty acids are the 16- and 18- carbon fatty acid otherwise known as palmitic acid. Fatty acid have a wide range of commercial applications.

## **CLASSIFICATION OF FATTY ACID:-**

Fatty acids are

classified according to the presence and number of double bonds in their carbon chain. Saturated fatty acids contain no double bonds, monounsaturated fatty acids contain one and polyunsaturated fatty acids contain more than one double bond.

# **SATURATED FATTY**

## **ACID:-**

Saturated fatty acid chain contain no double bond, monounsaturated fatty acid contain more than one double bond. Both length and saturation of fatty acids affects the arrangement of the membrane in our body cell and there by its

fluidity. Shorter chain fatty acids and ones with greater unsaturation are less, stiff and less viscous, making the membrane more flexible. This influences a range of important biological function. Polysaturated fats includes Omega 3 and Omega 6 fat. Omega 3's reduce inflammation,

support healthy hormone levels and cell membranes. Trans

## **QUESTION:5**

**Write short notes on the following:**

**1-Lipoprotein**

**2- Cholesterol**

## **1-LIPOPROTEINS:-**

Lipoproteins, any member of a group of substances containing

both lipids and proteins. Lipoproteins are complex particles that have a central hydrophobic core of non polar lipids, primarily cholesterol, ester and triglycerides. This hydrophobic core is surrounded by a hydrophobic membrane consisting of phospholipids, free



cholesterol and apolipoproteins.

## TYPES OF

### LIPOPROTEINS:-

#### 1-LOW DENSITY

#### LIPOPROTEINS(LDL):

Low density lipoprotein(LDL).It's often called the bad cholesterol.A molecule that is a combination of lipid (fat) and proteins.Lipoproteins

are the form in which lipids are transported in the blood. Low density lipoproteins transports cholesterol from the liver to the tissues of the body.

## **2- HIGH DENSITY**

### **LIPOPROTEIN (HLD):-**

High density of lipoproteins ( HLD )that's is also called good cholesterol.It is one of

the five major group of lipoprotein. Lipoproteins are complex particles composed of multiple proteins which transport all fat molecule around the body with in the water outside cell.

## **LIPOPROTEIN**

## **METABOLISM:-**

The handling of lipoproteins in the body is referred to as

lipoprotein metabolism. It is divided into two pathways, exogenous and endogenous, depending in large part on whether they are composed chiefly of dietary ( exogenous) lipids or whether they originated in the liver.

## **FUNCTION OF LIPOPROTEINS:-**

The role of lipoprotein particles is to transport fat molecules such as triacylglycerol and cholesterol within the extra cellular water of the body to all the cells and tissues of the body.

## **CHOLESTEROL:-**

Cholesterol is a waxy fat like substance that found in all the cells

in our body.our body needs some cholesterol to make hormones, vitamins D and substances that help to digest food.

## **STRUCTURE OF CHOLESTEROL:-**

Cholesterol is a lipid with a unique structure consisting of four linked hydrocarbon rings forming the bulky

steroid structure. There is a hydrocarbon tail linked to one end of the steroid and a hydroxyl group linked to the other end. The hydroxyl group is able to form hydrogen bonds with nearby carbonyl oxygen of phospholipid.

Cholesterol played an important role on every cell in our

body, especially abundant on the cell membrane. Cholesterol is an amphipathic molecule, that is contain its hydrophilic and hydrophobic parts. The hydroxyl group ( —OH) in cholesterol is aligned with the phosphate head the phospholipid on cell membrane , which the rest of the cholesterol



goes with the fatty acids the cell membrane. It is very important on all cell membrane due to its properties keep the cell firm and avoid being overly fluid.

## **SYNTHESIS OF CHOLESTEROL :-**

The liver is the primary organ that synthesizes cholesterol. About 20-25% of total

daily cholesterol production occurs here. Cholesterol is also synthesized to smaller extents in the adrenal glands, intestines, reproductive organ etc. The synthesis of cholesterol begins with a molecule of acetyl CoA and one molecule of acetoacetyl-CoA which are dehydrated to form

3-hydroxy-3-methylglutaryl CoA. This molecule is then reduced to mevalonate by the enzyme HMG-CoA reductase. This step is an irreversible step in cholesterol synthesis. This step is blocked by cholesterol lowering drugs like statins.

# **FUNCTION OF** **CHOLESTEROL:-**

Cholesterol is essential for all living organisms. It is synthesized from simpler substances within the body. Cholesterol can also be obtained from food. Saturated fats in food can be converted to cholesterol. This may lead to

excessive cholesterol in blood.

## **CELL MEMBRANE**

### **SYNTHESIS:-**

Cholesterol helps to regulate membrane fluidity over the range of physiological temperatures. It has a hydroxyl group that interacts with the polar head groups of

membranes  
phospholipids. These  
exist along with non  
polar fatty acid chain of  
the other lipids.

Cholesterol also  
prevents the passage of  
protons and sodium ions  
across the plasma  
membranes.

**CELL**

**TRANSPORTERS:-**

The cholesterol

molecules exist as transporters and signalling molecules along the membrane. cholesterol also help in nerve conduction and signalling by assisting in the formation of lipid in the plasma membrane

## **ROLE INSIDE THE CELL:-**

With in the cells, cholesterol is the

precursor molecule in several biochemical pathway. For example, liver is converted to bile, which is then stored in the gallbladder.

## **HORMONES AND VITAMIN D:-**

Cholesterol is an important precursor molecule for the synthesis of vitamin D and the steroid hormone



like corticosteroids, sex -  
steroids ( sex hormones  
like estrogen,  
progesterone and  
testosterone etc.