SNS COLLEGE OF NURSING

SARAVANAMPATTI,COIMBATORE-35

DEPARTMENT OF NURSING

COURSE NAME : BSC (NURSING) I YEAR

SUBJECT : BIOCHEMISTRY

UNIT III: CARBOHYDRATES

TOPIC : TYPES,FOOD ITEMS

INTRODUCTION

- Carbohydrates, or carbs, are sugar molecules. Along with proteins and fats, carbohydrates are one of three main nutrients found in foods and drinks.
- Our body breaks down carbohydrates into glucose. Glucose, or blood sugar, is the main source of energy for your body's cells, tissues, and organs. Glucose can be used immediately or stored in the liver and muscles for later use.

TYPES

- **Sugars:** They are also called simple carbohydrates, they can be added to foods, such as the sugar in candy, desserts, processed foods, and regular soda and are found naturally in fruits, vegetables, and milk.
- **Starches:** They are complex carbohydrates, which are made of lots of simple sugars strung together.

TYPES

- Our body needs to break starches down into sugars to use them for energy. Starches include bread, cereal, and pasta and also include certain vegetables, like potatoes, peas, and corn.
- **Fiber:** It is also a complex carbohydrate. Diets high in fiber have other health benefits. They may help prevent stomach or intestinal problems, such as constipation. They may also help lower cholesterol and blood sugar.

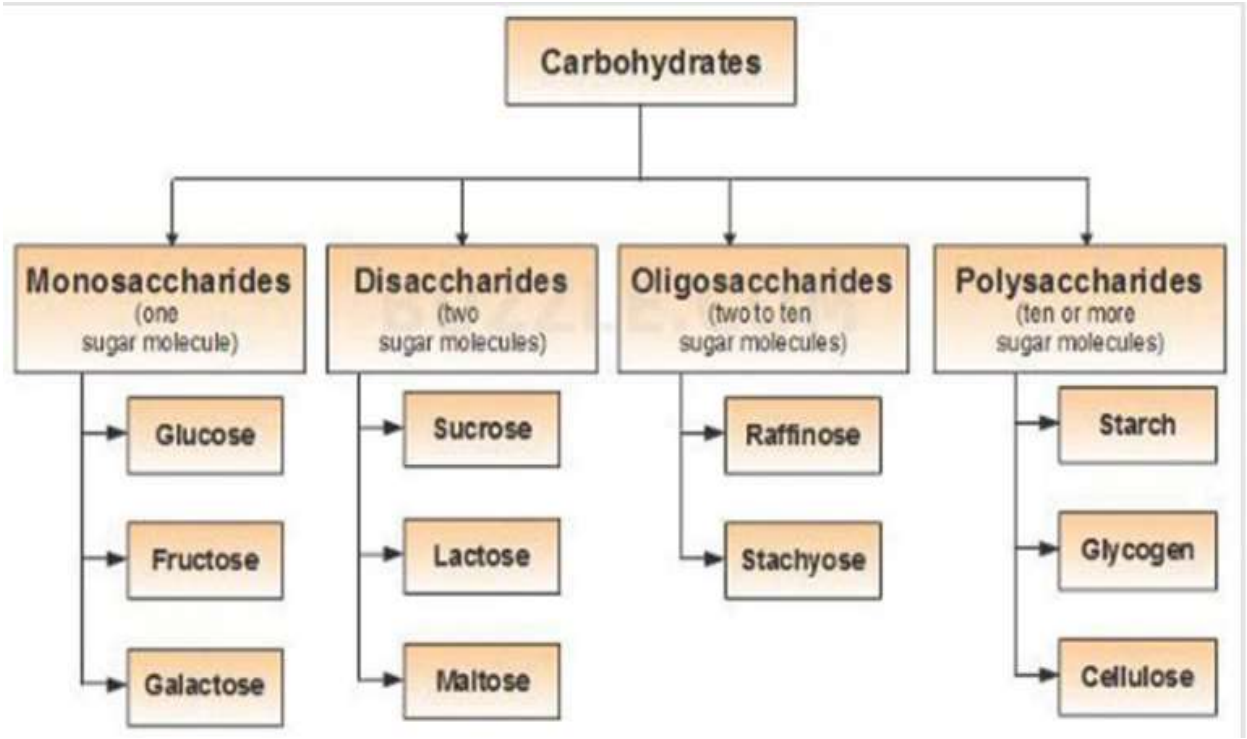
COMMON FOOD ITEMS

- Grains, such as bread, noodles, pasta, crackers, cereals, and rice
- Fruits, such as apples, bananas, berries, mangoes, melons, and oranges
- Dairy products, such as milk and yogurt
- Legumes, including dried beans, lentils, and peas

COMMON FOOD ITEMS

- Snack foods and sweets, such as cakes, cookies, candy, and other desserts
- Juices, regular sodas, fruit drinks, sports drinks, and energy drinks that contain sugar
- Starchy vegetables, such as potatoes, corn, and peas

CLASSIFICATION



Monosaccharides

- The building blocks of all carbohydrates are simple sugars called monosaccharides.
- A monosaccharide can be a polyhydroxy aldehyde (aldose) or a polyhydroxy ketone (ketose).
- Monosaccharide carbohydrates are those carbohydrates that cannot be hydrolyzed further to give simpler units of polyhydroxy aldehyde or ketone.

Monosaccharides

- If a monosaccharide contains an aldehyde group then it is called aldose and on the other hand, if it contains a keto group then it is called a ketose.
- One of the most important monosaccharides is glucose. The two commonly used methods for the preparation of glucose are

Monosaccharides

- **From Sucrose**: If sucrose is boiled With dilute acid in an alcoholic solution then we Obtain glucose and fructose.
- **From Starch**: We can obtain glucose by hydrolysis of starch and by boiling it with dilute H2S04 at 393K under elevated pressure.

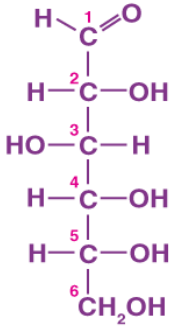
Glucose

- Glucose is also called aldohexose and dextrose and is abundant on earth.
- Glucose is named as D (+)-glucose, D represents the configuration whereas (+) represents the dextrorotatory nature of the molecule.
- The ring structure of glucose can explain many properties of glucose which cannot be figured by open- chain structure.

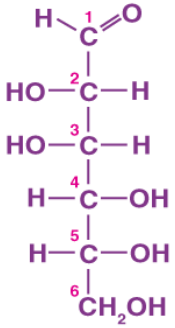
GLUCOSE

- The two cyclic structures differ in the configuration of the hydroxyl group at C1 called anomeric carbon.
- Such isomers i.e. α and β form are known as anomers.
- The cyclic structure is also called pyranose structure due to its analogy with pyran.

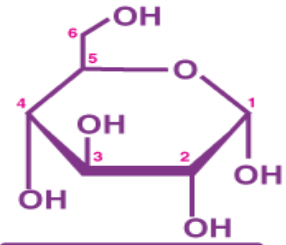
Glucose



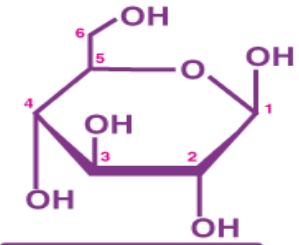
D Glucose



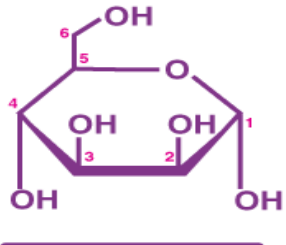
D Mannose



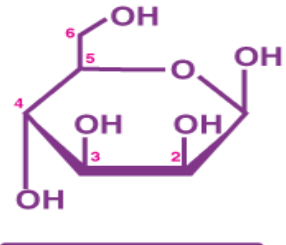
α D Glucose



β D Glucose



α D Mannose

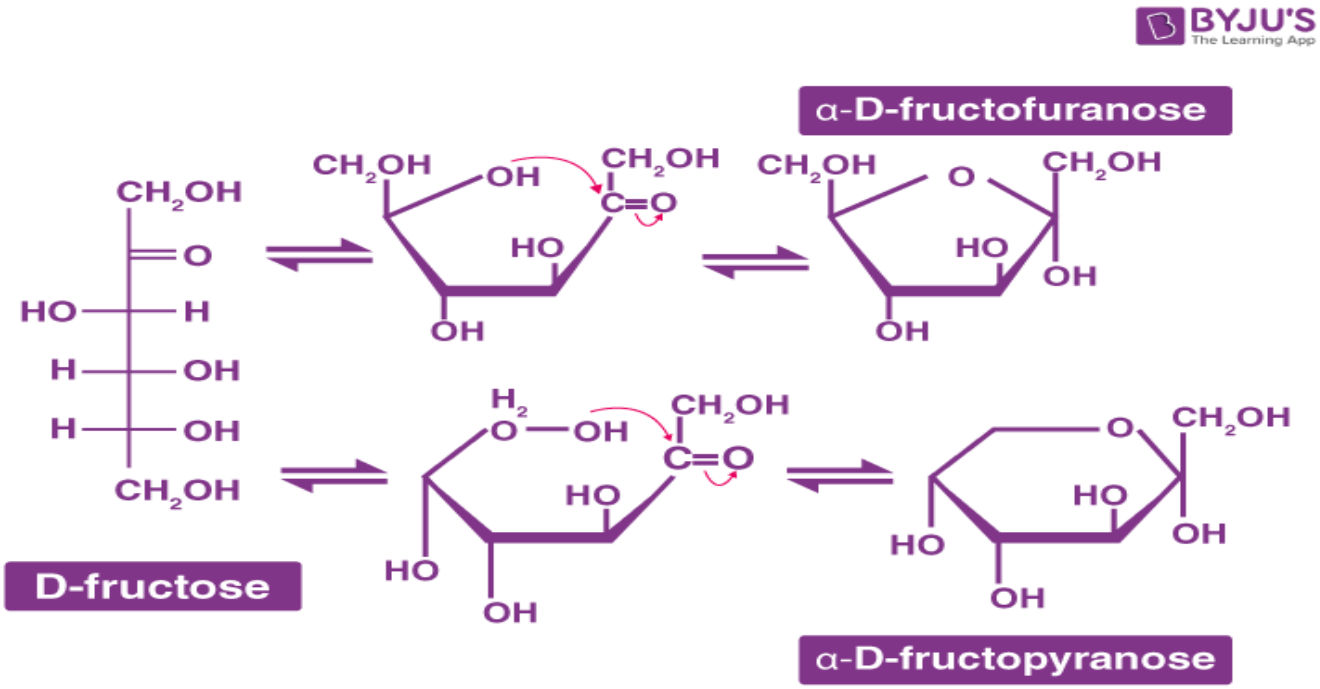


β D Mannose

Fructose

- It is an important ketohexose.
- The molecular formula of fructose is C6H1206 and contains a ketonic functional group at carbon number 2 and has six carbon atoms in a straight chain.
- The ring member of fructose is in analogy to the compound Furan and is named furanose.

STRUCTURE OF FTUCTOSE



Disaccharides

- On hydrolysis, disaccharides yield two molecules of either the same or different monosaccharides.
- The two monosaccharide units are joined by oxide linkage which is formed by the loss of water molecule and this linkage is called glycosidic linkage.
- Sucrose is one of the most common disaccharides which on hydrolysis gives glucose and fructose.

Disaccharides

- Maltose and Lactose (also known as milk sugar) are the other two important disaccharides.
- In maltose, there are two a-D-glucose and in lactose, there are P-D-glucose which are connected by an oxide bond.

Polysaccharides

- Polysaccharides contain long monosaccharide units joined together by glycosidic linkage.
- Most of them act as food storage for e.g. Starch.
- Starch is the main storage polysaccharide for plants.
- It is a polymer of a glucose and consists of two components-Amylose and Amylopectin.

Polysaccharides

- Cellulose is also one of the polysaccharides that are mostly found in plants.
- It is composed of D- glucose units joined by a glycosidic linkage between Cl of one glucose unit and C4 of the next glucose unit.
- Polysaccharides are also called "glycans".Polysaccharides contain more than 10 monosaccharide units and can be hundreds of sugar units in length.

Polysaccharides

- Polysaccharides differ from each other in the identity of their recurring monosaccharide units, in the length of their chains, in the types of bond linking units and in the degree of branching.
- They are primarily concerned with two important functions ie. Structural functions and the storage of energy.

HOMOPOLYSACCHARIDES

- Homopolysaccharides are chemical compounds that are composed of a single type of monomer
- Composed of the same repeating unit
- Single type of monosaccharide is involved in the formation
- Have simple structures when cornpared to heteropolysaccharides

HETEROPOLYSACCHARIDES

- Heteropolysaccharides are polysaccharides made out of two or more different monosaccharides
- Composed Of different repeating units
- Different types of monosaccharides are
- involved in the formation
- Have complex structures

Oligosaccharides

- Oligosaccharides are compound sugars that yield 2 to 10 molecules of the same or different monosaccharides on hydrolysis.
- The monosaccharide units are joined by glycosidic linkage.
- Based on the number of monosaccharide units, it is further classified as a disaccharide, trisaccharide, tetrasaccharide, etc.

Functions of Carbohydrates

- Carbohydrates are widely distributed molecules in plant and animal tissues.
- In plants and arthropods, carbohydrates from the skeletal structures, they also serve as food reserves in plants and animals.
- They are important energy sources required for various metabolic activities, the energy is derived by oxidation.

Glycoproteins

- Any protein molecule with a carbohydrate attached is known as a glycoprotein.
- The protein’s polypeptide side chains are covalently joined to the carbohydrate, an oligosaccharide chain (glycan).
- Either the process takes place during protein translation, or it occurs post-translationally via glycosylation.

Structure

- Glycoproteins are proteins containing glycans attached to amino acid side chains.
- Glycans are oligosaccharide chains; which are saccharide polymers, that can attach to either lipids (glycolipids) or amino acids (glycoproteins).
- Typically, these bonds are formed through a process called glycosylation.

Structure

- A sugar component (glyco) linked to a protein describes the structure of glycoproteins. Covalent bonds are used to bind the two components together.
- Glycoproteins have higher hydrophilicity than simple proteins due to the -OH groups of sugars. This implies that compared to other proteins, glycoproteins are more drawn towards water.

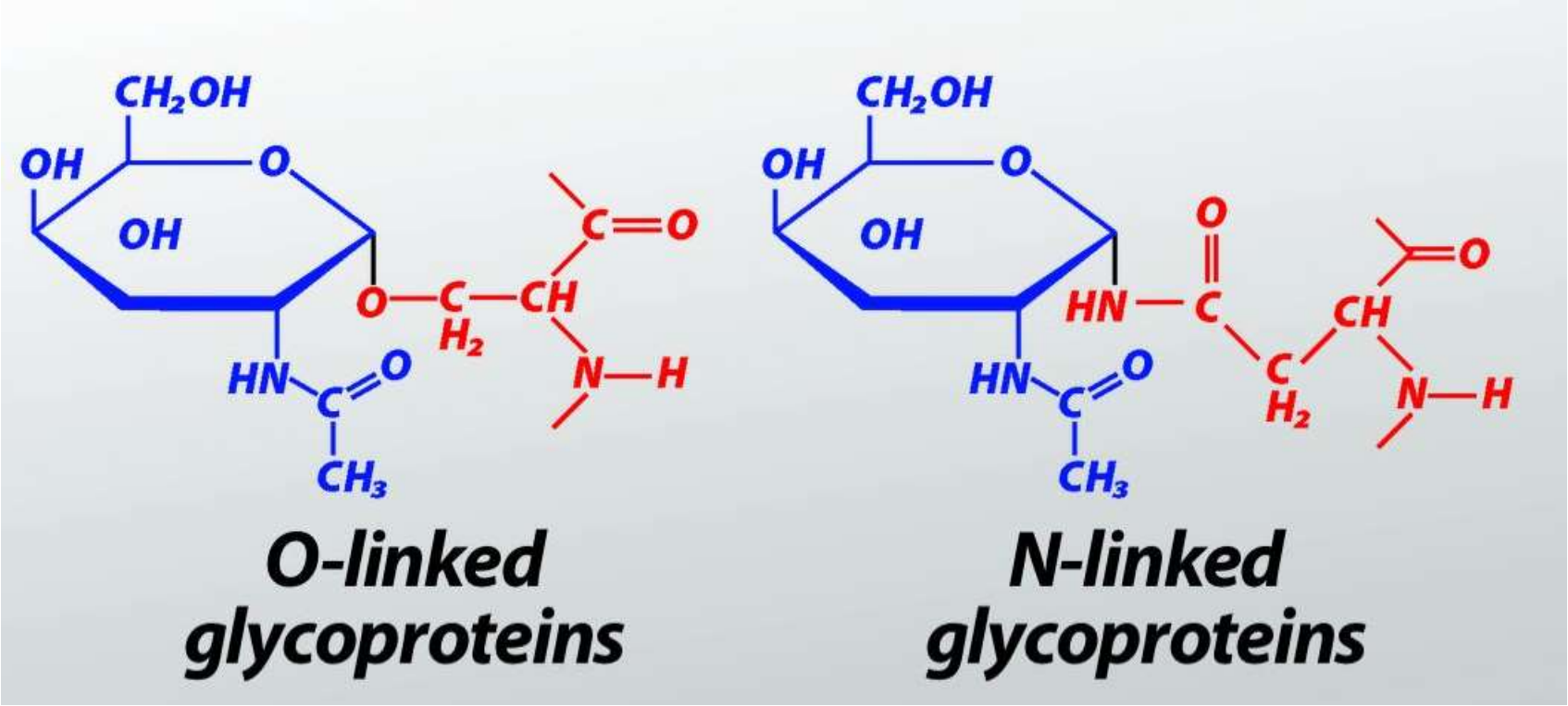
N-Linked and O-Linked Glycoproteins

- Based on where the carbohydrate attaches to an amino acid in the protein, glycoproteins are divided into different groups.
- A carbohydrate is attached to the nitrogen (N) of the amino group (-NH2) of the R group of the amino acid asparagine in N-linked glycoproteins. The amide side chain of asparagine often serves as the R group.

N-Linked and O-Linked Glycoproteins

- The process of bonding is known as N-glycosylation. The endoplasmic reticulum (ER) membrane provides sugar to N-linked glycoproteins, which are then transferred to the Golgi complex for processing.
- O-linked glycoproteins are those in which the carbohydrate forms a chemical bond with the hydroxyl group (-OH) of either the R group of the amino acid threonine or the R group of the amino acid serine.

STRUCTURE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N-linked glycoproteins

Functions

- Nearly all cellular processes involve glycoproteins.They play various roles in our body, including those related to our immune systems, physical protection, cell-to-cell communication, and reproductive systems.
- Glycoproteins are present on the lipid bilayer of cell membranes. They can operate in the aqueous environment due to their hydrophilic character, which plays a role in chemical bonding and cell-cell recognition.

Functions

- Cell surface glycoproteins are crucial for cross-linking proteins (such as collagen) and cells to strengthen and stabilise a tissue.
- Plants can resist gravity because of glycoproteins found in their cells.
- The glycoproteins thrombin, prothrombin, and fibrinogen are necessary for blood coagulation.
- Due to their ability to facilitate sperm cell attachment to the egg’s surface, glycoproteins are essential for reproduction.

CONCLUSION

Carbohydrates constitute a group of chemically defined substances with a range of physical and physiological properties and health benefits for consumers.

ASSESSMENT

1.Enlist the functions of carbohydrates?

2. Explain about structure of carbohydrates?

3. Enlist the types of carbohydrates?

REFERENCE

- Shivananda Nayak b ," Hand book of Biochemistry & Nutrition (For B.sc Nursing students)
- Biochemistry for nurses,Uma Bhardwaj,Ravindra Bhardwaj,Pearson Publication.


Thank You