

Introduction:



Carbohydrates are

- * a major source of energy from our diet.
- * composed of the elements C, H and O.
- * also called saccharides, which means “sugars.”
- * are produced by photosynthesis in plants.
- * such as glucose are synthesized in plants from CO_2 , H_2O , and energy from the sun.
- * are oxidized in living cells to produce CO_2 , H_2O , and energy.

- ✓ **Carbohydrates** are sugars and provide energy when consumed.
- ✓ Our bodies break down carbohydrates to extract energy. Carbon dioxide and water are released in the process.
- ✓ **Glucose** is the primary carbohydrate our bodies use to produce energy.
- ✓ Carbohydrates are classified as biomolecules.
- ✓ **Simple carbohydrates** are referred to as
- ✓ **simple sugars** and are often sweet to the taste.
- ✓ Consumption of more sugar than is needed for energy results in conversion of these sugars to fat.
- ✓ **Complex carbohydrates** include starches and the plant and wood fibers known as **cellulose**.

Introduction to Carbohydrates, Continued

- Carbohydrates are found on the surface of cells where they act as “road signs” allowing molecules to distinguish one cell from another.
- **ABO blood markers** found on red blood cells are made up of carbohydrates. They allow us to distinguish our body’s blood type from a foreign blood type.
- Carbohydrates in our body prevent blood clots. They are also found in our genetic material.

Classification of Carbohydrates

- **Monosaccharides** are the simplest carbohydrates. They cannot be broken down to smaller carbohydrates.
- **Disaccharides** consist of two monosaccharide units joined together; they can be split into two monosaccharides. Sucrose, table sugar, can be broken down into glucose and fructose.
- **Oligosaccharides** contain anywhere from three to nine monosaccharide units. ABO blood groups are oligosaccharides.
- **Polysaccharides** are large molecules containing 10 or more monosaccharide units. Carbohydrate units are connected in one continuous chain or the chain can be branched.

Monosaccharide

- One Sugar Unit
- Important Single Sugar are Glucose, Fructose, Galactose

Glucose (Dextrose):

- Give Energy for body Activity
- It is primary Fuel of Cell
- It usually not found in Diet (Corn Syrup)
- Produce from Starch.

Monosaccharide

Fructose:

- Fruit, Honey
- Sweetest of Simple Sugar
- Soft drink, Ready to use Cereals, Desserts

Galactose:

- Milk Sugar



Monosaccharides;

Some Important Monosaccharides

- Glucose is the most abundant monosaccharide found in nature. Glucose is also known as dextrose, blood sugar, and grape sugar.
- Glucose is broken down in cells to produce energy.
- Diabetics have difficulty getting glucose in their cells, which is why they must monitor their blood glucose levels regularly.
- Galactose is found combined with glucose in the disaccharide lactose, which is present in milk and other dairy products.
- Mannose, a monosaccharide, is found in some fruits and vegetables.
- Cranberries contain high amounts of mannose, which has been shown to be effective in urinary tract infections.

Monosaccharides, Continued

- Fructose commonly referred to as fruit sugar or levulose.
- Fructose is combined with glucose to give sucrose, or table sugar.
- Fructose is the sweetest monosaccharide and is found in fruits, vegetables, and honey.
- Fructose can be broken down for energy in the body.

Disaccharides

- **Disaccharides** consist of two monosaccharide units joined together;
- they can be split into two monosaccharides.

Eg;

- Maltose
- Lactose
- Sucrose

Disaccharides

- Are Simple Double Sugar
- Which Link with two Single Sugar
- Important Disaccharides are
Sucrose, Lactose & Maltose
- ❑ Sucrose = Glucose + Fructose
e.g Sugar, Brown Sugar
Sugarcane, Sugar beet.

Disaccharides

- ❑ **Lactose** = Glucose + Galactose
e.g Milk Sugar
Lactose is less soluble
Less Sweet than Sucrose
- ❑ **Maltose** = Glucose + Glucose
Starch => Maltose => Glucose
Sugar alcohols such Sorbitol
Used in Candies, Beverages.

Disaccharides, Continued

Maltose

- Maltose is known as malt sugar.
- It is formed by the breakdown of starch.
- Malted barley, a key ingredient in beer, contains high levels of maltose.
- During germination of barley seeds, the starch goes through hydrolysis to form maltose. This process is halted by drying and roasting barley seeds prior to their germination.

Disaccharides, Continued

Lactose

- Lactose is known as milk sugar.
- It is found in milk and milk products.
- An intolerance to lactose can occur in people who inherit or lose the ability to produce the enzyme lactase that hydrolyzes lactose into its monosaccharide units.

Disaccharides, Continued

Sucrose

- Sucrose is known as table sugar.
- It is the most abundant disaccharide found in nature.
- Sucrose is found in sugar cane and sugar beets.

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- **Oligosaccharides** are a type of carbohydrate formed when three to 10 simple sugars are linked together.
- Small amounts occur naturally in many plants.
- **Oligosaccharides** can have many functions including cell recognition and cell binding.
- For example, **glycolipids** have an important role in the immune response.
- Eg; **maltodextrins** or **cellodextrins**,

Polysaccharides

- **Polysaccharides** are large molecules of monosaccharides that are connected to each other through their anomeric carbons. There are two types of polysaccharides:
 1. **Storage polysaccharides** contain only α -glucose units. Three important ones are starch, glycogen, and amylopectin.
 2. **Structural polysaccharides** contain only β -glucose units. Two important ones are cellulose and chitin. Chitin contains a modified β -glucose unit.

Polysaccharides

- **Starch** = (Glucose)_n
e.g Cereals, Legumes, Tubers
- **Glycogen** = (Glucose)_n
Animal Food
Stored in Liver & Muscles
- **Fiber** :
Plant food – Vegetable, Fruits, Grains
Not digested by Human
e.g. Cellulose, Hemicellulose, Pectins, Gums, Lignin.

Polysaccharides, Continued

Amylose and amylopectin—starch

- **Starch** is a mixture of amylose and amylopectin and is found in plant foods.
- Amylose makes up 20% of plant starch.
- Long chains of amylose tend to coil.
- Amylopectin makes up 80% of plant starch.
- During fruit ripening, starch undergoes hydrolysis to produce glucose and maltose, which are sweet.
- When we consume starch, our digestive system breaks it down into glucose units for use by our bodies.

Polysaccharides, Continued

Glycogen

- **Glycogen** is a storage polysaccharide found in animals.
- Glycogen is stored in the liver and muscles.
- When glucose is needed, glycogen is hydrolyzed in the liver to glucose.

Glycogen

Glycogen

- is the polysaccharide that stores glucose in muscle.
- is similar to amylopectin, but is more highly branched.



Polysaccharides, Continued

Cellulose

- **Cellulose** contains glucose units bonded
- This glycosidic bond configuration changes the three-dimensional shape of cellulose compared with that of amylose.
- The chain of glucose units is straight. This allows chains to align next to each other to form a strong rigid structure.

Heparin

- **Heparin** is a medically important polysaccharide because it prevents clotting in the bloodstream.
- It belongs to a group of polysaccharides called **glycosaminoglycans**.

Sources of Carbohydrates

- Sugar :
Honey, Fruits, Soft Drink, Milk, Sugar,
- Starch:
Cereals, Pasta, Flour, Bread, Potatoes, Root Vége.,
Pulses
- Fiber: Cereals, Bran, Outer skin of Fruits
& Vége., Brown rice, Oatmeals
Pectin: Fruits.

Sources of Carbohydrates

Carbohydrates	Food Source
Glucose	Fruits, Honey, Corn Syrup
Fructose	Fruits, Honey
Galactose	Milk
Maltose	Baked Starch
Sucrose	Cane & Beet Sugar
Lactose	Milk Product
Starch & Dextrin	Grains, Root & Tubers, Legumes
Glycogen	Meat Product, Sea Food
Cellulose	Vegetables, Outer coat of Seed
Pectin&Gum	Fruits, Plant Secretion, seeds.

Function of Carbohydrates

- **Energy Supply.** Brain, Cell
- **Spare Proteins**
- **Synthesis of Substances**
 - Non-essential Amino acids
 - Glycoproteins
 - Glycolipids
- **Promote complete lipid metabolism**
- **Provide Bulk Fiber in the Diet.**

Function of Carbohydrates

- Energy Supply for body function
- Essential for the Oxidation of Fats
- Proteins sparing action
- Provide Carbon for synthesis of Non-essential Amino acids
- Are present in some tissue Constituents
- Add flavour to Diet
- Nucleic acid of Connective tissue Matrix, Galactosides of Nerve Tissue
- Necessary for proper functioning of CNS
- Adequate hepatic Glycogen Storage enhances normal liver detoxification ability