

CARBOHYDRATE

Carbohydrate may be define as aldehyded or ketone derivative of poly hydroxyl alcohol which produce that derivative on hydrolysis.

Carbohydrate on the basis of sugar unit.

→ Monosaccharide

→ Disaccharide

→ Oligosaccharide

→ Polysaccharide

Monosaccharide

Number of the carbon atom

1. Treose → 3c

2. Tetrose → 4c

3. Pentose → 5c

4. Hexose → 6c

Functional group

Aldose Ketose

→ Glyceraldehyde

→ Erythrose

→ Ribose

→ Glucose

Dihydroxy

Aceton

Erythritolose

Fruuctose

Ribulose

Xylulose

Disaccharide

Reducing

Non reducing

Poly saccharide

Homopoly saccharide

Heteropoly saccharide

Classification of Carbohydrate:

(a) Mono Saccharides: Are those sugars that can & not be hydrolyzed into simple carbohydrates.

e.g. Glucose, Fructose, Galactose

(b) Disaccharide: Are condensation products of 2 monosaccharide units.

- e.g. ✓ Sucrose = Glucose + Fructose
- ✓ Lactose = Glucose + Galactose
- ✓ Maltose = Glucose + Glucose

(c) Oligosaccharide: Are condensation products of 3 to 10 monosaccharide units.

e.g. Maltotriose, raffinose, blood group substances.

• Most are not digested by human enzymes.

d. Polysaccharides: Are condensation products of more than 10 monosaccharide units.

e.g. starch, cellulose, glycogen.

Classification of Disaccharide

On the basis of Reducing Property

① Reducing: Disaccharides that possess reducing property.

e.g. Maltose and Lactose.

② Non reducing: Disaccharides that do not possess reducing property.

e.g. sucrose.

• all mono and disaccharide are reducing sugar except sucrose.

Q. why reducing?

→ Because they have free functional group (-CHO, -COOH)

Q. Why non reducing?

→ Because they have no free functional group.

Q. Why not free functional group?

→ Because they are engaged in glycosidic bonds formation.

Poly saccharide classification

1. Homo poly saccharide

* Polymer of similar type of monosaccharide units connected by glycosidic bond.

e.g.: Starch, Glycogen, Insulin, Cellulose

2. Heteropolysaccharide

* Polymer of different varieties of monosaccharide units connected by glycosidic bond.

e.g. hyaluronic acid, chondroitin sulphate, Heparin.

• Sugar → Water soluble, crystalline and sweet in taste. All mono and disaccharides are sugar.

Non sugar → Water insoluble and amorphous, Polysaccharides are non sugar.

Importants of carbohydrates

→ Cheap and main source of energy (4 kcal/gm)

→ Storage of energy (glycogen)

→ Constituent of compound lipid and conjugated protein.

→ Precursor utilized for synthesis of fatty acids, cholesterol, ergoⁿo acid etc.

→ Constituent of mucopolysaccharides

which form the ground substance of mesenchymal tissue.

→ Helps in nucleic acid synthesis.

→ Helps in protein and fat metabolism. (ribose)

→ Disease associated with carbohydrate is diabetes mellitus, glycogen storage disease and lactose intolerance.

Dietary carbohydrates

Types

Dietary source

Starch

→ Rice, potato, wheat, etc

Lactose

→ Milk and milk products.

Sucrose

→ Table sugar, cane sugar, molasses.

Cellulose → Vegetables and Fruits

Maltose

→ Malt

* Difference between glycogen and starch.

<u>Features</u>	Glycogen	Starch
<u>Source</u>	Animal source only	Plant source only
<u>Structure</u>	highly branched	Less branched (amylopectin) or unbranched (amylose)
<u>Molecular weight</u>	10-40 mg/g	about 5 kg
<u>Colour with iodine solution</u>	Gives deep red colour	Gives reddish violet color

Importance	Storage form of carbohydrate in human	Main dietary carbohydrate in human
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Ans. (A) Whose source is salty food.

Cellulose:

→ Polymer of β -D-glucose and straight chain structure.

- Derived from plant source, it is non-digestible in humans, so gives no energy in humans.

Importance of cellulose: Advantage

→ Prevents constipation and maintains regular bowel habit.

→ Prevents the risk of obesity, diabetes mellitus and colon cancer.

→ Reduces post-prandial blood glucose concentration.

→ Facilitates cholesterol excretion.

→ Keeps serum cholesterol low and reduces the risk of coronary artery disease.

Disadvantages

→ It prevents the intestinal absorption of many nutrients (Fe, Zn, Ca etc)

Q. How cellulose prevents constipation?

Ans:

Cellulose acts as osmotic diuretics

They attract water towards them

Increase bulk of intestine

Increase Peristalsis

Easy expulsion of faeces (stool)

Mucosubstances:

Characteristics of mucosubstances:

- ① Composed of carbohydrate and protein.
- ② Whitish, viscous and slippery.
- ③ Strongly negative and hydrophobic.

Types of mucus substances:

① Glycoprotein (mucoprotein)

② Proteoglycan (peptidoglycan)

Functions (importance) of mucopolysaccharide
of glycosaminoglycan (GAG) (MPS)

→ ① Component of the extracellular matrix, synovial fluid, vitreous humor, mucus etc.

→ ② Acts as barriers, by this barrier's metabolism bacteria and other infections substance can't pass.

→ ③ Mucus of alimentary tract allow easy passage of food from mouth down to intestine.

- ④ Mucous substance in joint space and synovial fluid potential spacer prevent
- ⑤ Act as biological lubricant to provide protection against mechanical injury.
- ⑥ Heparin acts as anti-coagulant.

* Function of (importance) glycoprotein:

1. Component of the extra cellular matrix
2. Acts as biological lubricant to provide protection against mechanical injury and microbial invasion.
3. Cellular recognition and cell interaction
4. Serve as cell surface receptor and cell surface antigen.

Importance of fructose:

- ① Fructose is easily metabolized and a good source of energy.
- ② Seminal fluid is rich in fructose and spermatozoa utilize fructose for energy.
- ③ Excess dietary fructose is harmful and tends to tag in lipid synthesis triage - glycerid
- ④ In diabetes, fructose metabolism sorbitol pathway may account for the development of cataract.
- ⑤ Due to deficiency of aldose fructose intolerance occurs.