Carbohydrates
General characteristics

• The term carbohydrate is derived from the French: hydrate de carbone
• Compounds composed of C, H, and O
• Empirical formula: $(CH_2O)_n$
• Our body derives energy from the catabolism of energy yielding nutrients

- Carbohydrates
- Proteins
- Fats

• Carbohydrate are the single most abundant source of dietary energy comprising 50-70% of the total energy intake in the different population
Classification of carbohydrates

• Carbohydrates are the diverse organic molecules and can be classified based on their
  a) Molecular size/degree of polymerization (DP)
  b) Digestive fate
Classification on the basic of degree of polymerization (DP)

- **Monosaccharides**: consisting of single unit of sugar and also known as simple sugars (DP: 1)

- **Disaccharides**: consisting of (2) monosaccharide's (DP: 1-2)

- **Oligosaccharides**: each molecule consisting of (3-9) monosaccharide units (DP: 3-9)

- **Polysaccharides**: each molecule containing more than 9 but usually several monosaccharides units (DP: >9)
Classification based on digestive fate of carbohydrates

• The digestive fate of carbohydrates depends on their inherent chemical nature and on the supramolecular structures within foods of which they are a part.

• Carbohydrates are classified as ‘available’ and ‘unavailable’

• Carbohydrates that are digested to constituent monosaccharide and absorbed fall under the category of ‘available’ carbohydrates
Carbohydrates that are not digested by the endogenous enzymes of the human intestinal tract and therefore not absorbed were classified as ‘unavailable’ carbohydrates.

However the undigested carbohydrates enter the colon and are fermented by microflora.

Therefore the unavailable carbohydrates are not really unavailable and are termed as ‘non glycemic carbohydrates’
Functions of carbohydrates

- **Source of energy:** Glucose is the major source of energy to all the body cells.

  1 gram of carbohydrates provide 4kcal

Energy is required for the normal functioning of the organs in the body.

Glucose is stored in the body as glycogen. The liver is an important storage site for glycogen.
Protein sparing effect: carbohydrates help in regulating the protein metabolism.

This protein sparing action allows the major portion of protein to be used for its basic structural purpose of tissue building.

Therefore patients who are unable to eat are temporarily administrated with 5% glucose solution intravenously.

Anti-ketogenic effect: Presence of carbohydrates is necessary for normal fat metabolism.
Excretion of toxins: Glucuronic acid, a metabolite of glucose, combines with chemical and bacterial toxins and some normal metabolites in the liver and thereby helps in their excretion.

Act as Precursors: Carbohydrates and their derivatives serve as precursors to compounds such as nucleic acid, connective tissue matrix and galactoside of nerve tissue.
Overall positive health: non glycemic carbohydrates including non starch polysaccharides are beneficial for the function of gastrointestinal tract and thus have a positive effect on overall health.
Food sources

Carbohydrate Rich Food

Sugars

Vegetables

Pulses

Milk Products

Maize

Jerusalem

Oil Seeds

Soybeans

Cereals

Onions

Nuts

Chicory

Cocoa

Potatoes

Asparagus

Brisk Post
Dietary carbohydrates and blood glucose

• Some carbohydrate-containing foods produce a rapid rise followed by a steep fall in blood glucose concentration, whereas others result in a gradual rise followed by a slow decline.

• Food with a low glycemic index tends to create a sense of satiety over a longer period of time, and may be helpful in limiting caloric intake.
Glycemic index is defined as the area under the blood glucose curves seen after ingestion of a meal with carbohydrate-rich food, compared with the area under the blood glucose curve observed after a meal consisting of the same amount of carbohydrate in the form of glucose or white bread.
Requirements for carbohydrate

- Carbohydrates are not essential nutrients, because the carbon skeletons of amino acids can be converted into glucose.

- However, the absence of dietary carbohydrate leads to ketone body production, and degradation of body protein whose constituent amino acids provide carbon skeletons for gluconeogenesis.
Requirements for carbohydrate

• The RDA for carbohydrate is set at 130 g/day for adults and children.

• Adults should consume 45–65 percent of their total calories from carbohydrates.

• It is recommended that added sugar represent no more than 25% of total energy because of concerns that sugar may displace nutrient-rich foods from the diet, potentially leading to deficiencies of certain micronutrients.
Simple sugars and disease

• There is no direct evidence that the consumption of simple sugars is harmful. Contrary to folklore, diets high in sucrose do not lead to diabetes or hypoglycemia.

• Carbohydrates are not inherently fattening, and result in fat synthesis only when consumed in excess of the body's energy needs.

• However, there is an association between sucrose consumption and dental caries.