OBJECTIVES OF THE LECTURE

By the end of this lecture, student can:

► Define what is carbohydrate
► Explain the structure, roles and metabolism of carbohydrates
► Explain the impact of deficiency and excessive intake of carbohydrate
Chemist’s View of Carbohydrate

- **Dietary carbohydrate family includes:**
  - **simple carbohydrate** *(sugars)*
  - **complex carbohydrate** *(Starches and Fibers)*

- **The simple carbohydrates**
  - **Monosaccharide** *(single sugar)*
  - **Disaccharides** *(a pairs of monosaccharide)*

- **The Complex carbohydrate**
  - **Polysaccharides** *(chains of monosaccharide)*
Simple Carbohydrates

- Monosaccharide
- Most of the monosaccharide important in nutrition are hexose (hex = six)
- Simple sugars with six atoms of carbon and the formula $C_6H_{12}O_6$
- Monosaccharide:
  - Glucose - hexagons
  - Fructose - pentagons
  - Galactose - hexagons
Simple Carbohydrates

- **Disaccharides:**
  - Maltose (Glucose + Glucose)
  - Sucrose (Glucose + Fructose)
  - Lactose (Glucose + Galactose)

- Are pairs of monosaccharide, each containing a glucose paired with one of the three monosaccharides
The Complex Carbohydrate

- Contain many glucose units: Poly
- Contain few glucose units: Oligo
- Three polysaccharides:
  - Glycogen
    - Animal – meat and not at all in plants
    - Composed of glucose
    - Manufactured and stored in the liver and muscles
    - As a storage form of glucose
• **Cellulose**
  - Primary constituent of plant cell walls in vegetables, fruits and legumes.
  - Composed of glucose molecules and long chains however do not branch

• **Hemicelluloses**
  - Main constituent of cereal fibers
  - Various monosaccharide's backbones with branching side
  - Many backbones and side chains are soluble and other are insoluble.

• **Pectin**
  - Found in vegetables and fruits : citrus fruits and apples)
  - Used by food industry to thicken jelly, salad dressings and texture
• **Gums and Mucilages**
  - Gum such as gam arabic used as additives by food industry
  - Mucilages (guar and carrageenan) added to foods as stabilizers.
• **Lignin**
  - Gives strength to foods
  - Occurs in the woody parts of vegetables - carrots and the small seeds - strawberries
Other Classifications of Fiber

- Fiber can be classified as
  - Soluble fibers
  - Insoluble fibers
- Water-holding capacity
  - The capacity to capture water like a sponge, swelling and increasing the bulk of the intestines
- Viscosity
  - The capacity to form viscous, gel-like solutions
- Cation-exchange capacity
  - The ability to bind minerals
- Bile-binding capacity
  - The ability to bind to bile acid
Functions of Carbohydrate

- Supplying Energy
  - Brain cell and red blood cell
- Sparing protein
- Aid in synthesis of other substances
  - Non essential amino acid
  - Glycoprotein
  - Glycolipid
- Promotes complete lipid metabolism
- Provide bulk (fiber in the diet)
- As sweetener
- Food concentrated agent
Digestion and Absorption of Carbohydrates

- **Mouth** - amylase
  - Starch \(\rightarrow\) Small polysaccharides (maltose)

- **Stomach**
  - Stomach's acid + bolus

- **Small intestine**
  - Maltose \(\rightarrow\) Glucose + glucose
    - Maltase
  - Sucrose \(\rightarrow\) Fructose + Glucose
    - Sucrase
  - Lactose \(\rightarrow\) Galactose + Glucose
    - Lactase
Summary

- All CHO breaks down in digestion to monosaccharide: glucose, fructose, & galactose.
- Monosaccharide is absorbed and fructose & galactose becomes glucose.
- Glucose is used by the cell; hormone insulin needed for glucose to go from blood to cell.
- Body's uses of glucose
  - Energy
  - Maintenance of normal blood glucose level.
  - Glycogen.
  - Converted to body fat & stored.
Health Problem Related to Carbohydrate

- **Lactose Intolerance**
  - Inability to digest the milk sugar
  - Bloating, gas, abdominal discomfort, diarrhea.
  - Acidophilus milk – a cultured milk created by adding *Lactobacillus acidophilus*
    - Breaks down lactose to glucose and galactose.

- **Dental Caries**
  - Sugar and starch breaking down in the mouth – contribute tooth decay.

- **Obesity**

- **Chronic diseases** i.e. coronary heart disease, diabetes
Thank You........