CARBOHYDRATES

By:

SHAMSUL AZAHARI ZAINAL BADARI
Department of Resource Management And Consumer Studies
Faculty of Human Ecology
UPM
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 Carbohydrates

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

- The simple carbohydrate
  - 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 monosaccharide
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.

- **Hemicellulloses**
  - 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 gambier 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 to tooth decay.

- **Obesity**

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