Carbohydrates

Lecture.3

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Carbohydrates

Carbohydrates(CHO): are organic compounds composed of carbon, hydrogen, and oxygen.

- Produced by photo-synthesis (Co2+ H2O)
- All animals are depended CHO as a source of energy.

- **Sources of CHO:**
  1. Plant sources: starch and cellulose.
  present in cereal, milk, rice, bread, potato, corn.
  2. Animal sources: store as Glycogen in liver and muscle.

- **Functions of CHO:**
  1. Supply body for energy 1gm gives 4 cal
  2. Main source of energy for CNS is glucose
- 3. It stores in the liver and muscles for use as needed.
  4. Normal fat metabolism requires an adequate supply of carbohydrates.
  5. Providing fiber in the diet. Dietary fiber is found in grains, vegetables, and fruits.
  6. Add flavor to the diet.

Classification of carbohydrates

1. Simple carbohydrates (sugars).
2. Complex carbohydrates (starches and fibres).

Carbohydrates are classified according to the number of saccharides (sugar units), as follow:

1- Monosaccharides (simple sugars) include:

a) Glucose – "blood sugar" (usually found in grapes, corn).

b) Fructose – sweetest of simple sugar, found in honey, fruits and vegetables.

c) Galactose – not found in free foods, consider a result of the lactose breakdown.

** **Simple sugar are water soluble, and quickly absorb in the bloodstream** ***

- **Biological importance of Monosaccharide's:**

- Synthesis of RNA
- Synthesis of DNA
- Synthesis of blood sugar
- Synthesis of semen

2- Disaccharides (double sugars) include:

a) Sucrose – (glucose + fructose) ordinary table sugar.

b) Lactose – (glucose + galactose) “milk sugar”

c) Maltose – (glucose+ glucose) (malt sugar).

3- Polysaccharides (complex sugars) include:

- **a) Starch** – ex: rice, wheat, corn, carrots and potatoes.

  b) Dextrins – formed by the breakdown of starch.

  c) cellulose (fiber) – Non-digestible by humans. They lower the blood glucose level of people with diabetes.

- **d) Glycogen** – “animal starch”.

- **Dietary fiber**

  is a complex mixture of plant materials that are resistant to breakdown (digestion) by the human digestive enzymes.

  Fiber has two forms:

  1. Insoluble fibers: means it does not dissolve in water. found in whole-grain products such as brown bread.

- Promotes normal elimination, helps to satisfy appetite by creating a full feeling, and bacteria generally do not grow and produce intestinal gas.

2. Soluble fibers: fibers found in fruits, vegetables, dry beans and peas, and some cereals such as oats.

Importance of Soluble fibers:

- play a role in reducing the level of cholesterol in the blood.
- It seems to bind up cholesterol allowing it to be eliminated with the stool.

Disadvantages of Dietary Fibers:

1. Decrease absorption of some minerals.

2. Intestinal bacteria ferment some fibers causing flatulence and abdominal discomfort.

Requirements of dietary fiber = 20 – 25 gms / day OR 7 gm/ 1000 kcal

Requirements of CHO:

Infants 7---10 gm / kgm of body weight 40 % -- 60 % of total energy

Adult 4---6 gm / kgm of body weight 50 % ---70 % of total energy

- **Deficiency of carbohydrates causes:**

➢ Weight loss, fatigue, and ketoacidosis.

To prevent these effects:

➢ Intake each day a minimum of 50–100 grams of carbohydrates

- **Digestion and Absorption:**

- **Monosaccharides:** glucose, fructose, and galactose—are absorbed from the intestine directly into the bloodstream.
- Fructose and galactose are changed to glucose, then the blood carries glucose to the cells.
- **Disaccharides**—sucrose, maltose converted to the simple sugar(glucose) before they can be absorbed into bloodstream. This conversion is accomplished by the enzymes sucrase, maltose, and lactase.

- **Polysaccharides:** are more complex.
- cellulose wall is broken down ➔ starch is changed to ➔dextrin ➔ maltose ➔ glucose.

Metabolism and elimination.

- All carbohydrates are changed to the simple sugar.
- Glucose is converted to glycogen and is stored in the liver and muscles.
- When more glucose is ingested than the body can either use immediately or store in the form of glycogen, it is converted to fat and stored as adipose (fatty) tissue.

- The process of glucose metabolism is controlled mainly by the hormone insulin, which is secreted by the **islets of Langerhans in the pancreas** and which maintains normal blood glucose at 70–110 mg/dl.
- When the secretion of insulin is impaired or absent, the glucose level in the blood becomes excessively high. This condition is called hyperglycemia (blood glucose more than 126 mg/dl) and is usually a symptom of diabetes mellitus.

- When blood glucose levels are unusually low, the condition is called hypoglycemia (blood glucose less than 70 mg/dl). A mild form of hypoglycemia may occur **if one waits too long between meals or if the pancreas secretes too much insulin.** Symptoms include fatigue, shaking, sweating, and headache.

- **Over consumption of sugar leads to :**

- **Obesity:** high calorie intake stored as fat.
- **Dental caries:** remain sugar contact with teeth, support bacteria to growth plague formation and tooth decay.
- Risk of diabetes mellitus type 2 development.
- Cardiovascular disease.

Thank you