

CARBOHYDRATES

OBJECTIVES/RATIONALE

Knowledge of nutrients is important in understanding energy production and use. The student will identify carbohydrates and relate their use to health and wellness.

TEKS 121.24 1C, 6A

TAKS ELA 1, 3, 4, 5, 6
Science 2, 4

KEY POINTS

I. Carbohydrates - Sugars

Carbohydrates and food are converted into glucose and give immediate energy and glycogen, which is stored for reserve energy. Glucose and glycogen provide approximately one half of the energy nerves, muscles and other body tissues use daily. Glucose provides most if not all of the energy for brain cells.

A. Simple – the most important sugars in nutrition

1. Monosaccharides – All have the chemical formula $C_6H_{12}O_6$. It's their spatial configuration that makes them different. The basic structure is ring shaped.
 - a. Glucose – mildly sweet
 - b. Galactose – barely sweet
 - c. Fructose – very sweet
2. Disaccharides – Made when two monosaccharides are combined through the process of condensation. Condensation is a chemical reaction in which two molecules join together to make one larger molecule. The OH group from one of the molecules is combined with a H from the other producing H_2O and a larger molecule. When broken down all disaccharides provide at least one glucose molecule. $OH + H$ produces H_2O
 - a. sucrose
 - aa. made by combining glucose and fructose
 - bb. table sugar
 - b. maltose
 - aa. made by combining glucose and galactose
 - bb. only a minor constituent in food
 - c. lactose
 - aa. made by combining glucose and glucose
 - bb. principle sugar in milk

B. Complex – Made of many glucose units linked together. (Polysaccharides)

1. Glycogen
 - a. the storage form of glucose in our bodies
 - b. manufactured in the liver and muscle tissue

- c. not considered as a dietary source of carbohydrates. (Not found in plants and in only limited amounts in meats.)
- 2. Starch
 - a. storage form of glucose in plants
 - b. made of long chains of glucose units that may be straight or branched.
 - c. Hydrolyzed into glucose after it is eaten
 - cc. hydrolysis is a chemical reaction that breaks disaccharides apart. It splits a molecule into two parts by adding H to one and a OH group to the other.
- 3. Fibers
 - a. polysaccharides made of linked glucose units
 - b. indigestible by humans
 - aa. humans do 't have the enzyme to break the Beta 1~4 linkage
 - c. bacteria in the digestive system can break down some of the fibers so they are important for health and digestion.
 - d. Soluble and insoluble fibers both affect the digestive process by influencing the movement and absorption rate of nutrients in the GI tract.

II. Carbohydrates in the body

A. Digestion and absorption

1. Purpose – breaks down large carbohydrates into glucose units. In one to four hours after eating, all the sugars and most of the starches are digested.
2. mouth
 - a. salivary amylase hydrolyzes starch into shorter polysaccharide units
 - b. little digestion takes place here because it is in the mouth such as short time
3. stomach
 - a. salivary amylase is destroyed by acid so its action stops
 - b. although acid breaks down starch to some extent, no enzymes are present in the stomach to break down carbohydrates.
4. small intestine
 - a. carries out most of the digestion of carbohydrates
 - b. major digestive enzyme is pancreatic amylase.
 - c. Other enzymes specific for carbohydrates are maltase, sucrase and lactase.
 - d. Fibers delay the absorption of carbohydrates and fats.
 - e. Some fibers can bind with minerals and prevent their absorption
5. large intestine
 - a. site of fiber action - include softening stools and absorption of water.
 - b. Digestion of fibers by bacteria produce water, gas and fatty acids. (the fatty acids are broken down and absorbed to produce energy.)

6. absorption into the bloodstream
 - a. most is absorbed in the small intestine but a small amount can be absorbed in the mouth.
 - b. monosaccharides are absorbed by active transport through the walls of the small intestine.
 - c. Circulated in the blood and converted mainly into glucose by the liver for energy
 - d. Converted into glycogen and stored if energy is not needed.

III. Sugars and Health

A. Myths - Sugars

1. Honey is more nutritious than table sugar.
2. Obesity- it may contribute but is NOT the sole cause.
3. Heart disease – when eaten at moderate levels for most people.
4. Hyperactivity or misbehavior

B. Health risks - if eaten in excess

1. contribute to nutritional deficiencies by supplying calories without providing nutrients
2. provide excess calories which can be turned into fat
3. contribute to tooth decay.

IV. Diseases and disorders

A. Hypoglycemia

B. Hyperglycemia

C. Diabetes

D. Lactose intolerance

1. Inability to digest lactose
2. symptoms include bloating, abdominal discomfort and diarrhea occur after eating lactose.
3. 20% of prescriptions contain lactose as a filler.

ACTIVITIES

- I. Create three a 3-D model of a carbohydrate.
- II. Compare and contrast advertisements for products that claim to be quick energy sources. Report findings in multimedia presentation.

Teacher Note

Students should conclude that all carbohydrates are digested and absorbed the same way.

MATERIALS NEEDED

Internet
Library

ASSESSMENT

Completion of the model

Multimedia Rubric

ACCOMMODATIONS

For reinforcement, the student will draw the digestive system identifying where enzymes are secreted and include which enzymes responsible for the breakdown of carbohydrates.

For enrichment: The students will research and write a disease report for a disease or disorder associated with metabolism and use of carbohydrates, such as diabetes.

REFLECTIONS
