Nutrition & Diet Therapy
Third Stage
First Semester 2022-2023

Lecture Two : Part1- Carbohydrate

Ass.Lec. Iman Hadi Auda
Ass.Lec. Maryem Jawad Abd alateef

Branch of Basic Medical Sciences
College of Nursing
University of Basrah

Carbohydrates

- Carbohydrates (CHO) are composed of C, H, & O.
- Sugars, starches, and fiber are the main forms.
- Starches and sugars are the major source of energy.
- Most carbohydrates found in plant foods, a few are of animal origin.
- Carbohydrates are also good sources of fiber, which is the indigestible part of plant foods. It is nutritionally significant in gastrointestinal functioning.

Food Sources

- Cereal grains and their products such as rice, wheat, barley, pastas, breakfast cereals, rye and oat.
- Vegetables such as potatoes, beets, peas, and corn.
- Green leafy vegetables provide dietary fiber.
- Fruits provide sugar and fiber.
- Sugars such as table sugar, syrup, and honey and sugar-rich foods such as desserts and candy.

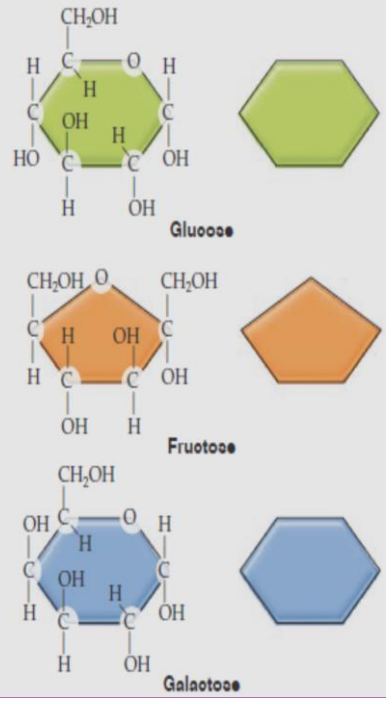
Classification

1- Simple Carbohydrate

a- Monosaccharaides: small molecules, which dissolve in water and are absorbed very quickly in the body. They are sweet, require no digestion, and can be absorbed directly into the bloodstream from the small intestine. They include glucose, fructose, and galactose.

Monosaccharides are simple sugars that may be absorbed from the intestine directly into the bloodstream. They are subsequently carried to the liver, where fructose and galactose are changed to glucose, the blood then carries glucose to the cells.

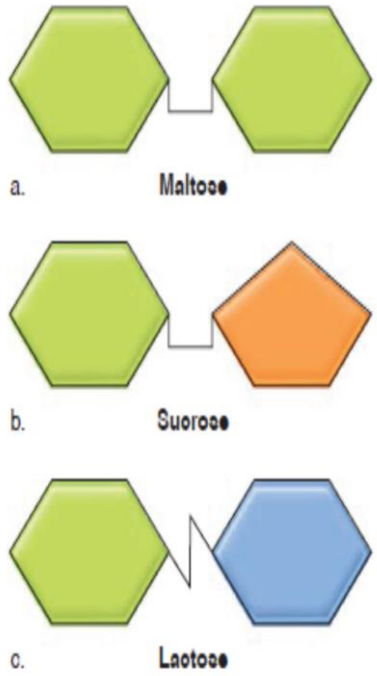
- **Glucose (dextrose):** also called dextrose, is the form of carbohydrate to which all other forms are converted for eventual metabolism. It is found naturally in corn syrup and some fruits and vegetables. The central nervous system, the red blood cells, and the brain use only glucose as fuel; therefore, a continuous source is needed.
- **Fructose (levulose):** also called levulose or fruit sugar, is found with glucose in many fruits and in honey. It is the sweetest of all the monosaccharides.
- **Galactose:** is a product of the digestion of milk. It is not found naturally.



b-Disaccharides:

- These are small molecules, which dissolve in water and are absorbed very quickly in the body. They are sweet and must be changed to simple sugars by hydrolysis before they can be absorbed. Disaccharides include sucrose, maltose, and lactose.
- Disaccharides are require an additional step of digestion. They must be converted to the simple sugar glucose before they can be absorbed into the bloodstream. This conversion is accomplished by the enzymes amylase, maltase, and lactase.

- **Sucrose:** is composed of glucose and fructose. It is the form of carbohydrate present in granulated, powdered, and brown sugar and in molasses. It is one of the sweetest and least expensive sugars.
- **Maltose:** is a disaccharide that is an intermediary product in the hydrolysis of starch. It is produced by enzyme action during the digestion of starch in the body. It also is created during the fermentation process that produces alcohol. It can be found in some infant formulas, malt beverage products, and beer. It is considerably less sweet than glucose or sucrose.
- **Lactose:** is the sugar found in milk. It is distinct from most other sugars because it is not found in plants. It helps the body absorb calcium. Lactose is less sweet than monosaccharides or other disaccharides.



2- Complex carbohydrates

a- Polysaccharides: they are compounds of many monosaccharides (simple sugars). Three polysaccharides are important in nutrition: starch, glycogen, and fiber. Polysaccharides are more complex, and their digestibility varies. After the cellulose wall is broken down, starch is changed to the intermediate product dextrin; it is then changed to maltose and finally to glucose. Cooking can change starch to dextrin. For example, when bread is toasted, it turns golden brown and tastes sweeter because the starch has been changed to dextrin. The digestion of starch begins in the mouth, where the enzyme salivary amylase begins to change starch to dextrin. The second step occurs in the stomach, where the food is mixed with gastric juices. The final step occurs in the small intestine, where the digestible carbohydrates are changed to simple sugars by the enzyme action of pancreatic amylase and are subsequently absorbed into the blood.

- **Starch:** is a polysaccharide found in grains and vegetables. It is the storage form of glucose in plants. Vegetables contain less starch than grains because vegetables have a higher moisture content. Legumes (dried beans and peas) are another important source of starch as well as of dietary fiber and protein. Starches are more complex than monosaccharides or disaccharides, and it takes the body longer to digest them.
- **Glycogen:** is sometimes called animal starch because it is the storage form of glucose in the body. In the healthy adult, approximately one-half day's supply of energy is stored as glycogen in the liver and muscles.
- **Fibers:** also called roughage, are indigestible because it cannot be broken down by digestive enzymes. It is classified as soluble or insoluble.

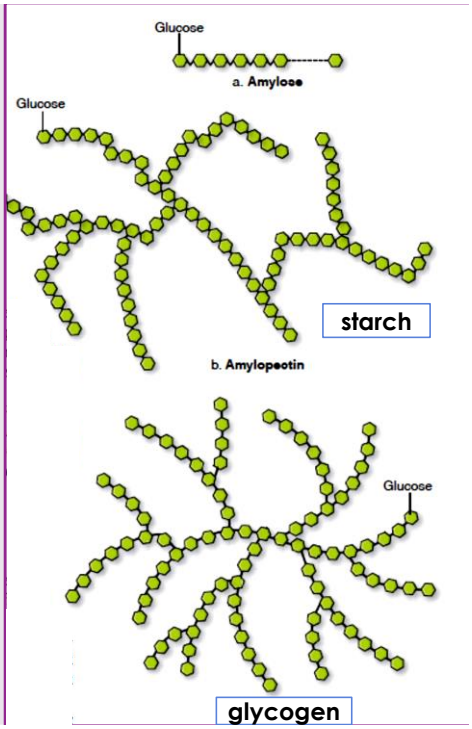


TABLE 5.6 *Classifying Fiber*

Type	Component(s)	Physiological Effects	Food Sources
Insoluble	Cellulose, hemi-celluloses	Increases fecal bulk and speeds fecal passage through GI tract	All plants Wheat, rye, brown rice, vegetables
	Lignin	Increases fecal bulk, may ease bowel movements	Whole grains, wheat bran
Soluble	Pectins, gums, mucilages, some hemicelluloses	Delays stomach emptying; slows glucose absorption; can lower blood cholesterol	Apples, bananas, citrus fruits, carrots, oats, barley, psyllium seeds, beans, and thickeners added to foods

Comparative Sweetness of Sugars

Sugar	Sweetness Value
Fructose	173
Invert sugar	130
Sucrose	100
Glucose	74
Galactose, Maltose	32
Lactose	16

Alternative Sweeteners

Alternative sweeteners (referred to as sugar replacers, sugar substitutes, or "artificial" sweeteners) are substances added to food that sweeten the item while providing few or no kilocalories. Alternative nutritive sweeteners include sugar alcohols (provide 2 kcal/g): sorbitol, xylitol, and mannitol. Unlike sugars, sugar alcohols do not promote dental decay. Thus, these compounds are used to replace sucrose in products such as sugar-free chewing gums, breath mints, and "dietetic" candies.

Sweetener	Comparison to Sugar	Kilocalories
Aspartame	200 times sweeter	0
Saccharin	200 to 700 times sweeter	0
Acesulfame-K	200 times sweeter	0
Neotame	7,000 to 13,000 times sweeter	0
Sucralose	600 times sweeter	0
Stevia extracts	200 to 300 times sweeter	0

Functions

- The primary function of carbohydrates in the body is to supply energy it provides 4 kcal/g.
- Carbohydrates act also as reserve fuel supply in the form of glycogen, stored in muscles and liver.
- Carbohydrates provide chemical framework which combine with the nitrogen to synthesize non-essential amino acids in the body.
- Carbohydrates and their derivatives work as precursors of important metabolic compounds such as nucleic acids, the matrix of connective tissue.
- Lactose provides galactose which needed for brain development. It aids absorption of calcium and phosphorus.

- Lactose forms lactic acid in the intestinal track due to the action of the bacteria (lactobacilli) is necessary for synthesize some of the vitamins B-complex.
- Carbohydrates are an important part of some compounds, which increase our resistance to infection (immunopolysaccharides), for example ribose, a five carbon sugar, is an essential part of DNA and RNA.
- Carbohydrates are needed for ensuring complete normal metabolism of fats, thus preventing ketoacidosis.
- Carbohydrates are needed to prevent dehydration. A low carbohydrate diet causes loss of water from tissues as also electrolytes (especially sodium and potassium) in the urine and can lead to involuntary dehydration.
- Dietary fiber acts like a sponge and absorbs water. It helps smooth movement of food waste through the digestive tract and the soft, bulky stools are comfortably eliminated.

Metabolism and Elimination

- All carbohydrates are changed to the simple sugar glucose before metabolism can take place in the cells. After glucose has been carried by the blood to the cells, it can be oxidized. Frequently, the volume of glucose that reaches the cells exceeds the amount the cells can use. In these cases, glucose is converted to glycogen and is stored in the liver and muscles. (Glycogen is subsequently broken down only from the liver and released as glucose when needed for energy.) 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.

Case in point: Margarita managing steroid-induced diabetes

- Margarita is a 59-year-old Hispanic nurse who has been admitted to the hospital for a left total knee replacement. She is 5 feet 6 inches and weighs 210 pounds. She has been NPO (nothing by mouth) all night and arrives to the hospital at 7 in the morning to be prepared for surgery. Once the operation is over, the healing process begins, and the physician notices that the incision is not healing as fast as expected. Margarita tells her nurse that since the surgery, she has noticed bilateral temporal pain. Her hemoglobin drops dramatically, and she has been newly diagnosed with giant cell arteritis. The cure is large doses of prednisone. Large doses of prednisone cause steroid-induced diabetes. The doctor prescribed a 1,200-calorie diabetic diet. Margarita is overwhelmed with all that has happened.

- **ASSESSMENT**

1. Calculate Margarita's ideal weight using Table 3-3. (calculate for yourself)
2. What does the dietitian need to know about Margarita's meal choices?
3. What does the dietitian need to know about Margarita's way of life?
4. What sources of carbohydrates would be most helpful in weight loss and maintenance of blood sugar levels?

- **DIAGNOSIS** 5. Write a nursing diagnosis for Margarita.

Table 3-3 Suggested Weights for Adults

Height (without shoes)	Weight in Pounds Without Clothes 19 to 34 years	35 years and over
5′0″	97–128	108–138
5′1″	101–132	111–143
5′2″	104–137	115–148
5′3″	107–141	119–152
5′4″	111–146	122–157
5′5″	114–150	126–162
5′6″	118–155	130–167
5′7″	121–160	134–172
5′8″	125–164	138–178
5′9″	129–169	142–183
5′10″	132–174	146–188
5′11″	136–179	151–194
6′0″	140–184	155–199
6′1″	144–189	159–205
6′2″	148–195	164–210
6′3″	152–200	168–216
6′4″	156–205	173–222
6′5″	160–211	177–228
6′6″	164–216	182–234

Metric-English Conversions

Length

English (USA)	Metric
inch (in)	= 2.54 cm, 25.4 mm
foot (ft)	= 0.30 m, 30.48 cm
yard (yd)	= 0.91 m, 91.4 cm
mile (statute) (5280 ft)	= 1.61 km, 1609 m
mile (nautical) (6077 ft, 1.15 statute mi)	= 1.85 km, 1850 m

Metric	English (USA)
millimeter (mm)	= 0.039 in (thickness of a dime)
centimeter (cm)	= 0.39 in
meter (m)	= 3.28 ft, 39.4 in
kilometer (km)	= 0.62 mi, 1091 yd, 3273 ft

Weight

English (USA)	Metric
grain	= 64.80 mg
ounce (oz)	= 28.35 g
pound (lb)	= 453.60 g, 0.45 kg
ton (short—2000 lb)	= 0.91 metric ton (907 kg)

Metric	English (USA)
milligram (mg)	= 0.002 grain (0.000035 oz)
gram (g)	= 0.04 oz (1/28 of an oz)
kilogram (kg)	= 35.27 oz, 2.20 lb
metric ton (1000 kg)	= 1.10 tons

Volume

English (USA)	Metric
cubic inch	= 16.39 cc
cubic foot	= 0.03 m^3
cubic yard	= 0.765 m^3
teaspoon (tsp)	= 5 ml
tablespoon (tbsp)	= 15 ml
fluid ounce	= 0.03 liter (30 ml)*
cup (c)	= 237 ml
pint (pt)	= 0.47 liter
quart (qt)	= 0.95 liter
gallon (gal)	= 3.79 liters

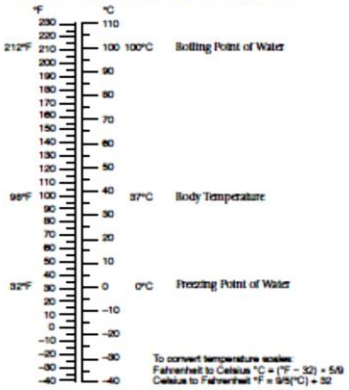
Metric	English (USA)
milliliter (ml)	= 0.03 oz
liter (L)	= 2.12 pt
liter	= 1.06 qt
liter	= 0.27 gal

1 liter ÷ 1000 = 1 milliliter or 1 cubic centimeter (10^{-3} liter)*
1 liter ÷ 1,000,000 = 1 microliter (10^{-6} liter)

Metric and Other Common Units

Unit/Abbreviation	Other Equivalent Measure
milligram/mg	1/1000 of a gram
microgram/μg	1/1,000,000 of a gram
deciliter/dl	1/10 of a liter (about ½ cup)
milliliter/ml	1/1000 of a liter (5 ml is about 1 tsp)
International Unit/IU	Crude measure of vitamin activity generally based on growth rate seen in animals

Fahrenheit-Celsius Conversion Scale



Household Units

3 teaspoons	= 1 tablespoon
4 tablespoons	= ¼ cup
5⅓ tablespoons	= ⅓ cup
8 tablespoons	= ½ cup
10⅔ tablespoons	= ⅔ cup
16 tablespoons	= 1 cup
1 tablespoon	= ½ fluid ounce
1 cup	= 8 fluid ounces
1 cup	= ½ pint
2 cups	= 1 pint
4 cups	= 1 quart
2 pints	= 1 quart
4 quarts	= 1 gallon