Chapter 1: Carbohydrates

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Which type of monosaccharide do body cells use for energy?
A. Fructose
B. Glucose
C. Galactose
D. Lactose

____ 2. In what form does the body store carbohydrates?
A. Glycogen
B. Fat
C. Cellulite
D. Amylopectin

____ 3. Which of the following is a naturally occurring, plant-based, noncaloric sweetener?
A. Stevia
B. Sorbitol
C. Saccharin
D. Neotame

____ 4. Which type of carbohydrate is structurally composed of a chain of three to ten simple sugars?
A. Amylose
B. Galactose
C. Amylopectin
D. Oligosaccharide

____ 5. Which type of starch is easily digested?
A. Amylose
B. Amylopectin
C. Cellulose
D. Glycogen

____ 6. What deficiency will cause the painful gastrointestinal symptoms associated with lactose intolerance?
A. Alpha-dextrinase deficiency
B. Pancreatic amylase deficiency
C. Lactase deficiency
D. Trehelase deficiency

____ 7. Approximately how many grams of glycogen can the body store for energy use?
A. 90 g
B. 150 g
C. 240 g
D. 500 g

____ 8. What organ produces the enzymes responsible for maintaining blood sugar levels within normal limits?
A. Pancreas
B. Liver
C. Gallbladder
D. Small intestine

____ 9. According to acceptable macronutrient distribution ranges (AMDRs), how many grams of carbohydrates should be consumed daily by an athlete consuming a 3,000-calorie diet?
A. 130 to 200 g/day
B. 225 to 325 g/day
C. 338 to 488 g/day
D. 500 to 650 g/day

____ 10. What is the glycemic load (GL) of a small orange (15 g carbohydrates [CHO]) with a glycemic index (GI) of 40?
A. 2.2
B. 4.5
C. 6
D. 8.25

____ 11. What is the best way for an athlete to spare protein and avoid gluconeogenesis?
A. Limit glycogen stores.
B. Consume only water during training sessions in excess of 45 min in duration.
C. Consume high amounts of fiber on training days.
D. Consume adequate carbohydrates to fuel performance.

____ 12. What type of bond joins monosaccharides together to form disaccharides, oligosaccharides, and polysaccharides?
A. Glycosidic bond
B. Glucogenic bond
C. Carbon double bond
D. Glycerol bond

____ 13. Which of the following is a benefit attributed to fructooligosaccharides that are found naturally in some fruits and vegetable and are commercially produced as reduced-calorie sweeteners?
A. Increased triglyceride levels
B. Relief of constipation
C. Decreased glycogen storage
D. Increased amino acid production

____ 14. Which enzyme begins the process of carbohydrate digestion?
A. Pancreatic amylase
B. Insulin
C. Salivary amylase
D. Glucagon

____ 15. What substance is released by the pancreas into the duodenum to create a more alkaline environment to allow the digestive enzymes to perform their assigned functions in carbohydrate digestion?
A. Insulin
B. Glucagon
C. Pancreatic amylase
D. Bicarbonate

Multiple Response
Identify one or more choices that best complete the statement or answer the question.

____ 16. Which of the following statements describes what happens after digested sugars are delivered to the liver through the portal system? *Select all that apply.*
A. Fructose and galactose are converted to glucose.
B. Glucose is converted to glycogen and stored in the pancreas for later use.
C. Glucose enters the bloodstream based on body needs.
D. Glucose is converted to fat based on body needs.

____ 17. Which of the following are considered health benefits associated with high-viscosity fiber consumption? *Select all that apply.*
A. Increased feeling of fullness
B. Decreased fat absorption
C. Decreased cholesterol levels
D. Decreased insulin resistance

True/False
Indicate whether the statement is true or false.

____ 18. All types of carbohydrates provide 4 calories per gram.

____ 19. Research indicates that consuming foods with a lower glycemic load may offer significant health benefits, including weight control and decreased risk of diabetes and heart disease.

____ 20. The average American consumes and exceeds the daily recommendations for fiber intake.

Completion
Complete each statement.

21. Place the steps of carbohydrate digestion in order. (1 to 10)
_____ 1. Enzyme action is inhibited due to acidic environment, and bolus is converted to chyme.
_____ 2. Chyme passes into the duodenum, and pancreatic enzymes help to break glycosidic bonds.
_____ 3. Salivary amylase begins to break polysaccharides into oligosaccharides and disaccharides.
_____ 4. Bolus moves into the stomach.
_____ 5. Brush border enzymes break carbohydrates into monosaccharides, and absorption occurs into the microvilli.
_____ 6. Undigested carbohydrates move into the large intestine.
_____ 7. Chyme passes into the jejunum and ileum.
_____ 8. Some fiber is partially digested by bacteria through fermentation, and the remaining fiber is excreted.
_____ 9. Monosaccharides absorbed into the bloodstream pass through portal circulation for distribution or storage.
_____ 10. Bolus passes through the esophagus.

Short Answer

22. Describe the manner in which insulin and glucagon regulate blood sugar levels.

23. Why is glycemic load a more accurate representation of the impact of a particular food on blood sugar response than glycemic index?

Chapter 1: Carbohydrates
Answer Section

MULTIPLE CHOICE

1. ANS: B
   Rationale: Lactose is a disaccharide, and fructose and galactose must be converted to glucose for the cells to use for energy.

   PTS: 1 DIF: Easy OBJ: 1-1
   KEY: monosaccharide | glucose | energy sources
2. ANS: A
   Rationale: The body stores carbohydrates as glycogen in the liver and muscles.

   PTS: 1 DIF: Easy OBJ: 1-1 | 1-4 KEY: glycogen | carbohydrate storage
3. ANS: A
   Rationale: The stevia plant produces a noncaloric, all-natural sweetener.

   PTS: 1 DIF: Easy OBJ: 1-1 KEY: stevia | noncaloric sweeteners
4. ANS: D
   Rationale: Oligosaccharides are chains of three to ten monosaccharides. Amylose and amylopectin are examples of polysaccharide starches, and galactose is a monosaccharide.

   PTS: 1 DIF: Easy OBJ: 1-2 KEY: oligosaccharide
5. ANS: B
   Rationale: Amylose is resistant to digestion. Cellulose is a basically indigestible fiber, and glycogen is not a form of starch.

   PTS: 1 DIF: Easy OBJ: 1-2 KEY: starch | carbohydrate structure
6. ANS: C
   Rationale: The enzyme lactase is responsible for breaking lactose into its component parts. The inability to break down lactose results in painful gastrointestinal symptoms like abdominal cramps, bloating, diarrhea, and flatulence.

   PTS: 1 DIF: Moderate OBJ: 1-4
   KEY: lactose intolerance | carbohydrate digestion
7. ANS: C
   Rationale: The body can store approximately 240 g of glycogen (90 g in the liver and 150 g in the muscles). Any additional glucose not needed for normal body activity is converted to fat for storage.

   PTS: 1 DIF: Moderate OBJ: 1-4 KEY: glycogen | carbohydrate storage
8. ANS: A
   Rationale: Insulin and glucagon, the hormones responsible for regulating blood sugar, are produced in the pancreas.

   PTS: 1 DIF: Moderate OBJ: 1-5 KEY: blood sugar
9. ANS: C

Rationale: AMDR is 45% to 65% of calories from carbohydrates. For an individual consuming a 3,000-calorie diet, that is 1,350 to 1,950 calories. Carbohydrates carry 4 cal/g.

PTS: 1 DIF: Difficult OBJ: 1-5
KEY: recommended intake | AMDR | acceptable macronutrient distribution range

10. ANS: C
Rationale: GL = (GI × g CHO)/100; GL = (40 × 15 g CHO)/100; GL = 6

PTS: 1 DIF: Difficult OBJ: 1-6 KEY: glycemic load

11. ANS: D
Rationale: Gluconeogenesis occurs when there is limited glucose or glycogen available as an energy source.

PTS: 1 DIF: Moderate OBJ: 1-8 KEY: gluconeogenesis

12. ANS: A
Rationale: Glycosidic bonds connect monosaccharides together to form the other types of carbohydrate chains.

PTS: 1 DIF: Easy OBJ: 1-1 KEY: glycosidic bond

13. ANS: B
Rationale: Fructooligosaccharide use has been associated with constipation relief, improved triglyceride levels, and decreased production of foul-smelling digestive by-products.

PTS: 1 DIF: Moderate OBJ: 1-1 KEY: fructooligosaccharides

14. ANS: C
Rationale: Digestion of carbohydrates begins in the mouth when salivary amylase breaks large polysaccharides into oligosaccharides and disaccharides.

PTS: 1 DIF: Easy OBJ: 1-4
KEY: salivary amylase | carbohydrate digestion

15. ANS: D
Rationale: Bicarbonate results in a more alkaline environment, so digestive enzymes can survive the acidity of the materials moving into the small intestine from the stomach.

PTS: 1 DIF: Moderate OBJ: 1-4 KEY: bicarbonate | carbohydrate digestion

MULTIPLE RESPONSE

16. ANS: A, C, D
Rationale: Sugars may be converted to glycogen, but glycogen is stored in the muscles and liver, not the pancreas.

PTS: 1 DIF: Difficult OBJ: 1-4
KEY: portal system | glycogen | carbohydrate absorption

17. ANS: A, B, C, D
Rationale: High-viscosity or soluble fiber typically slows gastric emptying, which contributes to feelings of fullness and better regulation of blood sugar levels. In addition, it interferes with fat and cholesterol absorption and recirculation. This fiber is also linked in improving cells' sensitivity to insulin, therefore decreasing insulin resistance and type 2 diabetes risk.

PTS: 1 DIF: Difficult OBJ: 1-7 KEY: high-viscosity fiber | soluble fiber

TRUE/FALSE

18. ANS: F
Rationale: Most carbohydrates provide 4 calories per gram; however, dietary fiber contributes approximately 1.5 to 2.5 calories per gram.

PTS: 1 DIF: Easy OBJ: 1-1 KEY: calorie

19. ANS: T
Rationale: Significant health benefits are associated with low-glycemic-load foods due to their nutrient density and the stability they provide to blood sugar and insulin levels.

PTS: 1 DIF: Easy OBJ: 1-6 KEY: glycemic load

20. ANS: F
Rationale: Americans consume far less than the recommended fiber intake of 14 g per 1000 calories, or 25 to 35 g per day.

PTS: 1 DIF: Easy OBJ: 1-7 KEY: fiber

COMPLETION

21. ANS: 3, 10, 4, 1, 2, 5, 7, 9, 6, 8

PTS: 1 DIF: Difficult OBJ: 1-4 KEY: carbohydrate digestion

SHORT ANSWER

22. ANS:
When blood sugar levels begin to rise, insulin aids in the uptake of glucose and conversion of carbohydrates into fat for long-term storage. Glucagon is released when blood sugar levels decrease; it increases blood sugar levels by regulating the breakdown of glycogen into glucose and the conversion of fat into fuel to maintain blood glucose levels while conserving glycogen.

PTS: 1 DIF: Difficult OBJ: 1-5 KEY: insulin | glucagon

23. ANS:
Glycemic load accounts for portion size while glycemic index solely measures the impact of a food on blood sugar levels compared with a reference amount of 50 g of carbohydrates. Foods can have a high glycemic index but a small typical portion size and therefore a low glycemic load. In addition, very few foods are composed solely of carbohydrates. The fat, protein, and fiber in a food also lowers the glycemic load.

PTS: 1 DIF: Moderate OBJ: 1-6 KEY: glycemic load | glycemic index