Chapter 2: Protein

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

____ 1. Which of the following best describes a nonessential amino acid?
A. An amino acid that must be consumed in the diet.
B. An amino acid that is used to form a low-quality protein.
C. An amino acid that limits protein synthesis.
D. An amino acid that can be made by the body from other substances.

____ 2. What is measured in a protein digestibility-corrected amino acid score (PDCAAS)?
A. Quality of a protein
B. Rate at which a protein is digested
C. Percentage of a protein that is able to be digested
D. Number of amino acids contained in a protein

____ 3. An egg has a protein digestibility-corrected amino acid score (PDCAAS) score of 1. What can you infer from this score?
A. An egg provides 100% of all essential amino acids.
B. An egg provides 10% of the body's daily protein needs.
C. An egg is a good example of an incomplete protein.
D. An egg provides one essential amino acid.

____ 4. Which of the following is an example of complementary proteins?
A. Green beans and pimentos
B. Carrots and ranch dressing
C. Rice and black beans
D. Tomatoes and cucumbers

____ 5. A lactose intolerant athlete would like to supplement his diet with whey protein. What form of whey protein is recommended?
A. Whey protein powder
B. Whey protein isolate
C. Whey protein concentrate
D. Whey protein with casein

____ 6. When the body sees or smells food, the hormone _____ stimulates the release of hydrochloric acid in the stomach. This rapid increase in stomach acid triggers the release of the enzyme _____, which further breaks down the peptide bonds between amino acids.
A. Gastrin; pepsin
B. Salivary amylase; gastrin
C. Trypsin; peptic acid
D. Trypsinogen; trypsin

____ 7. Sally is a triathlete working with a dietician who recommends that 20% of the 2,500 calories Sally consumes each day should come from protein. How many grams of protein should Sally consume?
A. 100 g
B. 125 g
C. 300 g
D. 625 g

____ 8. Protein consumption above _____ is unlikely to result in additional muscle gains.
A. 1 g/kg/day
B. 1.6 g/kg/day
C. 2 g/kg/day
D. 2.4 g/kg/day

____ 9. What mechanism contributes to the initial weight loss in high-protein/low-carbohydrate diets such as Atkins or South Beach?
A. Diuretic effect of low carbohydrate consumption
B. Increase in percentage of lean muscle mass
C. Glycogen sparing and storage
D. Proteolytic metabolism

____ 10. Although amino acid supplementation is not recommended due to inconsistent research findings, which type of amino acid supplementation has shown enhanced endurance, delayed fatigue, and increased protein synthesis when taken in conjunction with an exercise program?
A. Dipeptide amino acids
B. Tripeptide amino acids
C. Deaminated amino acids
D. Branched-chain amino acids

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

____ 11. Which of the following correctly describes denaturation? *Select all that apply.*
A. Destroys the structure of the protein, leaving only individual amino acids
B. Facilitated by the hydrochloric acid in the stomach
C. Can be accomplished through food preparation, like marinating a meat in a citrus marinade
D. Facilitates digestion as it makes the protein more available to digestive enzymes

____ 12. In which of the following situations would a positive protein balance be important? *Select all that apply.*
A. During recovery from an illness or injury
B. In the hours just before an endurance race
C. During pregnancy
D. During childhood

____ 13. How do protein recommendations differ for vegetarians compared to those for the general population? *Select all that apply.*
A. Vegetarians should consume about 10% more grams of protein than recommended for the general population.
B. Vegetarians should consume a variety of complementary proteins.
C. Vegetarians are required to consume soy as it is a complete protein.
D. Vegetarians should consume a higher percentage of carbohydrates to make up for the deficit of animal products.

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

____ 14. Complete proteins are found solely in animal products.

____ 15. Amino acids have both anabolic and catabolic functions.

____ 16. Excess protein consumed is stored in the muscle tissue.

Completion
Complete each statement.

17. Place the following types of whey protein from first to last in order of protein content.
_____ 1. Whey concentrate
_____ 2. Whey powder
_____ 3. Whey isolate

18. Place the following components of branched-chain amino acid metabolism in order from first to last.
_____ 1. Alanine is deaminated in the liver into pyruvate and nitrogen.
_____ 2. Nitrogen enters the urea cycle.
_____ 3. The branched-chain amino acid is transaminated in the muscle.
_____ 4. Pyruvate enters gluconeogenesis.
_____ 5. The carbon skeleton is used to make energy, glucose, or fat, and the nitrogen is used to make the nonessential amino acid alanine.

Short Answer

19. Why might a person whose diet lacks high-quality proteins find that they are frequently sick?

20. Explain why an endurance athlete consuming a diet high in protein but insufficient in carbohydrates might find themselves in a negative protein (nitrogen) balance and not experience muscle growth.

Matching

Match the following recommended protein intakes with the appropriate population group based on the recommendations from the Academy of Nutrition and Dietetics (AND), Dieticians of Canada, and the American College of Sports Medicine (ACSM).
A. 0.8 g/kg/day
B. 1.2 to 2 g/kg/day
C. 0.88 g/kg/day
D. 2.1 to 2.9 g/kg/day

____ 21. Samantha, a stay-at-home mother of two toddlers

____ 22. Roy, a football running back

____ 23. Shelby, a marathon runner

____ 24. Miranda, a vegan walker

____ 25. Steve, an accountant who is training to swim the English Channel

Chapter 2: Protein
Answer Section

MULTIPLE CHOICE

1. ANS: D
   Rationale: Nonessential amino acids, of which there are 11, can be made by the body and therefore do not have to be consumed in the diet.

   PTS: 1 DIF: Moderate OBJ: 2-1
   KEY: nonessential amino acid | protein quality
2. ANS: A
   Rationale: The PDCAAS is a mathematical formula in which the amino acid content of a food is compared to a reference food. Fecal digestibility is also factored into the equation.

   PTS: 1 DIF: Moderate OBJ: 2-1
   KEY: protein digestibility-corrected amino acid score | PDCAAS
3. ANS: A
   Rationale: A PDCAAS score of 1 is the highest possible score; it indicates that after digestion, a food will provide 100% of all essential amino acids.

   PTS: 1 DIF: Difficult OBJ: 2-1
   KEY: protein digestibility-corrected amino acid score | PDCAAS | essential amino acid
4. ANS: C
   Rationale: Complementary proteins are two incomplete proteins that, when combined, form a complete protein. Examples include grains and legumes, grains and dairy, and legumes and seeds.

   PTS: 1 DIF: Moderate OBJ: 2-1 KEY: complementarity
5. ANS: B
   Rationale: Whey protein isolate is the only type of whey that is lactose-free.

   PTS: 1 DIF: Difficult OBJ: 2-5 KEY: whey | isolate | casein
6. ANS: A
   Rationale: Gastrin triggers increased hydrochloric acid in anticipation of eating. This rapid acidification prompts the release of pepsin, which shortens long polypeptide chains into shorter chains by breaking the peptide bonds between amino acids.

   PTS: 1 DIF: Moderate OBJ: 2-2 KEY: gastrin | pepsin
7. ANS: B
   Rationale: Twenty percent of the 2,500 calories would be 500 calories from protein. 500 divided by 4 cal/g = 125 g.

   PTS: 1 DIF: Difficult OBJ: 2-3 KEY: recommended intake
8. ANS: C
   Rationale: The body has a limited ability to use amino acids to build muscle, so consumption of protein beyond recommended levels is unlikely to result in muscle gain.

   PTS: 1 DIF: Easy OBJ: 2-4 KEY: recommended intake

9. ANS: A
Rationale: Loss of water weight secondary to the diuretic effects of a low-carbohydrate diet is thought to be the primary source of initial weight loss.

PTS: 1 DIF: Difficult OBJ: 2-4 KEY: weight loss

10. ANS: D
Rationale: Branched-chain amino acids have been shown to enhance endurance, delay fatigue, contribute to energy availability, increase protein synthesis, and decrease protein catabolism.

PTS: 1 DIF: Easy OBJ: 2-6 KEY: supplementation

MULTIPLE RESPONSE

11. ANS: B, C, D
Rationale: Denaturation is the destruction of the quaternary, tertiary, and secondary structure of the protein, leaving only the primary structure. This occurs due to the acid environment in the stomach and in some types of acidic food preparation techniques.

PTS: 1 DIF: Difficult OBJ: 2-2 KEY: denaturation | protein digestion

12. ANS: A, C, D
Rationale: Positive protein balance occurs when protein consumed is greater than protein that is broken down. It is particularly important in times of growth.

PTS: 1 DIF: Difficult OBJ: 2-3
KEY: positive protein balance | protein metabolism

13. ANS: A, B
Rationale: It is recommended that vegetarians consume additional protein beyond the general recommendation as plant proteins are not as readily digested as animal proteins. Soy is not a requirement as long as complementary proteins are consumed in adequate amounts.

PTS: 1 DIF: Moderate OBJ: 2-4 KEY: vegetarian diet

TRUE/FALSE

14. ANS: F
Rationale: Complete proteins are mainly found in animal products. However, soy is an example of a plant-based complete protein.

PTS: 1 DIF: Easy OBJ: 2-1 KEY: complete protein

15. ANS: T
Rationale: Amino acids can be used to build tissue (anabolic) or can be broken down and used as fuel (catabolic).

PTS: 1 DIF: Moderate OBJ: 2-3 KEY: metabolism | anabolic | catabolic

16. ANS: F
Rationale: The body does not store protein. The amount of protein a healthy body ingests is equal to the amount of protein it excretes.

PTS: 1 DIF: Moderate OBJ: 2-3 KEY: nitrogen balance | metabolism

COMPLETION

17. ANS:
2, 3, 1
Rationale: Whey isolate (90% or more protein), Whey concentrate (25% to 89% protein), Whey powder (11% to 15% protein)

PTS: 1 DIF: Difficult OBJ: 2-5 KEY: whey | performance enhancement

18. ANS:
3, 4, 1, 5, 2
Rationale: The branched-chain amino acid is transaminated in the muscle. Pyruvate enters gluconeogenesis. Alanine is deaminated in the liver into pyruvate and nitrogen. The carbon skeleton is used to make energy, glucose, or fat, and the nitrogen is used to make the nonessential amino acid alanine. Nitrogen enters the urea cycle.

PTS: 1 DIF: Difficult OBJ: 2-3
KEY: transamination | deamination | gluconeogenesis | protein metabolism

SHORT ANSWER

19. ANS:
The antibodies that the body uses to fight infection are proteins.

PTS: 1 DIF: Moderate OBJ: 2-1 KEY: antibodies

20. ANS:
If the athlete is consuming insufficient amounts of carbohydrates, they will rely more heavily on protein as a fuel source, thereby causing a negative energy balance, decreased performance, and decreased muscular strength and endurance.

PTS: 1 DIF: Difficult OBJ: 2-3 KEY: negative protein balance

MATCHING

21. ANS: A PTS: 1 DIF: Difficult OBJ: 2-6
KEY: protein intake
22. ANS: C PTS: 1 DIF: Difficult OBJ: 2-6
KEY: protein intake
23. ANS: B PTS: 1 DIF: Difficult OBJ: 2-6
KEY: protein intake
24. ANS: C PTS: 1 DIF: Difficult OBJ: 2-6
KEY: protein intake
25. ANS: B PTS: 1 DIF: Difficult OBJ: 2-6
KEY: protein intake