Answers to Study Questions

Chapter 1

1. What are the main factors that influence our food choices?
   Sensory, cognitive, and cultural

3. List the 6 classes of nutrients.
   Carbohydrate, protein, fat, vitamins, minerals, and water

5. List and define the four main Dietary Reference Intake categories.
   The Estimated Average Requirement (EAR) is the nutrient intake level that is estimated to meet the needs of 50 percent of the individuals in a life-stage and gender group.
   The Recommended Dietary Allowance (RDA) is the daily intake level that meets the needs of most (97 to 98 percent) people in a life-stage and gender group.
   An Adequate Intake (AI) level is set when an RDA has yet to be established due to lack of knowledge and the need for more scientific research.
   The Tolerable Upper Intake Level (UL) is the maximum daily intake level that is unlikely to pose health risks to almost all of the individuals in a life-stage and gender category.

7. What is an epidemiological study?
   An epidemiological study observes and compares how disease rates vary among different population groups and identifies conditions related to diseases or conditions within the populations. This enables researchers to identify associations between factors within the population and the particular disease being studied.

9. What is a placebo?
   A placebo is an imitation treatment that looks the same as the experimental treatment (such as a sugar pill) but has no effect. The placebo is important for reducing bias because subjects do not know if they are receiving the intervention and are less inclined to alter their responses or reported symptoms based on what they think should happen.

Chapter 2

1. Define undernutrition and overnutrition.
   Undernutrition is poor health resulting from the depletion of nutrients due to inadequate nutrient intake over time. It is most often associated with poverty, alcoholism, and some types of eating disorders.
   The most common type of overnutrition in the United States is due to the regular consumption of excess calories, fats, saturated fats, and cholesterol.

3. What are the recommended amounts for each of the food groups of MyPyramid for a 2,000-calorie diet?
   Grains: 6 ounce equivalents; half should be whole grains
   Vegetable group: 2½ cups
   Fruits: 2 cups
   Milk: 3 cups
   Meat and beans: 5½ ounce equivalents

5. What determines whether a mineral is a macromineral or a micro-(trace) mineral?
   Macrominerals are found in and used by the body in the largest amounts.
   Microminerals are found in and used by the body in smaller amounts.

7. The standard Nutrition Facts panel shows information on which nutrients?
   Calories
   Calories from fat
   Total fat
   Saturated fat
   Trans fat
   Cholesterol
   Total carbohydrates
   Dietary fiber
   Sugars
   Protein
   Sodium
   Calcium, iron, vitamins A and C (all as a % Daily Value)

9. Define the three types of claims that may be found on food labels.
   Nutrient content claims describe the level of a nutrient or dietary substance in the product using terms such as good source, high, or free.
   A health claim is any statement that associates a food or a substance in a food with a disease or health-related condition.
   A structure/function claim describes a benefit related to a nutrient-deficiency disease or describes the role of a nutrient or dietary ingredient intended to affect a structure or function in humans; for example, calcium helps build strong bones.

Chapter 3

1. The contents of which organ has the lowest pH? Which organ produces an alkaline or basic solution to buffer this low pH?
   The stomach's contents have the lowest pH due to the stomach’s production of hydrochloric acid.
Chapter 5

1. Explain how it is possible for oils to contain a mixture of polyunsaturated, monounsaturated, and saturated fats.

Oils are triglycerides. Triglycerides contain a glycerol molecule and three fatty acids. These fatty acids can vary in three main ways: length, saturation, and omega number. An oil such as corn oil has more polyunsaturated fatty acids attached to glycerol than it does monounsaturated or saturated fatty acids. Therefore, corn oil is known as a mostly polyunsaturated fat, but like all oils, it contains a mixture of fatty acids.

3. What is the most common form of lipid found in food?

Triglycerides

5. List the many functions of triglycerides.

- Provide energy (9 kilocalories per gram)
- Provide a concentrated source of stored calories (triglycerides in fat cells)
- Carry flavor in foods
- Pad and protect vital organs
- Provide thermal insulation (subcutaneous fat)

7. What foods contain cholesterol?

Any foods that contain ingredients derived from an animal will contain cholesterol.

Chapter 6

1. List the functions of body proteins.

- Comprise muscles and organs
- Work as hormones, enzymes, and antibodies
- Help to regulate fluid and electrolyte balance
- Help to regulate acid-base balance
- Used as transporter molecules

3. Among the nutrient molecules, which element is unique to protein, and how does it fit into the basic structure of an amino acid?

Nitrogen is part of the chemical structure of amino acids (proteins), but not of carbohydrates and lipids. Nitrogen is part of the amino group, -NH₂.

5. What are complementary proteins? List three examples of food combinations that contain complementary proteins.

Two proteins that, when combined, contain all of the indispensable amino acids (proteins), but not of carbohydrates and lipids. Nitrogen is part of the amino group, -NH₂.

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Chapter 4

1. Describe the difference between starch and fiber.

Both starch and fiber are long chains of glucose molecules, but we are unable to digest the bonds between the glucose units in fiber. Therefore, fiber moves through the small intestine undigested, while starch is broken down into glucose and absorbed.

3. What are the consequences of eating too few carbohydrates?

Carbohydrates provide energy (fuel) to the cells of the body. Consuming too few carbohydrates can result in the breakdown of body proteins that supply glucose and energy. Inadequate carbohydrate intake prevents fats from breaking down normally, and this results in ketosis.

5. Which foods contain carbohydrates?

Grains, fruits, and vegetables are the most carbohydrate-dense foods. Many dairy foods also contribute quite a bit of carbohydrate. Legumes often are rich in both carbohydrates and protein. Sweets, of course, contain carbohydrates in the form of sugars.

7. Describe the structure of a monosaccharide, disaccharide, and polysaccharide.

A monosaccharide is a single sugar (e.g., glucose, fructose, and galactose). A disaccharide is a molecule of two single sugars (e.g., maltose, sucrose, and lactose). A polysaccharide is a long chain of sugar units (e.g., starch and fiber).
ANSWERS TO STUDY QUESTIONS

Chapter 7

1. What is the “universal energy currency”? Where is most of it produced?
   ATP is the energy form usable by cells, so it is called the universal energy currency. Most ATP is produced inside mitochondria, so often they are called the powerhouses of the cell.

2. In the catabolic pathways, what two molecules are major electron acceptors? After they accept electrons, what electron carriers do they become? What is the primary function of the electron carriers?
   NAD+ and FAD+ are the electron acceptors in the breakdown pathways.
   NADH and FADH2 are the electron carriers. They carry these high-energy electrons to the electron transport chain, where the electrons power the production of ATP.

3. What two carbon molecules does beta-oxidation form as it “clips” the links of a fatty acid chain? What other molecules important to the production of ATP does beta-oxidation produce?
   Beta-oxidation, or fatty acid oxidation, is a step-by-step process that forms two carbon molecules of acetyl CoA as it clips two carbon links from a fatty acid chain. It also produces NADH and FADH2, which carry high-energy electrons to the electron transport chain for ATP production.

4. What are ketone bodies and when are they produced?
   Ketone bodies refer to the three compounds (acetoacetate, acetone, and beta-hydroxybutyrate) made during incomplete fatty acid oxidation. Although some ketone bodies are always produced and used, they become a substantial alternative energy source when the body lacks carbohydrate and needs to fuel vital cells.

5. Define gluconeogenesis and lipogenesis. Under what conditions do they predominantly occur? What are their primary inputs and outputs?
   Gluconeogenesis is the making of “new” glucose. When the body has a low glucose supply, it can make glucose from the glycerol component of triglycerides and from some amino acids.
   Lipogenesis is the process of synthesizing long-chain fatty acids. Lipogenesis occurs when ATP is plentiful and building blocks are abundant. Precursors of fatty acid synthesis include ketogenic amino acids, alcohol, and fatty acids themselves.

Chapter 8

1. What is a standard serving of beer, wine, and liquor?
   A standard amount of beer is 12 ounces, wine is 4 to 5 ounces, and liquor is 1½ ounces.

2. Where does alcohol metabolism take place?
   The liver is the chief organ for alcohol metabolism.

3. What causes “fatty liver” in an alcoholic?
   In alcohol metabolism, NAD is converted to NADH. Excess NADH blocks the entry of acetyl CoA into the citric acid cycle. The acetyl CoA is diverted and used to synthesize fatty acids.

4. Among health authorities, what is the consensus about drinking alcohol?
   Most health officials do not promote the consumption of alcohol; however, for people who do consume alcohol, they suggest moderation (no more than 2 drinks for males, 1 drink for females, per day).

5. Why do health care professionals advise pregnant women not to drink alcohol?
   Alcohol can cause fetal alcohol syndrome (FAS). A safe lower limit for alcohol consumption during pregnancy is not currently known.

6. Explain the six factors that determine energy expenditure.
   Energy expenditure is the amount of energy used by the body, whether at rest or during physical activity. The amount of energy expended depends on factors such as body size, physical activity level, and the type of activity.

7. Describe the concept of metabolic fitness.
   Some health experts advocate the replacement of goals to attain a particular weight with the goal of metabolic fitness, which is the absence of metabolic or biochemical risk factors associated with obesity. Individuals are considered metabolically fit when their blood lipids are at safe levels and their blood pressure is normal.
pressure is normal. Four suggested goals for metabolic fitness, from most to least aggressive, are to (1) significantly reduce the risk factors, (2) restore abnormal risk factors to normal ranges, (3) reverse the “high normal” or “borderline” parameters, and (4) prevent risk factors in overweight individuals.

9. What are the components of a sound approach to weight management?
- A balanced diet of moderate caloric intake
- Adequate exercise
- Cognitive-behavioral strategies for changing habits and behavior patterns
- Attention to balancing self-acceptance and the desire for change

11. Define “underweight.”
The term underweight is defined as a BMI of less than 18.5 kg/m².

Chapter 10

1. List at least three characteristics of fat-soluble vitamins.
- Vitamins A, D, E, and K are found in the fat and lipid components of food.
- Fat-soluble vitamins require bile for absorption and first travel in the lymphatic system (inside chylomicrons) before entering the bloodstream.
- Most fat-soluble vitamins are not readily excreted and are stored in the liver and adipose tissue.

3. What is the role of aldosterone in the body, and how is it released?
Aldosterone helps the kidneys retain sodium, which in turn causes the body to hold on to more water. When the kidneys detect dehydration, they secrete renin. Renin then causes the formation of angiotensin, which leads to the release of aldosterone.

9. How does a vitamin K deficiency lead to the inability to form a blood clot?
Vitamin K is necessary for the production of prothrombin, a protein that when activated is responsible for the formation of a solid clot.

Chapter 11

1. List the nine water-soluble vitamins and one main function for each.
- Thiamin functions in energy metabolism as the coenzyme thiamin pyrophosphate (TPP).
- Riboflavin functions in energy metabolism as the coenzymes flavin adenine dinucleotide (FAD) and flavin mononucleotide (FMN).
- Niacin functions in energy metabolism as the coenzymes nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP).
- Biotin acts as a coenzyme critical to energy and amino acid metabolism, as well as fat and glycogen synthesis.
- Pantothenic acid functions in energy metabolism as part of coenzyme A.
- Vitamin B₆ functions in amino acid and fatty acid metabolism as the coenzymes pyridoxal phosphate (PLP) and pyridoxamine phosphate (PMP).
- Folate functions in one-carbon transfer reactions in the synthesis of DNA and many other reactions.
- Vitamin B₁₂ promotes the growth and maintenance of the sheath that protects nerve fibers and activates the folate coenzyme, tetrahydrofolic acid (THFA).
- Vitamin C is important in collagen synthesis, assists with absorption of iron, and is an antioxidant.

3. Name the diseases and/or characteristic symptoms of deficiency of each water-soluble vitamin.
- Thiamin—beriberi
- Riboflavin—ariboflavinosis
- Niacin—pellagra
- Biotin—no disease name; a deficiency causes hair loss, nausea, and loss of appetite
- Pantothenic acid—no disease name
- Vitamin B₆—microcytic hypochromic anemia
- Folate—megaloblastic anemia
- Vitamin B₁₂—megaloblastic anemia and neurological damage
- Vitamin C—scurvy

5. List the water-soluble vitamins demonstrated to be toxic in large doses. What signs indicate toxic levels of each vitamin?
The only water-soluble vitamins with demonstrated toxicity are niacin, vitamin B₆, and vitamin C. Excessive amounts of niacin can dilate the capillaries and cause tingling sensations. When this occurs, it is called a “niacin flush.” Excessive amounts of vitamin B₆ can cause irreversible nerve degeneration; and excessive doses of vitamin C can cause diarrhea, nausea, and abdominal cramps.

Chapter 12

1. What are the two main factors that affect absorption of a mineral?
The physiological state of the body (i.e., is the body in a deficient or an overload state?) and the bioavailability of the mineral affect its absorption.

3. What is the role of aldosterone in the body, and how is it released?
Aldosterone helps the kidneys retain sodium, which in turn causes the body to hold on to more water. When the kidneys detect dehydration, they secrete renin. Renin then causes the formation of angiotensin, which leads to the release of aldosterone.

5. What is the recommended daily intake level for sodium?
The AI for sodium is 1,500 milligrams per day, a level that is substantially less than most Americans eat. The UL for sodium...
3. What are the general recommendations for an athlete (compared to a nonathlete) in terms of the percentage of calories from carbohydrates, proteins, and fats?

Muscle fibers are individual muscle cells. The two primary types are slow-twitch (ST) fibers and fast-twitch (FT) fibers. ST fibers have high aerobic endurance and take twice as long to reach maximum contraction as FT fibers. FT fibers have poor aerobic endurance. They perform anaerobically, contract quickly, and tire easily due to their limited endurance.

3. What are the general recommendations for an athlete (compared to a nonathlete) in terms of the percentage of calories from carbohydrates, proteins, and fats?

It is recommended that athletes consume 60 to 70 percent of their calories from carbohydrates, 20 percent from fat, and 15 percent from protein. Compared to a nonathlete whose diet should be 45 to 65 percent carbohydrate, this diet is higher in carbohydrates and lower in fat. The nonathlete's recommended fat intake is approximately 30 percent of total calories.

5. How do protein recommendations for athletes vary from those for nonathletes?

The adult nonathlete's RDA for protein is 0.8 grams per kilogram of body weight per day. This is less than the recommend-
Chapter 16

1. Describe the three stages of fetal growth.
In the first stage of fetal growth, called the blastogenic stage, the fertilized egg rapidly divides and begins to differentiate. During the embryonic stage, the major organ systems form. The fetal stage is the longest stage of development and during this stage, the fetus grows dramatically in size.

3. How do the recommended intake values for calories, protein, folate, and iron change for pregnancy?
- Calories—increased by 340 to 450 kilocalories per day during the second and third trimesters
- Protein—increased to 71 grams per day
- Iron—increased by 9 milligrams per day (from 18 to 27 milligrams per day)
- Folate—increased by 200 micrograms per day (from 400 to 600 micrograms per day)

5. Is it okay for an infant to experience weight loss immediately after birth? If an infant does lose weight, does it mean he or she is at nutritional risk?
It is normal for infants to lose weight in the first few days of life. In fact, they may lose up to 6 percent of their weight. This does not necessarily mean that an infant is at nutritional risk. Infants typically regain their birth weight within 2 weeks.

7. How much water does a breastfed or formula-fed infant need each day?
Babies need approximately 0.7 liters of water each day in the first six months of life and 0.8 liters per day from age 7 months to 1 year. Breastfed and formula-fed infants do not need supplemental water; the breast milk and properly mixed formula provide enough water for adequate hydration until significant amounts of solid foods have been added to the diet.

9. Describe the process for introducing solid foods into an infant’s diet.
Solid foods (anything other than breast milk or infant formula) should be introduced at about 6 months of age. Then new foods should be introduced one at a time to check for any allergies or intolerances. Most parents begin with infant rice cereal, mixed to a thin consistency with water, breast milk, or infant formula. After the infant is eating cereal several times a day, strained fruits and vegetables are introduced one at a time.

Chapter 17

1. Which vitamins and minerals are most likely to be deficient in a child’s diet?
Iron, vitamin D, and vitamin E (if parents follow a low-fat diet), and possibly zinc.

3. What are typical nutritional concerns for adolescents?
As at earlier ages, calcium, iron, and vitamin A are the nutrients that often are lacking in adolescent diets. Other nutritional concerns include obesity and eating disorders.
5. Compared with a younger adult, does a person older than 65 need more, less, or about the same amount of protein?
Even though older adults may have less lean mass, protein recommendations (as grams per day) are the same for all healthy adults, regardless of their age. However, because of taste changes and other factors, some individuals find it difficult to meet their protein needs. Some chronically ill people need more protein to maintain nitrogen balance. In addition, trauma, stress, and infection increase protein needs.

7. Discuss minerals that may need special attention in assessment of an older adult’s nutrition status.
Minerals of concern for elders include calcium, zinc, and magnesium. Calcium status is an important factor in the risk for osteoporosis. Marginal zinc deficiency has been suspected in many elders and may be the result of reduced intake of red meats.

5. List some of the organizations and programs fighting hunger and food insecurity in the United States.
- Supplemental Nutrition Assistance Program
- National School Lunch Program
- School Breakfast Program
- Child and Adult Care Food Program
- The Food Research and Action Center (FRAC)
- Special Supplemental Nutrition Program for Women, Infants and Children (WIC)

7. What are scientists’ major concerns about genetically engineered crops?
Concerns scientists have regarding genetically engineered crops are (1) GM crops will hurt innocent creatures, (2) GM crops will lead to the emergence of superweeds, or (3) the potential risk of introducing a new allergen into a GM food.

Chapter 19

1. What is the difference between food insecurity and hunger?
Food insecurity is the worry that one does not have the resources to obtain adequate food. Hunger is the physical sensation of unease or pain caused by a lack of food. Food insecurity can exist with or without hunger.

3. List four common nutritional deficiencies worldwide.
- Vitamin A
- Iodine
- Iron
- Protein-energy malnutrition (PEM)

5. What are the two main ways that pathogenic bacteria can cause foodborne illness?
Some types of pathogenic bacteria can directly infect a person who consumes contaminated food. Others may produce a toxin that can cause foodborne illness.

3. List four naturally occurring toxins.
- Aflatoxin, a fungus found on nuts and corn
- Ciguatera and methyl mercury, found in seafood
- Toxins found in poisonous mushrooms
- Solanine, found in potatoes

5. What are some ways to keep food safe at home?
When trying to keep a kitchen safe from pathogenic microorganisms, you should:
- Make sure hands and kitchen surfaces are thoroughly clean.
- Keep raw meats and poultry separate from other raw foods to avoid cross-contamination.
- Use proper temperatures while cooking.
- Chill food properly.

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