Nutrition for Health and Health Care 7th edition DeBruyne Solutions Manual

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Chapter 1 – Overview of Nutrition and Health

Objectives

1.1 Describe the factors that influence personal food choices.
1.2 Identify which of the major classes of nutrients are organic and which yield energy.
1.3 Describe the four categories of the Dietary Reference Intakes (DRI), the Estimated Energy Requirement (EER), and the Acceptable Macronutrient Distribution Ranges (AMDR).
1.4 Describe the ways in which the kinds of information collected by researchers from nutrition surveys are used.
1.5 Explain how each of the dietary ideals can be used to plan a healthy diet and how the Dietary Guidelines and USDA Food Intake Patterns help make diet planning easier.
1.6 Compare the information on food labels to make selections that meet specific dietary and health goals.
1.7 Discuss how misinformation and reliable nutrition information can be identified.

Chapter Outline **Instructor Resources**

I. Food Choices — Worksheet 1-1, Classroom Activities 1-1 and 1-2
   A. Introduction
      1. Healthy food choices do not ensure health and a long life.
      2. People often choose foods based on factors other than health.
      3. Changing eating habits is difficult.
      4. Healthcare professionals must understand the dynamics of food choices in order to help elicit change.
      5. Cultural competence is an important aspect of honoring individual preferences.
   B. Preference
   C. Habit
   D. Associations
   E. Ethnic Heritage and Regional Cuisines
   F. Values
   G. Social Interaction
   H. Emotional State
   I. Marketing
   J. Availability, Convenience, and Economy
   K. Age
   L. Body Weight and Image
   M. Medical Conditions
   N. Health and Nutrition

II. The Nutrients — Teaching Suggestion 1-1, Crossword 1
   A. Introduction
      1. The energy derived from nutrients composes cells, tissues, and organs.
      2. Foods contain many different materials.
      3. There are six classes of nutrients: water, carbohydrates, fats, proteins, vitamins, and minerals.

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4. Some nutrients must be derived from food and therefore are essential.

B. Six Classes of Nutrients
   1. Carbohydrates, Fats, and Proteins
      a. Are organic (contain carbon)
      b. Called the energy-yielding nutrients
      c. Major fuels
   2. Vitamins, Minerals, and Water
      a. Vitamins
         (i) Are organic
         (ii) Yield no energy
         (iii) Facilitate release of energy
      b. Minerals
         (i) Are inorganic
         (ii) Yield no energy
         (iii) Facilitate release of energy in addition to other roles
      c. Water: inorganic medium in which all body processes take place

C. kCalories: A Measure of Energy
   1. Dietary kcalories defined
      a. Carbohydrates: 4 kcalories per gram
      b. Protein: 4 kcalories per gram
      c. Fats: 9 kcalories per gram
      d. How to Calculate the Energy Available from Foods (Box 1-1)
   2. Energy Nutrients in Foods
      a. Almost all foods contain mixtures of carbohydrates, fats, and protein.
         (i) Beef: protein and fat
         (ii) Cornbread: carbohydrates, protein, and fat
      b. Some pure foods
         (i) Sugar: carbohydrate
         (ii) Oil: fat
   3. Energy Storage in the Body
      a. Energy-yielding nutrients are used to build new compounds and fuel metabolic and physical activities.
      b. Excesses are rearranged into storage compounds for later use.
      c. Too many kcalories from any of the nutrients will be stored as fat.
   4. Alcohol, Not a Nutrient
      a. Is not a nutrient
      b. Contains 7 kcalories per gram

III. Nutrient Recommendations Worksheet 1-2

A. Dietary Reference Intakes
   1. A set of dietary standards that supports health by defining recommended nutrient intakes.
      a. Energy
      b. Nutrients
      c. Other dietary components
      d. Physical activity
      e. Collaborative effort of USA and Canada
      f. Designed to support health

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2. Setting Nutrient Recommendations: RDA and AI
    a. RDA
        (i) Based on experimental evidence
        (ii) Basis for DRI
    b. AI
        (i) Based on scientific judgment, not experimental evidence
        (ii) Established when there is insufficient evidence to define an RDA
3. Facilitating Nutrition Research and Policy: EAR
    a. Average requirements for a given life stage and gender
4. Establishing Safety Guidelines: UL
    a. Tolerable Upper Intake Levels (UL)
    b. Levels of nutrients at which toxicity may occur
5. Using Nutrient Recommendations
    a. EAR: used to develop and evaluate programs for groups
    b. RDA or AI: used to set goals for individuals
    c. UL: helps prevent nutrient toxicity
    d. Values are recommendations for safe intake and not minimum requirements, except for energy
6. Setting Energy Recommendations
    a. Energy intake from food should be matched with energy expenditure
    b. Energy (EER) - values depend on age, gender, weight, height, and physical activity

B. Acceptable Macronutrient Distribution Ranges (AMDR)
1. Carbohydrates = 45–65% daily kcalories
2. Protein = 10–35% daily kcalories
3. Fat = 20–35% daily kcalories

IV. National Nutrition Surveys
A. To determine:
1. Foods people eat
2. Supplements taken
3. Nutritional health
4. Measure knowledge, attitudes, and behaviors related to nutrition

B. Used for:
1. Setting public policy
2. Food assistance programs
3. Regulating food supply
4. Food industry uses for public relations and product development
5. Establishing research priorities

C. Coordinating Nutrition Survey Data
1. National Nutrition Monitoring program coordinates many nutrition-related activities of various federal agencies
2. Major survey with two parts:
    a. Kind and amount of food people eat
    b. Nutritional assessment of people

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D. National Health Goals - Healthy People program
    1. Identifies national health priorities
    2. Guides policies
    3. Several objectives focus on nutrition-related health concerns

V. Dietary Guidelines, Fitness Guidelines, and Food Guides
A. Dietary Ideals
    1. Adequacy
    2. Balance
    3. kcal control
    4. Nutrient density
    5. Moderation
    6. Variety
B. Dietary Guidelines for Americans
    1. Promote health
    2. Goal is to achieve healthy eating patterns
C. Fitness Guidelines
    1. Physical fitness provides many health benefits
        a. More restful sleep
        b. Improved nutritional health
        c. Improved body composition
        d. Improved bone density
        e. Enhanced resistance to infectious disease
        f. Decreased risk of some cancers
        g. Stronger circulation and lung function
        h. Decreased risk of cardiovascular disease
        i. Lower risk of type 2 diabetes
        j. Reduced risk of gallbladder disease
        k. Lower incidence and severity of anxiety and depression
        l. Stronger self-image
        m. Long life and high quality of life in later years
D. The USDA Food Patterns
    1. Builds a diet from clusters of foods that are similar in vitamin and mineral content
    2. Assigns foods to five major food groups
        a. Fruits
        b. Vegetables
        c. Grains
        d. Protein foods
        e. Milk and milk products
    3. Recommended Amounts - recommends daily amounts of foods from each group to meet nutrient needs within kcal requirement
    4. Notable Nutrients
        a. Eat more:
            (i) Vegetables
            (ii) Fruits
            (iii) Whole grains

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b. Eat less:
(i) Sodium
(ii) Saturated fat, *trans*-fat
(iii) Refined grains
(iv) Foods and beverages with solid fats and added sugars

5. Nutrient-Dense Choices — Teaching Suggestion 1-2
   a. More nutrients and fewer kcalories = more nutrient dense
   b. Select low-fat items from each food group without solid fats and added sugars
   c. Select a small amount of oil from nuts, fish, and vegetables
6. Solid Fats, Added Sugars, and Alcohol Reduce Nutrient Density
7. Cup and Ounce Equivalents
   a. ¼ c dried fruit or nuts = a golf ball
   b. 1 c fruits or vegetables = a baseball
   c. 3 oz of meat = a deck of cards
   d. 2 T. peanut butter = 1 ping pong ball
8. Mixtures of Foods
9. Vegetarian Food Guide
10. Ethnic Food Choices

E. MyPlate — Internet Activity 1
   1. Illustrates use of five food groups
   2. Website: ChooseMyPlate.gov has many applications

VI. Food Labels — Worksheet 1-4, Classroom Activity 1-3

A. Must include
   1. The ingredient list
   2. Nutrition Facts panel
   3. Serving sizes
   4. Daily Values
   5. Nutrient quantities

B. May include
   1. Nutrient claims
   2. Health claims
   3. Structure-function claims

C. The Ingredient List - lists all ingredients in descending order by weight

D. Nutrition Facts Panel
   1. Serving Sizes
   2. The Daily Values
      a. Set of nutrient standards for use on food labels
      b. Adequacy standards for desirable nutrients
      c. Moderation standards for nutrients that must be limited
      d. Compares nutrients with daily goals of a person consuming 2000 kcalories
   3. Nutrient Quantities
   4. Front-of-Package Labels

E. Claims on labels
   1. Nutrient Claims
   2. Health Claims
   3. Structure-Function Claims

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VII. Nutrition in Practice - Finding the Truth about Nutrition

A. Why do nutrition news reports and claims for nutrition products seem to contradict each other so often?
   1. Popular media have limited reporting time and space.
   2. Scientists often disagree on new findings.
   3. Preliminary findings reported before validation or disapproval.
   4. New products or treatments promoted before validation.
   5. Consumers like to try new products even though they probably won't withstand tests of time.

B. So how can a person tell what claims to believe?
   1. Information should be supported by scientific research.
   2. Warning signs of nutrition quackery

C. What about nutrition and health information found on the Internet? How does a person know whether the websites are reliable? Worksheet 1-3
   1. No guarantee of accuracy of information
   2. Website must be evaluated.
   3. Food and Drug Administration (FDA) and other law enforcement agencies take action against fraudulent marketing on the Internet.
   4. Be suspicious of these claims:
      a. "Natural" or "non-toxic"
      b. "Scientific breakthrough," "miraculous cure," "secret ingredient," or "ancient remedy"
      c. Cures a wide range of illnesses
      d. Uses impressive-sounding medical terms
      e. Offers money-back guarantee

D. Everyone seems to be giving advice on nutrition. How can a person tell whom to listen to?
   1. Registered dietitians (RD)
   2. Nutrition professionals with advanced degrees: MS, PhD,

E. What about nurses and other health care professionals?
   1. Nurses
   2. Physicians
   3. Dietetic technicians (DTR)
   4. Physical therapists
   5. Social workers

F. What roles might these other health care professionals play in nutrition care? Classroom Activity 1-4

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Answers to Global Nutrition Watch Activities

1. a
2. b
3. c

Answers to Text "Clinical Applications" Questions

1. The list of foods and beverages will vary according to the individual's dietary intake. A variety of reasons may be given for food choices. Examples of influential factors that may be discussed include nutritional value, preference for taste, habit, convenience, maintaining relationships, part of a social interaction, to relieve boredom or depression, or a medical condition.

2. In order to help a client learn to vary dietary choices, the health care professional could begin with a discussion of variety as one of the dietary ideals. One tool that may be used to emphasize the importance of variety in dietary intake is the USDA Food Patterns. In using this tool, the health care professional could explain how to select foods from each group to ensure an adequate and balanced diet. Clients should also be encouraged to vary their choices within each food group from day to day because different foods in the same group contain different combinations of nutrients, ensuring adequacy. Another tool that might be used to emphasize the importance of variety is MyPlate. The division of the plate into several colors illustrates the importance of eating a variety of foods at each meal. This graphic simplifies the concepts presented in the USDA Food Patterns.

3 Responses will vary based upon the individual's dietary intake for the day. However, there should be a discussion comparing the individual's food choices with each of the five food groups: grains, vegetables, fruits, protein foods, and milk. The response should also include a comparison of the amounts eaten with those that are recommended by the USDA Food Patterns (see Table 1-7). If the selections and amounts are not within the recommendations, changes to meet those recommendations should be noted.

Answer Keys for Assignments

The following assignment/review worksheets are provided for duplication at the end of this instructor's manual section:

- Worksheet 1-1: The Meaning of Food in Your Life
- Worksheet 1-2: Nutrient Recommendation Standards Matching Exercise
- Worksheet 1-3: Junk Science
- **New!** Worksheet 1-4: Terms Used on a Food Label
- Crossword 1-1: Energy and Nutrients

Answer Key: Worksheet 1-1 and Worksheet 1-3 Answers will vary.

Answer Key: Worksheet 1-2

1. D	2. E	3. A	4. C	5. B

Answer Key: Worksheet 1-4

1. 3	3. 5	5. one third	7. 35
2. 140	4. 0.5	6. 10, 19	

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Answer Key: Crossword 1-1

1. nutrients
2. inorganic
3. calories
4. energy density
5. kcalories
6. nutrition
7. essential
8. organic
9. energy yielding
10. functional foods
11. phytochemicals

Classroom Activities

1-1 Pretest[1]

Begin the course with a true/false or multiple-choice quiz with questions projected on an overhead projector or using PowerPoint. The students reveal their responses by raising their hands. Make a note of the answer chosen by the majority of students for each question. (This can also be accomplished using an instant response system, a.k.a. "clickers"). Discussion and explanation follow.

This pretest is valuable because it creates interest in the subject matter, challenges students' erroneously-held beliefs, and introduces new terms and concepts. It is valuable to instructors in assessing the level of knowledge and attitudes in the subject area and identifying the needs and the focus for the chapter.

1-2 References to Food

Part A. Have students keep a record of every reference they hear to food during one day. Include television, radio, and comments from family and friends. At the next class period, discuss findings and the important role food plays in our lives.

Part B. Open a general discussion on the question, "Why do we eat?" (Some of the many reasons include habit, hunger, appetite, nutritional value, energy, and emotional reasons, such as anger, sadness, depression, boredom, and happiness.) Also, pose the question, "Why do we eat what we eat?" (Some of the reasons include taste, preference, habit, tradition, social pressure, availability, convenience, economy, and nutritional value.)[2]

1-3 Nutrition Labeling

Have each student bring in a food package which makes a health claim and identify why the claim is allowable under FDA guidelines, using the information in the text.

1-4 Health Professional Panel

Invite a panel of health professionals to class to discuss their role in the nutrition care of patients or clients. Suggested professionals include a registered dietitian, dietetic technician, nurse, physical therapist, social worker, and case manager.

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[1] Activity provided by: Lin Brown, Shasta College, Redding, CA.

[2] D. Crowley and J. Baker, *Instructor's Manual to Accompany Life Choices: Health Concepts and Strategies* (St. Paul, MN: West, 1988) p. 113.

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Teaching Suggestions

1-1 Define "Essential"
When you define "essential," as in essential nutrient, inform your students that the root *esse* is a French/Latin derivative of the verb "to be." This may stress the importance of including all the essential nutrients in the diet for life. It logically follows that the essential nutrients are water, the energy nutrients, vitamins, and minerals.[3]

1-2 Discuss Nutrient Density
Reinforce the concept of nutrient density by comparing selected nutrients in equal kcalorie amounts of orange juice and oranges. There is considerably more fiber, calcium, iron, and riboflavin in oranges than in orange juice.[4] You could also compare plain orange juice with one or more of the heavily-fortified orange juice varieties now available.

Internet Activity

1-1 Comparison of Foods from Around the World
Have students use the Internet to access information about foods from a different area of the world than their own: e.g., Mediterranean, Asian, or Latin American. One good resource is the site for the Oldways Preservation Trust at http://www.oldwayspt.org/.

[3] L. Fishman, *Instructor's Manual to Accompany Nutrition: Concepts and Controversies*, Fourth Edition (St. Paul, MN: West, 1988) p. 18.
[4] L. Turner, *Instructor's Manual to Understanding Nutrition*, Eighth Edition (Belmont, CA: West/Wadsworth, 1999).

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Worksheet 1-1: The Meaning of Food in Your Life

Although the primary function of food is to provide energy and nutrients for humans' biological needs, food is also an important medium used for social, political, and religious reasons. Food may be used to initiate and maintain interpersonal relationships with others, or express socio-religious ideas, often through ceremonies. Food may act as a symbolic medium to express love, reward, punish, or demonstrate belongingness to a group. Some foods are linked with social status, prestige, or individual and group achievements.

Briefly give an example of how food is used in your life, other than in satisfying your hunger, providing energy, or meeting your nutritional needs. You may focus on food as an expression of social, political, or religious ideas, or food as a symbolic medium. Discuss the role that food plays in your family or personal life other than that of providing nutrients. Be creative and original.

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Worksheet 1-2: Nutrient Recommendation Standards Matching Exercise

Instructions: Match the letter for the definition on the right to the number of the nutrient recommendation standard on the left. Use each letter only once.

Standard	**Definition**
_____ 1. DRI	A. These values establish the upper limits for nutrients that pose a hazard when consumed in excess.
_____ 2. EAR	B. These are the foundation of the DRI. They are a set of values, based on science, that are used to set dietary goals for individuals.
_____ 3. UL	C. These values are given to nutrients when scientific evidence is insufficient to generate an RDA.
_____ 4. AI	D. These recommendations are a set of standards that define the amounts of energy and nutrients to support the health of individuals. They take into account the amounts needed for disease prevention.
_____ 5. RDA	E. These values establish average requirements for groups based on life stages and gender. They are used to develop nutrition programs for school children and the military.

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Worksheet 1-3: Junk Science

There are numerous sites on the Internet that discuss nutrients. Some are reputable with scientifically based information. Others may appear scientific on the surface but are inaccurate. Look up the websites below or search for your own site of interest. Identify which of the sites below are reputable. Which are "junk science"? Select one site and evaluate it using the nine "warning signs" in Table NP1-1 on page 34 of the text to determine if it is reputable or quackery.

Site	URL
Linus Pauling Institute Micronutrient Information Center	http://lpi.oregonstate.edu/infocenter/vitamins.html
Colloidal Minerals	http://goaskalice.columbia.edu/answered-questions/whats-difference-between-ionic-and-colloidal-minerals
Mineral Water Store	http://www.mineralwaterstore.com
Quackwatch	http://www.quackwatch.org/
Acai Diet Info	http://www.acaidietinfo.com
Quick Weight Loss Centers	http://www.quickweightloss.net/
Blood Type Diet	http://www.thedietchannel.com/Blood-Type-diet.htm

Site selected:

Your evaluation:

1.

2.

3.

4.

5.

6.

7.

8.

9.

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Worksheet 1-4: Terms Used on a Food Label

Instructions: Fill in the blank with the correct number.

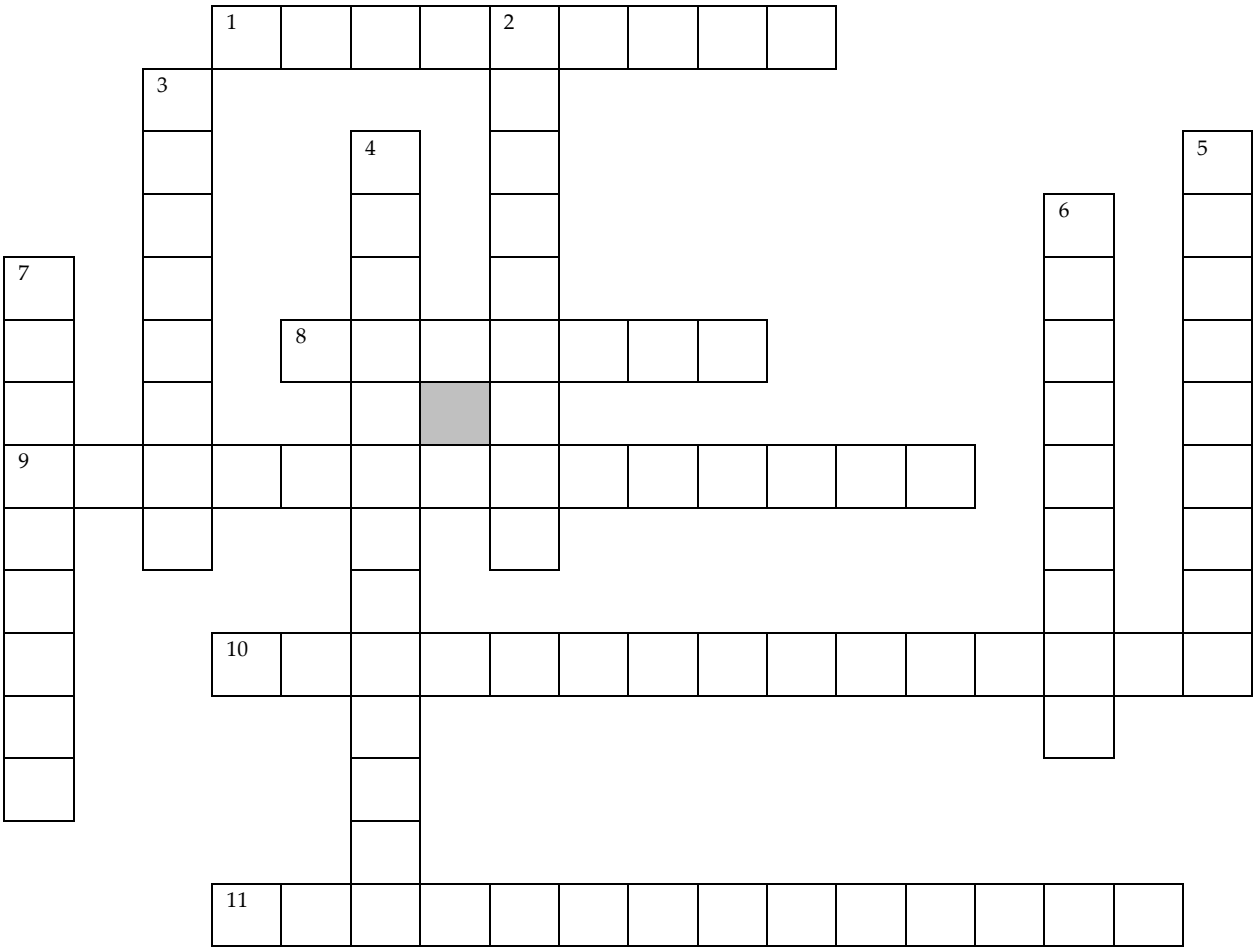
On a food label:

1. "Low fat" means _____ grams of fat or less preserving.
2. "Low sodium" means _____ mg or less of sodium per serving.
3. "High fiber" means _____ grams or more of fiber per serving.
4. "Fat free" means less than _____ grams of fat per serving.
5. "Light" means _____ fewer kcal per serving.
6. "A good source of calcium" means the product provides between _____% and _____% of the Daily Value for calcium per serving.
7. "Very low sodium" means less than _____ mg of sodium per serving.

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Crossword 1-1: Energy and Nutrients



Across	Down
1. Substances obtained from food and used in the body to provide energy and structural materials and to serve as regulating agents to promote growth, maintenance, and repair 8. Carbon containing 9. Category of nutrients that includes carbohydrate, protein, and fat 10. Whole or modified foods that contain bioactive food components believed to provide health benefits beyond those contributed by their nutrients 11. Nonnutrient compounds in plant-derived foods that alter physiological processes in the body	2. Not containing carbon or pertaining to living things 3. Units in which heat energy is measured 4. A measure of the energy a food provides relative to the amount of food (kcalories per gram) 5. Units of measure for food energy; one of these equals the amount of heat necessary to raise the temperature of 1 kilogram (kg) of water 1°C 6. The science of foods and the nutrients and other substances they contain, and of their ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion 7. Category of nutrients a person must obtain from food because the body cannot make them for itself in sufficient quantities to meet physiological needs

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Chapter 2 – Digestion and Absorption

Objectives

2.1 Describe the path followed that food takes during digestion and the muscular actions of digestion.
2.2 Describe the actions and origins of digestive secretions.
2.3 Describe the anatomical details of the GI tract and the features and activities of intestinal cells that facilitate nutrient absorption.
2.4 Describe the process of nutrient delivery from the GI tract to body cells by the vascular system and the different types of lipoproteins.
2.5 Explain the causes and effects of foodborne illnesses in humans and the methods of ensuring food safety.

Chapter Outline **Instructor Resources**

I. Anatomy of the Digestive Tract — Teaching Suggestion 2-1
   A. Introduction
      1. GI tract is a flexible, muscular tube.
      2. It extends from the mouth to the anus.
   B. The Digestive Organs — Worksheet 2-1; Teaching Suggestions 2-2 and 2-3
      1. Mouth to the Esophagus
         a. Food is chewed and softened in the mouth.
         b. Bolus is formed.
         c. Bolus passes epiglottis, which closes off the trachea to prevent choking.
         d. Food passes through the pharynx and across the epiglottis into the esophagus.
      2. Esophagus to the Stomach
         a. Bolus slides down the esophagus, through the esophageal sphincter to the stomach.
         b. Stomach adds gastric juices.
         c. Grinds the bolus to semi-liquid mass called chyme
         d. Chyme is released through the pyloric sphincter to small intestine.
      3. The Small Intestine
         a. Passes by the opening to the common bile duct
         b. Fluids enter from gallbladder.
         c. Fluids enter from pancreas.
         d. Travels through the duodenum, jejunum, and ileum
      4. The Large Intestine (Colon)
         a. Chyme passes through the ileocecal valve into the colon.
         b. Travels through the colon, past the appendix, to the rectum
         c. Colon withdraws water from the chyme.
      5. The Rectum
         a. Chyme is now a semi-solid waste.
         b. When it is time to defecate, the anal sphincter opens to allow the wastes to pass.
   C. The Involuntary Muscles and the Glands
      1. Gastrointestinal Motility - movement of material through the tract
      2. Peristalsis
         a. Begins in the esophagus
         b. Wavelike contractions propel or push chyme forward.

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c. Involves longitudinal and circular muscles

3. Segmentation
   a. Occurs in the intestines
   b. Mixes the chyme with more gradual pushing
   c. Periodic squeezing occurs, forcing the contents back a few inches
   d. Helps to mix with digestive juices
   e. Provides access to absorbing surface
4. Liquefying Process
   a. Begins in the mouth
      (i) Chewing
      (ii) Adding saliva
      (iii) Stirring with the tongue
   b. Stomach further mixes and kneads the food.
   c. Intestinal muscles promote further breakdown and give further access to the digestive juices.
5. Stomach Action
   a. Has three sets of muscles
      (i) Longitudinal
      (ii) Circular
      (iii) Diagonal
   b. Gastric glands secrete juices.
   c. Pyloric sphincter opens briefly, about three times per minute, to let portions of the liquefied chyme into the intestine.

II. The Process of Digestion
   A. Digestive juices come from:
      1. Salivary glands
      2. Stomach
      3. Small intestine
      4. Liver (via gallbladder)
      5. Pancreas
   B. Digestion in the Mouth
      1. Salivary glands secrete saliva, which contains:
         a. Water
         b. Salts
         c. Enzymes (including salivary amylase)
      2. Initial breakdown of starches
      3. Other nutrients aren't affected.
   C. Digestion in the Stomach
      1. Gastric juice = water, enzymes (pepsin), and hydrochloric acid
      2. Acid prevents bacterial growth.
      3. Mucus protects the stomach from acid.
      4. Initial breakdown of protein occurs
      5. Salivary amylase is digested.
      6. Minor events
         a. Digestion of fat by gastric lipase
         b. Digestion of sucrose by stomach acid
         c. Attachment of protein carrier to vitamin B_{12}

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D. Digestion in the Small and Large Intestines Internet Activity 2-1

1. Pancreatic juice contains digestive enzymes and bicarbonate.
2. Digestive Enzymes - enzymes to digest carbohydrates, fats, and protein
3. Bicarbonate - sodium bicarbonate to neutralize acidic chyme
4. Bile
   a. Secreted by liver and stored in gallbladder
   b. Emulsifies fat so that enzymes can work on it
   c. Emulsifiers are substances that disperse fat in water.
5. The Rate of Digestion
   a. Depends on the contents of the meal
   b. More rapid digestion with simple sugars
   c. Slower digestion with fats
6. Protective Factors
   a. GI bacteria protect against infectious bacteria.
   b. GI tract and small intestine have cells that confer specific immunity against intestinal disease.
7. The Final Stage Crossword 2, Internet Activity 2-2
   a. Energy-yielding nutrients are disassembled to basic building blocks and then absorbed.
   b. Vitamins, minerals, and water are absorbed as they are.
   c. Undigested residues such as fibers enter the colon and are excreted.
   d. Adequate ingestion of fiber and water relieves constipation.

III. The Absorptive System

A. The Small Intestine

1. Villi and Microvilli
   a. Most absorption occurs in the small intestine.
   b. Intestinal surface contains villi (fingerlike projections) and microvilli (microscopic "hairs"), which absorb nutrients.
2. Specialization in the Intestinal Tract - the cells of successive portions of the GI tract are specialized to absorb different nutrients.
3. The Myth of "Food Combining"
   a. Eating different foods at the same time (such as fruit and meat) does not cause problems for the digestive system.
   b. Some combinations are beneficial: vitamin C from citrus fruits aids in the absorption of iron from meats

B. Absorption of Nutrients

1. Water-soluble nutrients and small fat molecules are released into the blood.
2. Larger fats and fat-soluble vitamins are released into the lymphatic system.
3. Fats need packaging for transport.
4. Combine with special proteins to form chylomicrons, a type of lipoprotein

Worksheet 2-2

IV. Transport of Nutrients

A. The Vascular System

1. Circulatory system: heart → arteries → capillaries → veins → heart
2. Digestive vascular system: heart → arteries → capillaries in intestines → hepatic portal vein → liver → sinusoid →vein → heart

B. The Lymphatic System - a one-way route for fluids to travel from tissue spaces to the blood

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C. Transport of Lipids: Lipoproteins
   1. Lipids travel within the circulatory system bundled with a protein.
   2. Chylomicrons, a type of lipoprotein, transport newly absorbed dietary lipids from the intestinal cells to the rest of the body.
   3. VLDL, LDL, and HDL - very low-density lipoprotein, low-density lipoprotein, and high-density lipoprotein
      a. As chylomicrons circulate, their lipid contents are removed by cells, so they become smaller and smaller.
      b. Liver picks up chylomicron remnants and makes VLDL.
      c. Triglycerides are removed and become cholesterol-rich LDL.
      d. Cholesterol returning to liver is packaged as HDL.
   4. Health Implications of LDL and HDL
      a. Elevated concentrations of LDL are associated with risk of heart disease.
      b. Elevated concentrations of HDL are associated with low risk of heart disease.
      c. Ways to improve HDL/LDL ratio
         (i) Weight management
         (ii) Intake of poly- or monounsaturated fat instead of saturated fat
         (iii) Intake of soluble fibers
   5. Physical activity

V. The Health and Regulations of the GI tract

A. Gastrointestinal Hormones and Nerve Pathways

B. The System at Its Best – the GI tract is sensitive and responsive to environmental conditions.

VI. Nutrition in Practice - Food Safety
   A. The FDA lists foodborne illness as the leading food safety concern in the U.S.
   B. What is foodborne illness? - illness caused by food infection or intoxication
   C. What is the difference between foodborne infections and food intoxications?
      1. Infection is caused by eating food contaminated by infectious microbes.
      2. Intoxication is caused by eating food containing natural toxins or microbes that produce toxins.
   D. How do people get foodborne illness?
      1. Errors in food handling by individuals
      2. Errors made by food manufacturers or chefs
   E. What kinds of programs are in place to help keep food safe?
      1. FDA working with other countries to help them adopt safe food-handling practices
      2. HACCP
   F. Are foods bought in grocery stores and foods eaten in restaurants safe?
      1. "Sell by" dates
      2. Safety seals
      3. Package wrappers
      4. Government-provided guidelines on cleanliness and safe food preparation
      5. Consumer actions to help prevent foodborne illness when dining out
         a. Hand washing
         b. Expect cleanliness
         c. Expect food served at appropriate temperatures

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d. Refrigerate take-home food within two hours

G. What can people do to protect themselves from foodborne illness?
   1. Keep a clean, safe kitchen.
   2. Avoid cross-contamination.
   3. Keep hot foods hot.
   4. Keep cold foods cold.

H. What precautions need to be taken when preparing meat and poultry? - cook to proper temperatures

I. How can a person enjoy seafood safely?
   1. Cook fish until opaque.
   2. Choose pasteurized oysters.
   3. Keep seafood cold and clean before cooking.

J. Do foods that are unsafe to eat smell bad?
   1. Some bacterial waste produces off-odors.
   2. Not all do.
   3. Health Departments and USDA Extension Service offices can provide guidelines.

K. How can a person defend against foodborne illness when traveling to foreign countries?
   1. Wash hands frequently and/or properly use hand sanitizers.
   2. Eat only well-cooked and hot or canned foods.
   3. Wash produce to be eaten raw with purified water.
   4. Use only water that has been purified.
   5. Refuse unpasteurized and improperly refrigerated milk products.
   6. Travel with antidiarrheal medications.

Answers to Global Nutrition Watch Activities

1. b
2. c
3. wash fresh vegetables with warm water and a scrub brush

Answers to Text "Clinical Applications" Questions

1. The nutrients that are ready for absorption early are absorbed near the top of the gastrointestinal tract, and those that take longer to be digested are absorbed further down. Although much of the digestion of carbohydrates and proteins begins to take place in the mouth and stomach, respectively, the major enzymes that promote fat digestion are not present until fat reaches the small intestine. Fat absorption into the vascular system and cells is more complex than that of either carbohydrates or protein. The water-soluble nutrients from carbohydrate and protein digestion (and the smaller products of fat digestion) are released directly into the blood. However, the larger fats and fat-soluble vitamins are insoluble in water and need to be packaged for transport into the vascular system. Whereas water-soluble nutrients are absorbed directly into the bloodstream, fat-soluble nutrients are absorbed into the lymph. This lymph eventually returns to the bloodstream in an area near the heart. Because fat digestion and absorption are complex and rely on many different body tissues and processes, there is ample opportunity for something to go wrong. Thus, fat is not absorbed normally in most malabsorption disorders.

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2. The following information on fiber could be given to a client who frequently experiences constipation:

   Some fibers are not absorbed by the digestive tract but continue through and are excreted in the stool. They promote the wavelike contractions that keep food moving through the intestine. Fiber also absorbs many times its weight in water, which causes a large, soft, bulky stool that passes through the bowel easily and quickly. A softer, larger stool helps prevent constipation and straining. Drinking plenty of water, in addition to eating foods high in fiber, supplies fluids for the fiber to absorb. This is why it is recommended to drink plenty of fluids when eating high-fiber foods to relieve constipation.

Answer Keys for Assignments

The following assignment/review worksheets are provided for duplication at the end of this instructor's manual section:

- Worksheet 2-1: Digestive Organs Matching Exercise
- Worksheet 2-2: Digestion and Absorption Review
- Crossword 2-1: The Glands and Fluids of Digestion

Answer Key: Worksheet 2-1

1. G	3. A	5. F	7. D	9. B	11. C
2. D	4. C	6. H	8. E	10. D	12. D

Answer Key: Worksheet 2-2

1. The tongue moves the food around the mouth, facilitating chewing and swallowing. The teeth crush and soften food and moisten it for swallowing. The salivary glands in the mouth excrete saliva, which dissolves foods. Enzymes known as amylases begin to break down carbohydrates.
2. The muscular actions of peristalsis, segmentation, and sphincter contraction help to propel food through the gastrointestinal tract.
3. The cells of the stomach wall secrete mucus that coats and protects the stomach's lining.
4. Choosing monounsaturated and polyunsaturated fats instead of saturated fats, choosing foods high in soluble fibers, maintaining a healthy weight, and being physically active can improve the LDL-to-HDL ratio.
5. Nutrients are trapped among the villi and microvilli of the intestinal wall, and, with the help of enzymes, are completely digested and absorbed into the cells beneath them. Water-soluble nutrients and small lipids will move from the microvilli into the blood. Larger lipids, cholesterol, and fat-soluble vitamins will move into the lymph vessels.
6. The enzyme pepsin works with the stomach acids to help break down proteins.
7. The pancreas secretes pancreatic juices, which contribute enzymes that help to digest fats, protein, and carbohydrates.
8. Bile is produced by the liver and stored in the gallbladder. It helps emulsify fats so that enzymes can break them down for absorption.
9. The nutrient content of meals can influence the rate of digestion. High-fat meals remain in the stomach longer than high-carbohydrate meals.
10. Adequate fiber and fluids in the diet contribute to regularity and prevent constipation.
11. HCl (hydrochloric acid) kills some of the bacteria on food that may cause foodborne illness.

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12. Large lipids, cholesterol, and fat-soluble vitamins are packaged with protein into chylomicrons (a type of lipoprotein) for absorption into the lymph vessels.

Answer Key: Crossword 2

1. bicarbonate
2. intestinal juice
3. mucus
4. saliva
5. hydrochloric acid
6. salivary glands

7A. pancreatic juice

7D. pepsin

8. amylase
9. emulsifier
10. bile
11. gastric juice
12. gastric glands

Teaching Suggestions

2-1 Demonstration of the Digestive System

Coil a 23′ rope or dialysis hose in a bag. Begin the demonstration by pulling the rope out of the bag without disclosing its length. Expand on the concept of the size of the small intestine and large intestine by discussing the surface area. Another adaptation would be to depict the whole length of the digestive system, including the mouth, esophagus, stomach, small intestine, large intestine, and rectum by using the same rope.[1]

2-2 Digestion and Absorption

The study of digestion and absorption requires learning an immense number of new terms. With beginning students, it helps to introduce the GI tract systematically, using a chart or a film, and naming each part in sequence; then, use all the names with the chart while explaining the processes of digestion and absorption. Warn students frankly that the task of learning the digestive system parts and their functions is unglamorous but essential. To bring the subject to life, digress at intervals to share related knowledge they find intrinsically interesting about choking, ulcers, and other topics.[2]

2-3 Learning Game

The popularity of the game "Trivial Pursuit" inspired the construction of a similar game for use with students. The game, of course, was called "Nutritional Pursuit," and it was used for a nutrition and disease course, although it could be used for almost any course if the questions were modified. The students enjoyed it, and it really helped to reinforce what they learned in class.[3]

Internet Activities

2-1 Analysis of Internet Sites

Have students go to the following websites to look for information.

- American College of Gastroenterology: http://gi.org//
  Click on Patients and then GI Health & Disease. Have each student find information on a different disease of the GI tract and how that disease affects normal digestion or absorption.

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[1] L. Fishman, *Instructor's Manual to Accompany Nutrition: Concepts and Controversies, Fourth Edition* (St. Paul, MN: West, 1988) p. 7.

[2] L.W. Turner, *Instructor's Manual for Understanding Nutrition, Eighth Edition* (Belmont, CA: West/Wadsworth, 1999).

[3] Thanks to Gail Kauwell, University of Florida.

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- Three Rivers Endoscopy Center: http://www.gihealth.com/
  Click on Patient Education, then on Patient Pamphlets, and then on How Your Digestive System Works. Students can find a user-friendly description of digestion and pictures of the GI tract.

2-2 Research on Products for Digestive Problems

Have students search the Internet to learn about over-the-counter products designed to treat common digestive problems such as heartburn, constipation, diarrhea, and hemorrhoids. Have them write a brief paper which describes the appropriate and inappropriate uses of these medications and adverse health implications associated with misuse and overuse of certain medications.

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Worksheet 2-1: Digestive Organs Matching Exercise

Instructions: Match the letter for the organ on the right to its function(s) in digestion or absorption on the left. You may use an organ more than once.

Function in the Body

_____ 1. Bile is stored.

_____ 2. The pancreatic duct delivers digestive enzymes here.

_____ 3. Carbohydrate digestion begins.

_____ 4. Pepsin is produced for protein digestion.

_____ 5. Bicarbonate is produced here to neutralize stomach acid.

_____ 6. Bile is produced.

_____ 7. Large lipids are packaged in chylomicrons for absorption.

_____ 8. Bacteria degrade some of the fiber from food.

_____ 9. Using peristalsis, food is transported from the mouth to the lower esophageal sphincter.

_____ 10. Most digestion of carbohydrates, fats, and proteins occurs here.

_____ 11. Starch digestion stops because of the acidic conditions.

_____ 12. Bile emulsifies fat so enzymes can penetrate and digest it.

Organ

A. Mouth

B. Esophagus

C. Stomach

D. Small intestine

E. Large intestine (colon)

F. Pancreas

G. Gallbladder

H. Liver

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Worksheet 2-2: Digestion and Absorption Review

1. What factors contribute to digestion in the mouth?

2. What muscular actions help to propel food through the gastrointestinal tract?

3. Why doesn't gastric fluid cause harm to the stomach?

4. What diet and lifestyle factors can improve a person's LDL-to-HDL ratio?

5. How are nutrients absorbed into the circulatory system through the small intestine?

6. What is the role of pepsin in digestion?

7. What does the pancreas secrete, and how does it contribute to digestion?

8. Where is bile produced, and what is its purpose in digestion?

9. What factors can alter the rate of digestion?

10. What role do fiber and fluids play in the process of digestion?

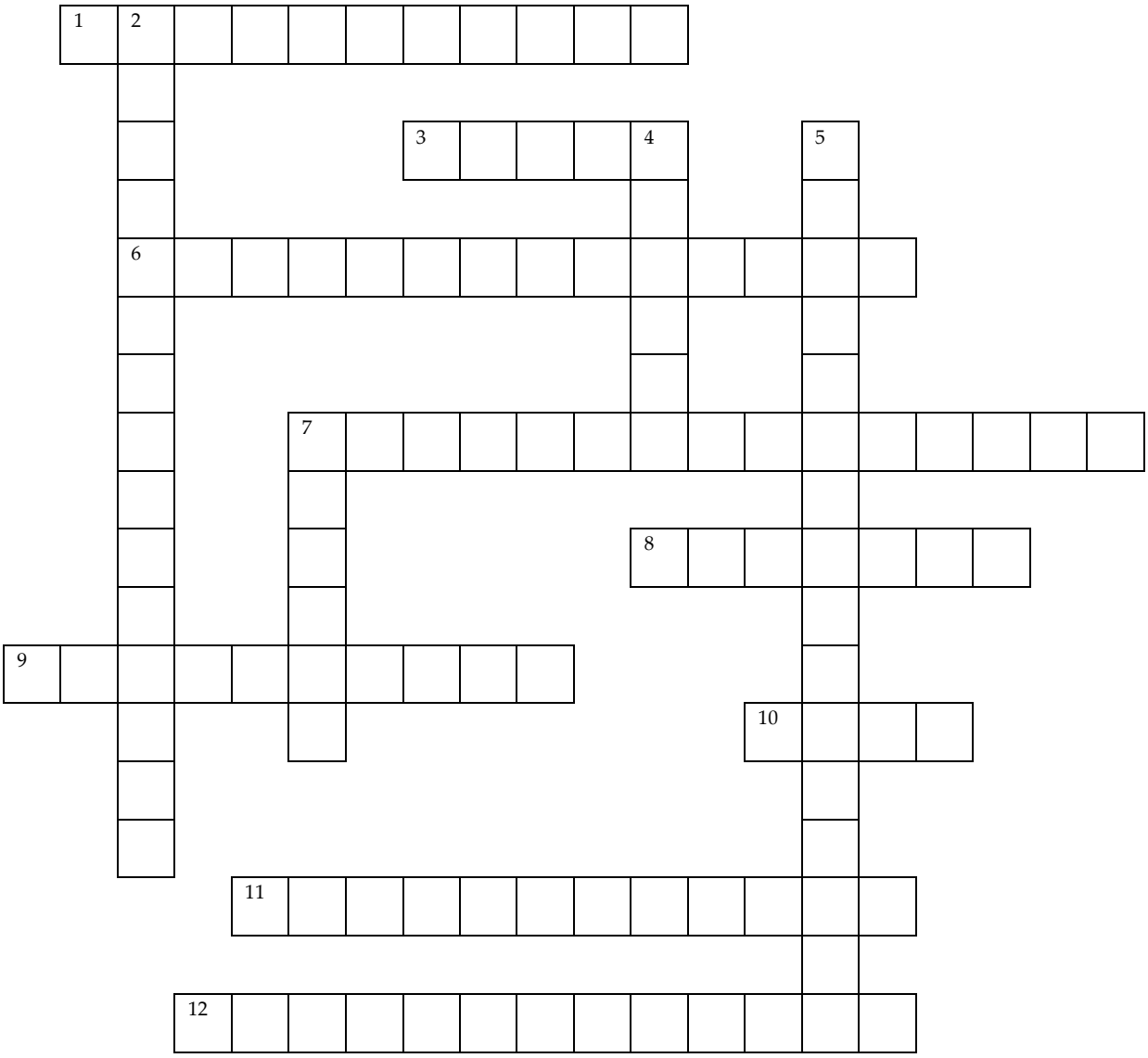
11. What substance produced in the stomach can kill bacteria and lower the risk of foodborne illness?

12. What role do chylomicrons play in absorption?

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Crossword 2: The Glands and Fluids of Digestion



Across	Down
1. An alkaline secretion of the pancreas; part of the pancreatic juice	2. The secretion of the intestinal glands
3. A mucopolysaccharide secreted by cells of the stomach wall that protects the cells from exposure to digestive juices	4. The secretion of the salivary glands
6. Exocrine glands that secrete saliva into the mouth	5. An acid composed of hydrogen and chloride atoms
7. The exocrine secretion of the pancreas, containing enzymes	7. A protein-digesting enzyme (gastric protease) in the stomach
8. An enzyme that splits amylose (a form of starch)	
9. A substance that mixes with both fat and water and that disperses the fat in the water, forming an emulsion	
10. An emulsifier that prepares fats and oils for digestion; made by the liver, stored in the gallbladder, and released into the small intestine when needed	
11. The digestive secretion of the gastric glands containing a mixture of water, hydrochloric acid, and enzymes	
12. Exocrine glands in the stomach wall that secrete gastric juice into the stomach	

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