DEBRUYNE
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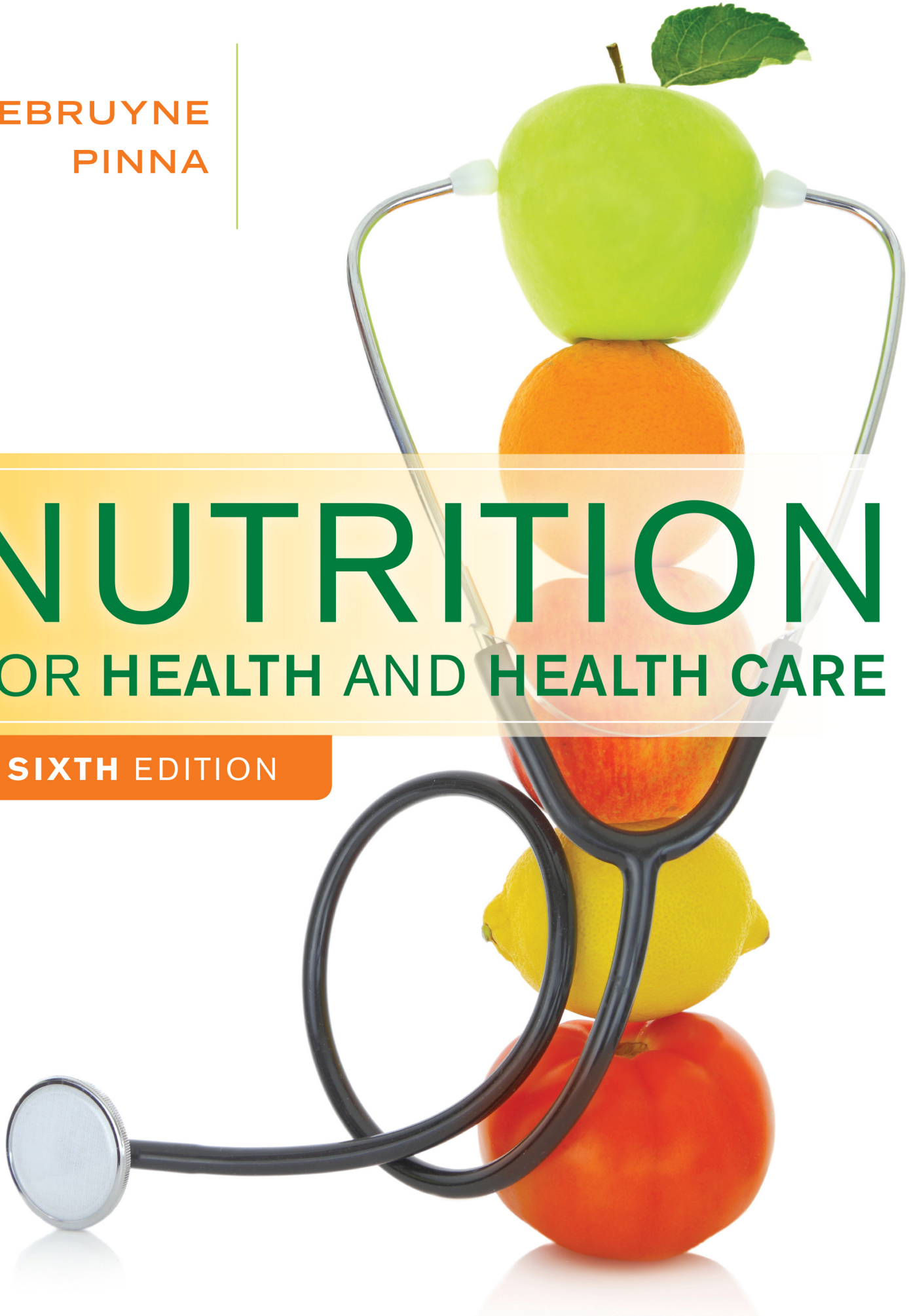

NUTRITION

FOR HEALTH AND HEALTH CARE

SIXTH EDITION

Dietary Reference Intakes (DRI)

The Dietary Reference Intakes (DRI) include two sets of nutrient intake goals for individuals—the Recommended Dietary Allowance (RDA) and Adequate Intake (AI). The RDA reflects the average daily amount of a nutrient considered adequate to meet the needs of most healthy people. If there is insufficient evidence to determine an RDA, an AI is set. In addition, the Estimated Energy Requirement (EER) represents the average dietary energy intake considered adequate to maintain energy balance in healthy people.

The DRI also include the Tolerable Upper Intake Level (UL) that represents the estimated maximum daily amount of a nutrient that appears safe for most healthy people to consume on a regular basis. Turn the page for a listing of the UL for selected vitamins and minerals. Note that the absence of a UL for a nutrient does not indicate that it is safe to consume in high doses, but only that research is too limited to set a UL. Chapter 1 describes these DRI values in detail.

Estimated Energy Requirements (EER), Recommended Dietary Allowances (RDA), and Adequate Intakes (AI) for Water, Energy, and the Energy Nutrients

Age (yr)	Reference BMI (kg/m²)	Reference Height cm (in)	Reference Weight kg (lb)	Water[a] AI (L/day)	Energy EER[b] (kcal/day)	Carbohydrate RDA (g/day)	Total Fiber AI (g/day)	Total Fat AI (g/day)	Linoleic Acid AI (g/day)	Linolenic Acid[c] AI (g/day)	Protein RDA (g/day)[d]	Protein RDA (g/kg/day)
Males												
0–0.5	—	62 (24)	6 (13)	0.7[e]	570	60	—	31	4.4	0.5	9.1	1.52
0.5–1	—	71 (28)	9 (20)	0.8[f]	743	95	—	30	4.6	0.5	11	1.20
1–3[g]	—	86 (34)	12 (27)	1.3	1046	130	19	—	7	0.7	13	1.05
4–8[g]	15.3	115 (45)	20 (44)	1.7	1742	130	25	—	10	0.9	19	0.95
9–13	17.2	144 (57)	36 (79)	2.4	2279	130	31	—	12	1.2	34	0.95
14–18	20.5	174 (68)	61 (134)	3.3	3152	130	38	—	16	1.6	52	0.85
19–30	22.5	177 (70)	70 (154)	3.7	3067[h]	130	38	—	17	1.6	56	0.80
31–50	22.5[i]	177 (70)[i]	70 (154)[i]	3.7	3067[h]	130	38	—	17	1.6	56	0.80
>50	22.5[i]	177 (70)[i]	70 (154)[i]	3.7	3067[h]	130	30	—	14	1.6	56	0.80
Females												
0–0.5	—	62 (24)	6 (13)	0.7[e]	520	60	—	31	4.4	0.5	9.1	1.52
0.5–1	—	71 (28)	9 (20)	0.8[f]	676	95	—	30	4.6	0.5	11	1.20
1–3[g]	—	86 (34)	12 (27)	1.3	992	130	19	—	7	0.7	13	1.05
4–8[g]	15.3	115 (45)	20 (44)	1.7	1642	130	25	—	10	0.9	19	0.95
9–13	17.4	144 (57)	37 (81)	2.1	2071	130	26	—	10	1.0	34	0.95
14–18	20.4	163 (64)	54 (119)	2.3	2368	130	26	—	11	1.1	46	0.85
19–30	21.5	163 (64)	57 (126)	2.7	2403[j]	130	25	—	12	1.1	46	0.80
31–50	21.5[i]	163 (64)[i]	57 (126)[i]	2.7	2403[j]	130	25	—	12	1.1	46	0.80
>50	21.5[i]	163 (64)[i]	57 (126)[i]	2.7	2403[j]	130	21	—	11	1.1	46	0.80
Pregnancy												
1st trimester				3.0	+0	175	28	—	13	1.4	46	0.80
2nd trimester				3.0	+340	175	28	—	13	1.4	71	1.10
3rd trimester				3.0	+452	175	28	—	13	1.4	71	1.10
Lactation												
1st 6 months				3.8	+330	210	29	—	13	1.3	71	1.30
2nd 6 months				3.8	+400	210	29	—	13	1.3	71	1.30

NOTE: For all nutrients, values for infants are AI. Dashes indicate that values have not been determined.

[a]The water AI includes drinking water, water in beverages, and water in foods; in general, drinking water and other beverages contribute about 70 to 80 percent, and foods, the remainder. Conversion factors: 1 L = 33.8 fluid oz; 1 L = 1.06 qt; 1 cup = 8 fluid oz.

[b]The Estimated Energy Requirement (EER) represents the average dietary energy intake that will maintain energy balance in a healthy person of a given gender, age, weight, height, and physical activity level. The values listed are based on an "active" person at the reference height and weight and at the midpoint ages for each group until age 19. Chapter 6 and Appendix D provide equations and tables to determine estimated energy requirements.

[c]The linolenic acid referred to in this table and text is the omega-3 fatty acid known as alpha-linolenic acid.

[d]The values listed are based on reference body weights.

[e]Assumed to be from human milk.

[f]Assumed to be from human milk and complementary foods and beverages. This includes approximately 0.6 L (~2½ cups) as total fluid including formula, juices, and drinking water.

[g]For energy, the age groups for young children are 1–2 years and 3–8 years.

[h]For males, subtract 10 kcalories per day for each year of age above 19.

[i]Because weight need not change as adults age if activity is maintained, reference weights for adults 19 through 30 years are applied to all adult age groups.

[j]For females, subtract 7 kcalories per day for each year of age above 19.

SOURCE: Adapted from the *Dietary Reference Intakes series*, National Academies Press. Copyright 1997, 1998, 2000, 2001, 2002, 2004, 2005, 2011 by the National Academies of Sciences.

Recommended Dietary Allowances (RDA) and Adequate Intakes (AI) for Vitamins

Age (yr)	Thiamin RDA (mg/day)	Riboflavin RDA (mg/day)	Niacin RDA (mg/day)[a]	Biotin AI (µg/day)	Pantothenic acid AI (mg/day)	Vitamin B_6 RDA (mg/day)	Folate RDA (µg/day)[b]	Vitamin B_{12} RDA (µg/day)	Choline AI (mg/day)	Vitamin C RDA (mg/day)	Vitamin A RDA (µg/day)[c]	Vitamin D RDA (µg/day)[d]	Vitamin E RDA (mg/day)[e]	Vitamin K AI (µg/day)
Infants														
0–0.5	0.2	0.3	2	5	1.7	0.1	65	0.4	125	40	400	10	4	2.0
0.5–1	0.3	0.4	4	6	1.8	0.3	80	0.5	150	50	500	10	5	2.5
Children														
1–3	0.5	0.5	6	8	2	0.5	150	0.9	200	15	300	15	6	30
4–8	0.6	0.6	8	12	3	0.6	200	1.2	250	25	400	15	7	55
Males														
9–13	0.9	0.9	12	20	4	1.0	300	1.8	375	45	600	15	11	60
14–18	1.2	1.3	16	25	5	1.3	400	2.4	550	75	900	15	15	75
19–30	1.2	1.3	16	30	5	1.3	400	2.4	550	90	900	15	15	120
31–50	1.2	1.3	16	30	5	1.3	400	2.4	550	90	900	15	15	120
51–70	1.2	1.3	16	30	5	1.7	400	2.4	550	90	900	15	15	120
>70	1.2	1.3	16	30	5	1.7	400	2.4	550	90	900	20	15	120
Females														
9–13	0.9	0.9	12	20	4	1.0	300	1.8	375	45	600	15	11	60
14–18	1.0	1.0	14	25	5	1.2	400	2.4	400	65	700	15	15	75
19–30	1.1	1.1	14	30	5	1.3	400	2.4	425	75	700	15	15	90
31–50	1.1	1.1	14	30	5	1.3	400	2.4	425	75	700	15	15	90
51–70	1.1	1.1	14	30	5	1.5	400	2.4	425	75	700	15	15	90
>70	1.1	1.1	14	30	5	1.5	400	2.4	425	75	700	20	15	90
Pregnancy														
≤18	1.4	1.4	18	30	6	1.9	600	2.6	450	80	750	15	15	75
19–30	1.4	1.4	18	30	6	1.9	600	2.6	450	85	770	15	15	90
31–50	1.4	1.4	18	30	6	1.9	600	2.6	450	85	770	15	15	90
Lactation														
≤18	1.4	1.6	17	35	7	2.0	500	2.8	550	115	1200	15	19	75
19–30	1.4	1.6	17	35	7	2.0	500	2.8	550	120	1300	15	19	90
31–50	1.4	1.6	17	35	7	2.0	500	2.8	550	120	1300	15	19	90

From Whitney/Rolfes, *Understanding Nutrition*, 13E. © 2013 Cengage Learning.

NOTE: For all nutrients, values for infants are AI. The glossary on the inside back cover defines units of nutrient measure.

[a]Niacin recommendations are expressed as niacin equivalents (NE), except for recommendations for infants younger than 6 months, which are expressed as preformed niacin.

[b]Folate recommendations are expressed as dietary folate equivalents (DFE).

[c]Vitamin A recommendations are expressed as retinol activity equivalents (RAE).

[d]Vitamin D recommendations are expressed as cholecalciferol and assume an absence of adequate exposure to sunlight.

[e]Vitamin E recommendations are expressed as α-tocopherol.

Recommended Dietary Allowances (RDA) and Adequate Intakes (AI) for Minerals

Age (yr)	Sodium AI (mg/day)	Chloride AI (mg/day)	Potassium AI (mg/day)	Calcium RDA (mg/day)	Phosphorus RDA (mg/day)	Magnesium RDA (mg/day)	Iron RDA (mg/day)	Zinc RDA (mg/day)	Iodine RDA (µg/day)	Selenium RDA (µg/day)	Copper RDA (µg/day)	Manganese AI (mg/day)	Fluoride AI (mg/day)	Chromium AI (µg/day)	Molybdenum RDA (µg/day)
Infants															
0–0.5	120	180	400	200	100	30	0.27	2	110	15	200	0.003	0.01	0.2	2
0.5–1	370	570	700	260	275	75	11	3	130	20	220	0.6	0.5	5.5	3
Children															
1–3	1000	1500	3000	700	460	80	7	3	90	20	340	1.2	0.7	11	17
4–8	1200	1900	3800	1000	500	130	10	5	90	30	440	1.5	1.0	15	22
Males															
9–13	1500	2300	4500	1300	1250	240	8	8	120	40	700	1.9	2	25	34
14–18	1500	2300	4700	1300	1250	410	11	11	150	55	890	2.2	3	35	43
19–30	1500	2300	4700	1000	700	400	8	11	150	55	900	2.3	4	35	45
31–50	1500	2300	4700	1000	700	420	8	11	150	55	900	2.3	4	35	45
51–70	1300	2000	4700	1000	700	420	8	11	150	55	900	2.3	4	30	45
>70	1200	1800	4700	1200	700	420	8	11	150	55	900	2.3	4	30	45
Females															
9–13	1500	2300	4500	1300	1250	240	8	8	120	40	700	1.6	2	21	34
14–18	1500	2300	4700	1300	1250	360	15	9	150	55	890	1.6	3	24	43
19–30	1500	2300	4700	1000	700	310	18	8	150	55	900	1.8	3	25	45
31–50	1500	2300	4700	1000	700	320	18	8	150	55	900	1.8	3	25	45
51–70	1300	2000	4700	1200	700	320	8	8	150	55	900	1.8	3	20	45
>70	1200	1800	4700	1200	700	320	8	8	150	55	900	1.8	3	20	45
Pregnancy															
≤18	1500	2300	4700	1300	1250	400	27	12	220	60	1000	2.0	3	29	50
19–30	1500	2300	4700	1000	700	350	27	11	220	60	1000	2.0	3	30	50
31–50	1500	2300	4700	1000	700	360	27	11	220	60	1000	2.0	3	30	50
Lactation															
≤18	1500	2300	5100	1300	1250	360	10	13	290	70	1300	2.6	3	44	50
19–30	1500	2300	5100	1000	700	310	9	12	290	70	1300	2.6	3	45	50
31–50	1500	2300	5100	1000	700	320	9	12	290	70	1300	2.6	3	45	50

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NOTE: For all nutrients, values for infants are AI. The glossary on the inside back cover defines units of nutrient measure.

Tolerable Upper Intake Levels (UL) for Vitamins

Age (yr)	Niacin (mg/day)[a]	Vitamin B_6 (mg/day)	Folate (µg/day)[a]	Choline (mg/day)	Vitamin C (mg/day)	Vitamin A (µg/day)[b]	Vitamin D (µg/day)	Vitamin E (mg/day)[c]
Infants								
0–0.5	—	—	—	—	—	600	25	—
0.5–1	—	—	—	—	—	600	38	—
Children								
1–3	10	30	300	1000	400	600	63	200
4–8	15	40	400	1000	650	900	75	300
9–13	20	60	600	2000	1200	1700	100	600
Adolescents								
14–18	30	80	800	3000	1800	2800	100	800
Adults								
19–70	35	100	1000	3500	2000	3000	100	1000
>70	35	100	1000	3500	2000	3000	100	1000
Pregnancy								
≤18	30	80	800	3000	1800	2800	100	800
19–50	35	100	1000	3500	2000	3000	100	1000
Lactation								
≤18	30	80	800	3000	1800	2800	100	800
19–50	35	100	1000	3500	2000	3000	100	1000

[a]The UL for niacin and folate apply to synthetic forms obtained from supplements, fortified foods, or a combination of the two.

[b]The UL for vitamin A applies to the preformed vitamin only.

[c]The UL for vitamin E applies to any form of supplemental α-tocopherol, fortified foods, or a combination of the two.

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Tolerable Upper Intake Levels (UL) for Minerals

Age (yr)	Sodium (mg/day)	Chloride (mg/day)	Calcium (mg/day)	Phosphorus (mg/day)	Magnesium (mg/day)[d]	Iron (mg/day)	Zinc (mg/day)	Iodine (µg/day)	Selenium (µg/day)	Copper (µg/day)	Manganese (mg/day)	Fluoride (mg/day)	Molybdenum (µg/day)	Boron (mg/day)	Nickel (mg/day)	Vanadium (mg/day)
Infants																
0–0.5	—	—	1000	—	—	40	4	—	45	—	—	0.7	—	—	—	—
0.5–1	—	—	1500	—	—	40	5	—	60	—	—	0.9	—	—	—	—
Children																
1–3	1500	2300	2500	3000	65	40	7	200	90	1000	2	1.3	300	3	0.2	—
4–8	1900	2900	2500	3000	110	40	12	300	150	3000	3	2.2	600	6	0.3	—
9–13	2200	3400	3000	4000	350	40	23	600	280	5000	6	10	1100	11	0.6	—
Adolescents																
14–18	2300	3600	3000	4000	350	45	34	900	400	8000	9	10	1700	17	1.0	—
Adults																
19–50	2300	3600	2500	4000	350	45	40	1100	400	10,000	11	10	2000	20	1.0	1.8
51–70	2300	3600	2000	4000	350	45	40	1100	400	10,000	11	10	2000	20	1.0	1.8
>70	2300	3600	2000	3000	350	45	40	1100	400	10,000	11	10	2000	20	1.0	1.8
Pregnancy																
≤18	2300	3600	3000	3500	350	45	34	900	400	8000	9	10	1700	17	1.0	—
19–50	2300	3600	2500	3500	350	45	40	1100	400	10,000	11	10	2000	20	1.0	—
Lactation																
≤18	2300	3600	3000	4000	350	45	34	900	400	8000	9	10	1700	17	1.0	—
19–50	2300	3600	2500	4000	350	45	40	1100	400	10,000	11	10	2000	20	1.0	—

[d]The UL for magnesium applies to synthetic forms obtained from supplements or drugs only.

NOTE: An upper Limit was not established for vitamins and minerals not listed and for those age groups listed with a dash (—) because of a lack of data, not because these nutrients are safe to consume at any level of intake. All nutrients can have adverse effects when intakes are excessive.

SOURCE: Adapted with permission from the *Dietary Reference Intakes for Calcium and Vitamin D*, © 2011 by the National Academies of Sciences, Courtesy of the National Academies Press, Washington, D.C.

NUTRITION FOR HEALTH AND HEALTH CARE

sixth edition

Linda Kelly DeBruyne
Kathryn Pinna

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To my newest grandson, Cruz Kai DeBruyne. You are welcomed with so much love and aloha.

LINDA KELLY DEBRUYNE

To my mom, Tina C. Pinna, who started me on the path to good nutritional practices in my earliest years.

KATHRYN PINNA

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Brief Contents

Contents

Case Studies

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Preface

We are pleased to present this sixth edition of *Nutrition for Health and Health Care*, which provides a solid foundation in nutrition science and the role of nutrition in clinical care. Health professionals and patients alike rank nutrition among their most serious concerns, as good nutrition status plays critical roles in both disease prevention and the appropriate treatment of illness. Moreover, medical personnel are frequently called upon to answer questions about foods and diets or provide nutrition care. Although much of the material has been written for nursing students and is relevant to nursing care, this textbook can be useful for students of other health-related professions, including nursing assistants, physician assistants, dietitians, dietary technicians, and health educators.

Each chapter of this textbook includes essential nutrition concepts along with practical information for addressing nutrition concerns and solving nutrition problems. The introductory chapters (Chapters 1 and 2) provide an overview of the nutrients and nutrition recommendations and describe the process of digestion and absorption. Chapters 3 through 5 introduce the attributes and functions of carbohydrates, lipids, and protein and explain how appropriate intakes of these nutrients support health. Chapters 6 and 7 introduce the concepts of energy balance and weight management and describe the health effects of overweight, underweight, and eating disorders. Chapters 8 and 9 introduce the vitamins and minerals, describing their roles in the body, appropriate intakes, and food sources. Chapters 10 through 12 explain how nutrient needs change throughout the life cycle. Chapters 13 and 14 explore how health professionals can use information from nutrition assessments to identify and address a patient's dietary needs. The remaining chapters (Chapters 15–23) examine nutrition therapy and its role in the prevention and treatment of common medical conditions.

FEATURES OF THIS TEXT

Students of nutrition often begin a nutrition course with some practical knowledge of nutrition; after all, they may purchase food, read food labels, and be familiar with common nutrition problems such as obesity or lactose intolerance. After just a few weeks of class, however, the nutrition student realizes that nutrition is a biological and chemical science with a fair amount of new terminology and new concepts to learn. This book contains abundant pedagogy to help students master the subject matter. Within each chapter, definitions of important terms appear in the margins. How To skill boxes help readers work through calculations or give practical suggestions for applying nutrition advice. The Nursing Diagnosis feature enables nursing students to correlate nutrition care with nursing care. Review Notes summarize the information following each major heading; these summaries can be used to preview or review key chapter concepts. The Self Check at the end of each chapter provides questions to help review chapter information. Each chapter concludes with a Nutrition on the Net feature, which lists websites relevant to the topics covered in the chapter.

In the life cycle and clinical chapters, Case Studies guide readers in applying nutrition therapy to patient care. Diet-Drug Interaction boxes in the clinical chapters identify important nutrient-drug and food-drug interactions. Clinical Applications throughout the text encourage readers to practice mathematical calculations, synthesize information from previous chapters, or understand how dietary adjustments affect patients. Nutrition Assessment Checklists remind readers of assessment parameters relevant to specific stages of the life cycle or medical problems.

The Nutrition in Practice sections that follow the chapters explore issues of current interest, advanced topics, or specialty areas such as dental health or dialysis. Examples of topics covered include foodborne illness, the glycemic index, vegetarian diets, alcohol in health and disease, nutritional genomics, metabolic syndrome, and childhood obesity and chronic disease.

APPENDIXES

The appendixes support the book with a wealth of information on the nutrient contents of thousands of foods, Canadian nutrient recommendations and food choices, U.S. nutrient intake recommendations, food lists for diabetes, physical activity and energy requirements, nutrition assessments, enteral formulas, aids to calculations, and answers to Self Check questions.

NEW TO THIS EDITION

Each chapter of this book has been updated to reflect advances in research and clinical practice since the fifth edition. In addition, we have made the following changes:

Chapter 1

- Defined empty kcalories, reorganized the fitness section, introduced the Dietary Guidelines for Americans 2015
- Added a new table of nutrients of concern
- Created a new figure showing recommended and actual intakes of food groups

Chapter 2

- Added definition of enzymes and more information about digestive enzymes in the glossary of digestive glands and their secretions
- Improved the discussion of LDL and HDL
- In the Nutrition in Practice section, enhanced the instructions for proper hand washing based on new CDC guidelines

Chapter 3

- Enhanced the discussion of cholesterol-lowering effects of fiber
- Added more information to Figure 3-5 (Characteristics, Sources, and Health Effects of Fibers)
- Enhanced Figure 3-6 (Fiber in Selected Foods) by adding tips to increase fiber intakes
- Added a discussion of added sugars and diabetes

Chapter 4

- Moved the table of major sources of various lipids from the Nutrition in Practice to the chapter
- Added a new table of omega-3 fatty acids in fish and seafood
- Included a new table of fat options among milk and milk products
- Updated information on dietary cholesterol restrictions based on American Heart Association and new Dietary Guidelines information
- Emphasized the importance of overall dietary patterns when reducing the intake of saturated and *trans* fat

Chapter 5

- Reorganized the malnutrition discussion
- Added definitions of wasting, stunting, and marasmic kwashiorkor
- Included a new How to Calculate Protein Intakes box
- In the Nutrition in Practice section, enhanced the glossary of vegetarian diets and added a new figure showing vegetarian sources and equivalents for protein foods and milk and milk products

Chapter 6

- Included the latest information from the 2013 American Heart Association/American College of Cardiology and The Obesity Society Guidelines for the management of overweight and obesity in adults
- In the Nutrition in Practice section, defined and discussed RED-S (relative energy deficiency in sport) from the International Olympic Committee to replace female athlete triad

Chapter 7

- Added information about microbiota and obesity and defined microbiota
- In the Nutrition in Practice section, enhanced the discussion of high-protein diets for weight loss and maintenance

Chapter 8

- Added a list of vitamins of concern from the 2015 Dietary Guidelines Advisory Committee
- Enhanced the discussion of vitamin D and obesity and other disease relationships

Chapter 9

- Added a list of minerals of concern from the 2015 Dietary Guidelines Advisory Committee

Chapter 10

- Moved the section on infancy to Chapter 11 to focus only on nutrition for the mother during pregnancy and lactation
- Included the latest FDA and EPA guidelines on fish consumption during pregnancy
- Added a brief discussion about choline and pregnancy

Chapter 11

- Added a discussion of the importance of zinc in complementary foods for breastfed infants
- Created a new table listing protective factors in breast milk and how they function
- Restructured and simplified table of nutrient supplements for infants
- Added a new table: USDA Nutrition Standards for Foods Sold in Schools.

Chapter 12

- Enhanced the discussion of protein needs for older adults
- In the Nutrition in Practice section, included new definitions for food security and food insecurity
- Revised the food security questionnaire

Chapter 13

- Updated nursing diagnoses
- Added a paragraph about C-reactive protein in the section on biochemical analyses
- Revised the discussion on fluid retention

Chapter 14

- Expanded the section on estimating energy intakes in hospital patients
- Shortened the section on foodservice
- Modified the paragraph on isoniazid and vitamin B_6 in the "Diet–Drug Interactions" section
- Modified the table showing examples of grapefruit juice–drug interactions
- In the Nutrition in Practice section, modified the table listing examples of herb–drug interactions

Chapter 15

- Updated the feeding tube photo
- Introduced the term cyclic feedings in the section on formula delivery methods
- Shortened the section on discontinuing parenteral nutrition
- In the Nutrition in Practice on inborn errors, added a photo showing phenylalanine-free formula and updated the medical foods and treatments used in phenylketonuria

Chapter 16

- Revised the section on estimating energy needs during acute stress
- Changed the table on using disease-specific stress factors for estimating energy needs to a "How To" box
- Emphasized the Penn State equation in the table on predictive equations used in ventilator-dependent patients
- Modified the discussion on the use of glutamine and arginine during critical illness
- Modified some sections on nutrition therapy for respiratory failure

Chapter 17

- Modified some of the material in the sections on dumping syndrome and bariatric surgery
- Added sleeve gastrectomy to the figure on surgical procedures for severe obesity
- In the Nutrition in Practice on oral health, revised the table on nutrient deficiencies and development of dental caries and modified several sections related to oral diseases and chronic illness.

Chapter 18

- Revised some of the material in the sections on intestinal gas, acute and chronic pancreatitis, cystic fibrosis, celiac disease, irritable bowel syndrome, and diverticular disease of the colon
- Introduced the concept of *FODMAPs* and added definitions of *bloating* and *bacterial translocation*
- Eliminated the photo of gluten-free foods and added photos showing the effect of celiac disease on intestinal tissue

Chapter 19

- Revised the paragraph on nutrition treatment for hepatitis
- Modified some of the sections about cirrhosis complications
- Revised the sections on the medical treatment and nutrition therapy for cirrhosis, introduced the term *transjugular intrahepatic portosystemic shunt* in the discussion about ascites treatment, and eliminated the description of the peritoneovenous shunt

Chapter 20

- Updated statistics throughout the chapter
- Added a note about the types of insulin used in the Diabetes Control and Complications Trial
- Added a margin table comparing HbA_{1c} and plasma glucose levels
- Revised various sections on nutrition therapy
- Added inhaled insulin and sodium-glucose cotransporter 2 (SGLT2) inhibitors to the tables listing the different types of insulin and antidiabetic drugs
- Modified the sections on insulin in type 2 diabetes, use of antidiabetic drugs, and maintaining glycemic control during exercise
- Updated several sections in the Nutrition in Practice on metabolic syndrome
- Added a figure showing how metabolic syndrome varies among ethnic groups and removed the figure showing how it varies with age

Chapter 21

- Revised various paragraphs in the sections on atherosclerosis, CHD risk assessment, CHD lifestyle management, hypertension, and heart failure
- Eliminated the box on assessing risk of heart disease
- Updated CHD recommendations to reflect the 2013 guidelines from the American Heart Association and American College of Cardiology
- Updated the section on hypertension treatment to reflect 2013 guidelines from the Eighth Joint National Committee (JNC 8).

Chapter 22

- Modified sections related to nephrotic syndrome
- Revised the table on causes of acute kidney injury
- Updated the section on nutrition therapy for acute kidney injury
- Updated the section on the evaluation of chronic kidney disease to reflect new clinical practice guidelines
- Clarified and updated some sections related to the nutrition therapy for chronic kidney disease to reflect current recommendations
- Modified the section on prevention of calcium oxalate stones
- Revised the table on food sources of oxalates

Chapter 23

- Rearranged and revised the sections related to the consequences of cancer
- Introduced the term *oral mucositis*, modified the section on hematopoietic stem cell transplantation, and introduced the term *graft-versus-host disease*
- Revised the paragraph about protein and energy intakes for cancer patients
- Revised the section about food safety concerns for immunosuppressed cancer patients
- Rearranged and revised some sections related to the consequences of HIV infection
- Revised some sections related to the nutrition therapy for HIV infection

STUDENT AND INSTRUCTOR RESOURCES

MindTap: A new approach to highly personalized online learning. Beyond an eBook, homework solution, digital supplement, or premium website, MindTap is a digital learning platform that works alongside your campus LMS to deliver course curriculum across the range of electronic devices in your life. MindTap is built on an "app" model allowing enhanced digital collaboration and delivery of engaging content across a spectrum of Cengage and non-Cengage resources. Includes the **Diet & Wellness Plus** App that helps you understand how nutrition relates to your personal health goals. Track your diet and activity, generate reports, and analyze the nutritional value of the food you eat.

Instructor Companion Site: Everything you need for your course in one place! This collection of book-specific lecture and class tools is available online via www.cengage.com/login. Access and download PowerPoint presentations, images, instructor's manual, videos, and more.

Test Bank with Cognero: Cengage Learning Testing Powered by Cognero is a flexible, online system that allows you to author, edit, and manage test bank content from multiple Cengage Learning solutions; create multiple test versions in an instant; and deliver tests from your LMS, your classroom, or wherever you want.

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Chapter 1 Overview of Nutrition and Health

Chapter Sections and Learning Objectives (LOs)

1.1 Food Choices
LO1.1 Describe the factors that influence personal food choices.

1.2 The Nutrients
LO1.2 Identify which of the major classes of nutrients are organic and which yield energy.

1.3 Nutrient Recommendations
LO1.3 Describe the four categories of the Dietary Reference Intakes (DRI), the Estimated Energy Requirement (EER), and the Acceptable Macronutrient Distribution Ranges (AMDR).

1.4 National Nutrition Surveys
LO1.4 Describe the ways in which the kinds of information collected by researchers from nutrition surveys are used.

1.5 Dietary Guidelines and Food Guides
LO1.5 Explain how each of the dietary ideals can be used to plan a healthy diet, and how the Dietary Guidelines and USDA Food Patterns help make diet planning easier.

1.6 Food Labels
LO1.6 Compare the information on food labels to make selections that meet specific dietary and health goals.

1.7 Nutrition in Practice: Finding the Truth about Nutrition
LO1.7 Discuss how misinformation and reliable nutrition information can be identified.

Rosenfeld/Flirt/Corbis

EVERY DAY, SEVERAL TIMES A DAY, YOU MAKE CHOICES THAT WILL EITHER improve your **health** or harm it. Each choice may influence your health only a little, but when these choices are repeated over years and decades, their effects become significant.

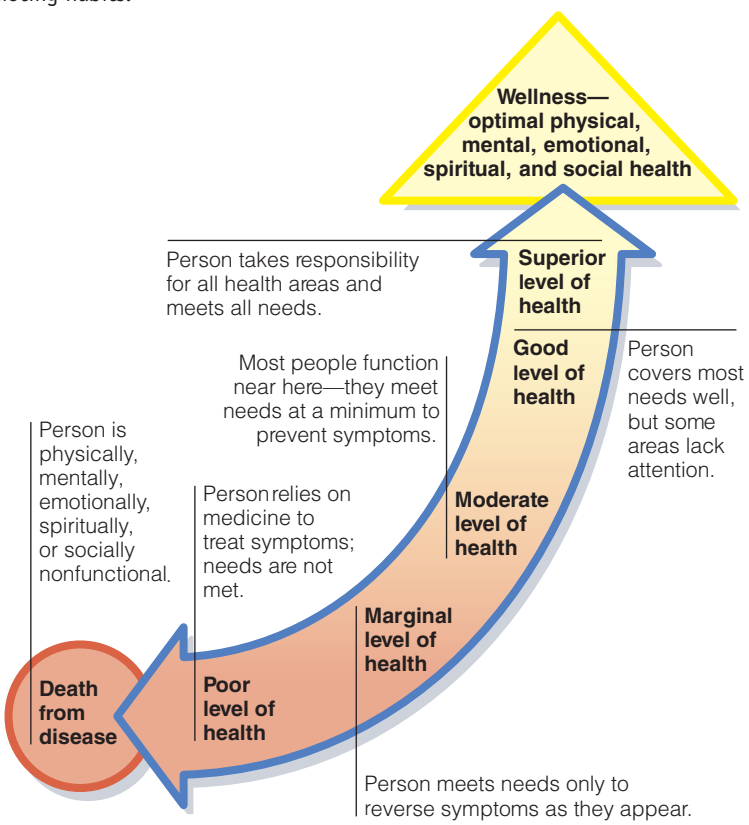
The choices people make each day affect not only their physical health but also their **wellness**—all the characteristics that make a person strong, confident, and able to function well with family, friends, and others. People who consistently make poor lifestyle choices on a daily basis increase their risks of developing diseases. Figure 1-1 shows how a person's health can fall anywhere along a continuum, from maximum wellness on the one end to total failure to function (death) on the other.

As nurses or other health care professionals, when you take responsibility for your own health by making daily choices and practicing behaviors that enhance your well-being, you prepare yourself physically, mentally, and emotionally to meet the demands of your profession. As health care professionals, however, you have a responsibility to your clients as well as to yourselves.* You have unique opportunities to make your clients aware of the benefits of positive health choices and behaviors, to show them how to change their behaviors and make daily choices to enhance their own health, and to serve as role models for those behaviors.

This text focuses on how nutrition choices affect health and disease. The early chapters introduce the basics of nutrition to promote good health and reduce disease risks. The later chapters emphasize medical nutrition therapy and its role in supporting health and in treating diseases and symptoms.

FIGURE 1-1 The Health Line

No matter how well you maintain your health today, you may still be able to improve tomorrow. Likewise, a person who is well today can slip by failing to maintain health-promoting habits.



health: a range of states with physical, mental, emotional, spiritual, and social components. At a minimum, health means freedom from physical disease, mental disturbances, emotional distress, spiritual discontent, social maladjustment, and other negative states. At a maximum, health means *wellness*.

wellness: maximum well-being; the top range of health states; the goal of the person who strives toward realizing his or her full potential physically, mentally, emotionally, spiritually, and socially.

*Health care professionals generally use either *client* or *patient* when referring to an individual under their care. The first 12 chapters of this text emphasize the nutrition concerns of people in good health; therefore, the term *client* is used in these chapters.

Food Choices

Sound **nutrition** throughout life does not ensure good health and long life, but it can certainly help to tip the balance in their favor. Nevertheless, most people choose foods for reasons other than their nourishing value. Even people who claim to choose foods primarily for the sake of health or nutrition will admit that other factors also influence their food choices. Because food choices become an integral part of their lifestyles, people sometimes find it difficult to change their eating habits. Health care professionals who help clients make diet changes must understand the dynamics of food choices because people will alter their eating habits only if their preferences are honored. Developing **cultural competence** is an important aspect of honoring individual preferences, especially for health care professionals who help clients to achieve a nutritious diet.[1]

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Nutrition is only one of the many factors that influence people's food choices.

Preference

Why do people like certain foods? One reason, of course, is their preference for certain tastes. Some tastes are widely liked, such as the sweetness of sugar and the savoriness of salt.[2] Research suggests that genetics influence people's taste preferences, a finding that may eventually have implications for clinical nutrition.[3] For example, sensitivity to bitter taste is an inheritable trait. People born with great sensitivity to bitter tastes tend to avoid foods with bitter flavors such as broccoli, cabbage, brussels sprouts, spinach, and grapefruit juice. These foods, as well as many other fruits and vegetables, contain **bioactive food components**—**phytochemicals** and nutrients—that may reduce the risk of cancer. Thus, the role that genetics may play in food selection is gaining importance in cancer research.[4] Nutrition in Practice 8 addresses phytochemicals and their role in disease prevention.

Habit

Sometimes habit dictates people's food choices. People eat a sandwich for lunch or drink orange juice at breakfast simply because they have always done so. Eating a familiar food and not having to make any decisions can be comforting.

Associations

People also like foods with happy associations—foods eaten in the midst of warm family gatherings on traditional holidays or given to them as children by someone who loved them. By the same token, people can attach intense and unalterable dislikes to foods that they ate when they were sick or that were forced on them when they weren't hungry.

Ethnic Heritage and Regional Cuisines

Every country, and every region of a country, has its own typical foods and ways of combining them into meals. The **foodways** of North America reflect the many different cultural and ethnic backgrounds of its inhabitants. Many foods with foreign origins are familiar items on North American menus: tacos, egg rolls, lasagna, sushi, and gyros, to name a few. Still others, such as spaghetti and croissants, are almost staples in the "American diet." North American regional cuisines such as Cajun and TexMex blend the traditions of several cultures. Table 1-1 presents selected **ethnic diets** and food choices.

Values

Food choices may reflect people's environmental ethics, religious beliefs, and political views. By choosing to eat some foods or to avoid others, people make statements that reflect their values. For example, people may select only foods that come in containers that can be reused or recycled. A concerned consumer may boycott fruit or vegetables picked by migrant workers who have been exploited. People may buy vegetables from local farmers to save the fuel and environmental costs of foods shipped from far away. Labels on some foods carry statements or symbols—known as *ecolabels*—that imply that the foods have been produced in ways that are considered environmentally favorable.

Religion also influences many people's food choices. Jewish law sets forth an extensive set of dietary rules. Many Christians forgo meat on Fridays during Lent, the period

nutrition: the science of foods and the nutrients and other substances they contain, and of their ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. A broader definition includes the study of the environment and of human behavior as it relates to these processes.

cultural competence: an awareness and acceptance of one's own and others' cultures, combined with the skills needed to interact effectively with people of diverse cultures.

bioactive food components: compounds in foods (either nutrients or phytochemicals) that alter physiological processes in the body.

phytochemicals (FIGH-toe-CHEM-ih-cals): compounds in plants that confer color, taste, and other characteristics. Some phytochemicals are bioactive food components in functional foods. Nutrition in Practice 8 provides details.

foodways: the eating habits and culinary practices of a people, region, or historical period.

ethnic diets: foodways and cuisines typical of national origins, races, cultural heritages, or geographic locations.

TABLE 1-1 Selected Ethnic Cuisines and Food Choices

	Grains	Vegetables	Fruits	Protein Foods	Milk
Asian  Becky Luigart-Stayner/ Encyclopedia/Corbis	Millet, rice, rice or wheat noodles	Baby corn, bamboo shoots, bok choy, leafy greens (such as amaranth), cabbages, mung bean sprouts, scallions, seaweed, snow peas, straw mushrooms, water chestnuts, wild yam	Kumquats, loquats, lychee, mandarin oranges, melons, pears, persimmon, plums	Pork; duck and other poultry; fish, octopus, sea urchin, squid, and other seafood; soybeans, tofu; eggs; cashews, peanuts	Soy milk
Mediterranean  Photodisc, Inc./ Getty Images	Bulgur, couscous, focaccia, Italian bread, pastas, pita pocket bread, polenta, rice	Artichokes, cucumbers, eggplant, fennel, grape leaves, leafy greens, leeks, onions, peppers, tomatoes	Berries, dates, figs, grapes, lemons, melons, olives, oranges, pomegranates, raisins	Fish and other seafood, gyros, lamb, pork, sausage, chicken, fava beans, lentils, almonds, walnuts	Feta, goat, mozzarella, parmesan, provolone, and ricotta cheeses; yogurt and yogurt beverages
Mexican  Mitch Hrdlicka/ Photodisc/Getty Images	Hominy, masa (corn flour dough), tortillas (corn or flour), rice	Bell peppers, cactus, cassava, chayote, chili pepper, corn, jicama, onions, summer squash, tomatoes, winter squash, yams	Avocado, bananas, guava, lemons, limes, mango, oranges, papaya, plantain	Beans, refried beans, beef, goat, pork, chorizo, chicken, fish, eggs	Cheese, flan (baked caramel custard), milk in beverages

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Ethnic meals and family gatherings nourish the spirit as well as the body.

prior to Easter. In Islamic dietary laws, permitted or lawful foods are called *halal*. Other faiths prohibit some dietary practices and promote others. Diet planners can foster sound nutrition practices only if they respect and honor each person's values.

Social Interaction Social interaction is another powerful influence on people's food choices. Meals are often social events, and the sharing of food is part of hospitality. Social customs invite people to accept food or drink offered by a host or shared by a group—regardless of hunger signals.[5] Food brings people together for many different reasons: to celebrate a holiday or special event, to renew an old friendship, to make new friends, to conduct business, and many more. Sometimes food is used to influence or impress someone. For example, a business executive invites a prospective new client out to dinner in hopes of edging out the competition. In each case, for whatever the purpose, food plays an integral part of the social interaction.

Emotional State Emotions guide food choices and eating behaviors.[6] Some people cannot eat when they are emotionally upset. Others may eat in response to a variety of emotional stimuli—for example, to relieve boredom or depression or to calm anxiety. A depressed person may choose to eat rather than to call a friend. A person who has returned home from an exciting evening out may unwind with a late-night snack. Eating in response to emotions can easily lead to overeating and obesity but may be appropriate at times. For example, sharing food at times of bereavement serves both the giver's need to provide comfort and the receiver's need to be cared for and to interact with others as well as to take nourishment.

Availability, Convenience, and Economy

The influence of these factors on people's food selections is clear. You cannot eat foods if they are not available, if you cannot get to the grocery store, if you do not have the time or skill to prepare them, or if you cannot afford them. Consumers who value convenience frequently eat out, bring home ready-to-eat meals, or have food delivered. Whether decisions based on convenience meet a person's nutrition needs depends on the choices made. Eating a banana or a candy bar may be equally convenient, but the fruit provides more vitamins and minerals and less sugar and fat.

Rising food costs have shifted some consumers' priorities and changed their shopping habits. They are less likely to buy higher-priced convenience foods and more likely to buy less-expensive store brand items and prepare home-cooked meals. Those who frequently prepare their own meals eat fast food less often and are more likely to meet dietary guidelines for fat, calcium, fruits, vegetables, and whole grains. It is not surprising that, when eating out, consumers choose low-cost fast-food outlets over more expensive fine-dining restaurants. Foods eaten away from home, especially fast-food meals, tend to be high in kcalories, sodium, saturated fat, and *trans* fat—which can contribute to a variety of health problems.[7]

Some people have jobs that keep them away from home for days at a time, require them to conduct business in restaurants or at conventions, or involve hectic schedules that allow little or no time for meals at home. For these people, the kinds of restaurants available to them and the cost of eating out so often may limit food choices.

Age

Age influences people's food choices. Infants, for example, depend on others to choose foods for them. Older children also rely on others but become more active in selecting foods that taste sweet and are familiar to them and rejecting those whose taste or texture they dislike. In contrast, the links between taste preferences and food choices in adults are less direct than in children. Adults often choose foods based on health concerns such as body weight. Indeed, adults may avoid sweet or familiar foods because of such concerns.

Body Weight and Image

Sometimes people select certain foods and supplements that they believe will improve their physical appearance and avoid those they believe might be detrimental. Such decisions can be beneficial when based on sound nutrition and fitness knowledge but may undermine good health when based on fads or carried to extremes. Eating disorders are the topic of Nutrition in Practice 6.

Medical Conditions

Sometimes medical conditions and their treatments (including medications) limit the foods a person can select. For example, a person with heart disease might need to adopt a diet low in certain types of fats. The chemotherapy needed to treat cancer can interfere with a person's appetite or limit food choices by causing vomiting. Allergy to certain foods can also limit choices. The second half of this text discusses how diet can be modified to accommodate different medical conditions.

Health and Nutrition

Finally, of course, many consumers make food choices they believe will improve their health.[8] Food manufacturers and restaurant chefs have responded to scientific findings linking health with nutrition by offering an abundant selection of health-promoting foods and beverages. Foods that provide health benefits beyond their nutrient contributions are called **functional foods**.[9] Whole foods—as natural and familiar as oatmeal or tomatoes—are the simplest functional foods. In other cases, foods have been modified through fortification, enrichment, or enhancement. Examples of these functional foods include orange juice fortified with calcium to build strong bones, bread enriched with folate to promote normal fetal development, and margarine enhanced with a plant sterol to lower blood cholesterol. Nutrition in Practice 8 offers more discussion of functional foods.

functional foods: whole, fortified, enriched, or enhanced foods that have a potentially beneficial effect on health when consumed as part of a varied diet on a regular basis at effective levels.

Consumers typically welcome new foods into their diets, provided that these foods are reasonably priced, clearly labeled, easy to find in the grocery store, and convenient to

prepare. These foods must also taste good—as good as the traditional choices. Of course, a person need not eat any "special" foods to enjoy a healthy diet; many "regular" foods provide numerous health benefits as well. In fact, foods such as whole grains; vegetables and legumes; fruits; lean meats, seafood, poultry, eggs, nuts, and seeds; and low-fat milk products are among the healthiest choices a person can make.

Review Notes

- A person selects foods for many different reasons.
- Food choices influence health—both positively and negatively. Individual food selections neither make nor break a diet's healthfulness, but the balance of foods selected over time can make an important difference to health.
- In the interest of health, people are wise to think "nutrition" when making their food choices.

The Nutrients

You are a collection of molecules that move. All these moving parts are arranged in patterns of extraordinary complexity and order—cells, tissues, and organs. Although the arrangement remains constant, the parts are continually changing, using **nutrients** and energy derived from nutrients.

Almost any food you eat is composed of dozens or even hundreds of different kinds of materials. Spinach, for example, is composed mostly of water (95 percent), and most of its solid materials are the compounds carbohydrates, fats (properly called lipids), and proteins. If you could remove these materials, you would find a tiny quantity of minerals, vitamins, and other compounds.

nutrients: 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. Nutrients may also reduce the risks of some diseases.

essential nutrients: nutrients a person must obtain from food because the body cannot make them for itself in sufficient quantities to meet physiological needs.

organic: in chemistry, substances or molecules containing carbon–carbon bonds or carbon–hydrogen bonds. The four organic nutrients are carbohydrate, fat, protein, and vitamins.

energy-yielding nutrients: the nutrients that break down to yield energy the body can use. The three energy-yielding nutrients are carbohydrate, protein, and fat.

inorganic: not containing carbon or pertaining to living organisms. The two classes of nutrients that are inorganic are minerals and water.

Six Classes of Nutrients

Water, carbohydrates, fats, proteins, vitamins, and minerals are the six classes of nutrients commonly found in spinach and other foods. Some of the other materials in foods, such as the pigments and other phytochemicals, are not nutrients but may still be important to health. The body can make some nutrients for itself, at least in limited quantities, but it cannot make them all, and it makes some in insufficient quantities to meet its needs. Therefore, the body must obtain many nutrients from foods. The nutrients that foods must supply are called **essential nutrients**.

Carbohydrates, Fats, and Proteins Four of the six classes of nutrients (carbohydrates, fats, proteins, and vitamins) contain carbon, which is found in all living things. They are therefore **organic** (meaning, literally, "alive").[†] During metabolism, three of these four (carbohydrates, fats, and proteins) provide energy the body can use.[‡] These **energy-yielding nutrients** continually replenish the energy you expend daily.

Vitamins, Minerals, and Water Vitamins are organic but do not provide energy to the body. They facilitate the release of energy from the three energy-yielding nutrients. In contrast, minerals and water are **inorganic** nutrients. Minerals yield no energy in the human body, but, like vitamins, they help to regulate the release of energy, among their many other roles. As for water, it is the medium in which all of the body's processes take place.

[†]Note that this definition of *organic* excludes coal, diamonds, and a few carbon-containing compounds that contain only a single carbon and no hydrogen, such as carbon dioxide (CO_2).

[‡]*Metabolism* is the set of processes by which nutrients are rearranged into body structures or broken down to yield energy.

kCalories: A Measure of Energy

The amount of energy that carbohydrates, fats, and proteins release can be measured in **calories**—tiny units of energy so small that a single apple provides tens of thousands of them. To ease calculations, energy is expressed in 1000-calorie metric units known as **kilocalories** (shortened to **kcalories**, but commonly called "calories"). When you read in popular books or magazines that an apple provides "100 calories," understand that it means 100 kcalories. This book uses the term *kcalorie* and its abbreviation *kcal* throughout, as do other scientific books and journals.[§] kCalories are not constituents of foods; they are a measure of the energy foods provide. The energy a food provides depends on how much carbohydrate, fat, and protein the food contains.

Carbohydrate yields 4 kcalories of energy from each gram, and so does protein. Fat yields 9 kcalories per gram. Thus, fat has a greater **energy density** than either carbohydrate or protein. Chapter 7 revisits energy density with regard to weight management. If you know how many grams of carbohydrate, protein, and fat a food contains, you can derive the number of kcalories potentially available from the food. Simply multiply the carbohydrate grams times 4, the protein grams times 4, and the fat grams times 9, and add the results together (Box 1-1 describes how to calculate the energy a food provides).

Energy Nutrients in Foods

Most foods contain mixtures of all three energy-yielding nutrients, although foods are sometimes classified by their predominant nutrient. To speak of meat as "a protein" or of bread as "a carbohydrate," however, is inaccurate. Each is rich in a particular nutrient, but a protein-rich food such as beef contains a lot of fat along with the protein, and a carbohydrate-rich food such as cornbread also contains fat (corn oil) and protein. Only a few foods are exceptions to this rule, the common ones being sugar (which is pure carbohydrate) and oil (which is pure fat).

Energy Storage in the Body

The body first uses the energy-yielding nutrients to build new compounds and fuel metabolic and physical activities. Excesses are then rearranged into storage compounds, primarily body fat, and put away for later use. Thus, if you take in more energy than you expend, the result is an increase in energy stores and weight gain. Similarly, if you take in less energy than you expend, the result is a decrease in energy stores and weight loss.

Alcohol, Not a Nutrient

One other substance contributes energy: alcohol. The body derives energy from alcohol at the rate of 7 kcalories per gram. Alcohol is not a nutrient, however, because it cannot support the body's growth, maintenance, or repair. Nutrition in Practice 19 discusses alcohol's effects on nutrition.

calories: a measure of *heat* energy. Food energy is measured in **kilocalories** (1000 calories equal 1 kilocalorie), abbreviated **kcalories** or kcal. One kcalorie is the amount of heat necessary to raise the temperature of 1 kilogram (kg) of water 1°C. The scientific use of the term *kcalorie* is the same as the popular use of the term *calorie*.

energy density: a measure of the energy a food provides relative to the amount of food (kcalories per gram).

BOX 1-1 How to Calculate the Energy a Food Provides

To calculate the energy available from a food, multiply the number of grams of carbohydrate, protein, and fat by 4, 4, and 9, respectively. Then add the results together. For example, one slice of bread with 1 tablespoon of peanut butter on it contains 16 grams of carbohydrate, 7 grams of protein, and 9 grams of fat:

16 g carbohydrate × 4 kcal / g = 64 kcal
7 g protein × 4 kcal / g = 28 kcal
9 g fat × 9 kcal / g = 81 kcal
Total = 173 kcal

From this information, you can calculate the percentage of kcalories each of the energy nutrients contributes to the total.

To determine the percentage of kcalories from fat, for example, divide the 81 fat kcalories by the total 173 kcalories:

81 fat kcal ÷ 173 total kcal = 0.468 (rounded to 0.47)

Then multiply by 100 to get the percentage:

0.47 × 100 = 47%

Dietary recommendations that urge people to limit fat intake to 20 to 35 percent of kcalories refer to the day's total energy intake, not to individual foods. Still, if the proportion of fat in each food choice throughout a day exceeds 35 percent of kcalories, then the day's total surely will, too. Knowing that this snack provides 47 percent of its kcalories from fat alerts a person to the need to make lower-fat selections at other times that day.

[§]Food energy can also be measured in kilojoules (kJ). The kilojoule is the international unit of energy. One kcalorie equals 4.2 kJ.

Review Notes

- Foods provide nutrients—substances that support the growth, maintenance, and repair of the body's tissues.
- The six classes of nutrients are water, carbohydrates, fats, proteins, vitamins, and minerals.
- Vitamins, minerals, and water do not yield energy; instead, they facilitate a variety of activities in the body.
- Foods rich in the energy-yielding nutrients (carbohydrates, fats, and proteins) provide the major materials for building the body's tissues and yield energy the body can use or store.
- Energy is measured in kcalories.

Dietary Reference Intakes (DRI): a set of values for the dietary nutrient intakes of healthy people in the United States and Canada. These values are used for planning and assessing diets.

Recommended Dietary Allowances (RDA): a set of values reflecting the average daily amounts of nutrients considered adequate to meet the known nutrient needs of practically all healthy people in a particular life stage and gender group; a goal for dietary intake by individuals.

Adequate Intakes (AI): a set of values that are used as guides for nutrient intakes when scientific evidence is insufficient to determine an RDA.

requirement: the lowest continuing intake of a nutrient that will maintain a specified criterion of adequacy.

deficient: in regard to nutrient intake, describes the amount below which almost all healthy people can be expected, over time, to experience deficiency symptoms.

Nutrient Recommendations

Nutrient recommendations are used as standards to evaluate healthy people's energy and nutrient intakes. Nutrition experts use the recommendations to assess nutrient intakes and to guide people on amounts to consume. Individuals can use them to decide how much of a nutrient they need to consume.

Dietary Reference Intakes

Defining the amounts of energy, nutrients, and other dietary components that best support health is a huge task. Nutrition experts have produced a set of standards that define the amounts of energy, nutrients, other dietary components, and physical activity that best support health. These recommendations are called **Dietary Reference Intakes (DRI)** and reflect the collaborative efforts of scientists in both the United States and Canada.* The inside front covers of this book present the DRI values. (A set of nutrient recommendations developed by the World Health Organization for international use is presented in Appendix B.)

Setting Nutrient Recommendations: RDA and AI

One advantage of the DRI is that they apply to the diets of individuals. The DRI committee offers two sets of values to be used as nutrient intake goals by individuals: a set called the **Recommended Dietary Allowances (RDA)** and a set called **Adequate Intakes (AI)**.

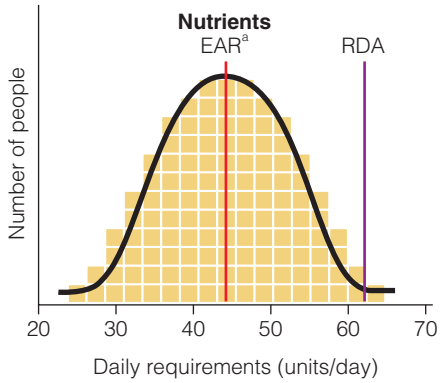
Based on solid experimental evidence and other reliable observations, the RDA are the foundation of the DRI. The AI values are based on less extensive scientific findings and rely more heavily on scientific judgment. The committee establishes an AI value whenever scientific evidence is insufficient to generate an RDA. To see which nutrients have an AI and which have an RDA, turn to the inside front cover.

In the last several decades, abundant new research has linked nutrients in the diet with the promotion of health and the prevention of chronic diseases. An advantage of the DRI is that, where appropriate, they take into account disease prevention as well as an adequate nutrient intake. For example, the RDA for calcium is based on intakes thought to reduce the likelihood of osteoporosis-related fractures later in life.

To ensure that the vitamin and mineral recommendations meet the needs of as many people as possible, the recommendations are set near the top end of the range of the population's estimated average requirements (see Figure 1-2). Small amounts above the daily **requirement** do no harm, whereas amounts below the requirement may lead to health problems. When people's intakes are consistently **deficient**, their nutrient stores decline, and over time this decline leads to deficiency symptoms and poor health.

FIGURE 1-2 Nutrient Intake Recommendations

The nutrient intake recommendations are set high enough to cover nearly everyone's requirements (the boxes represent people).



[a]Estimated Average Requirement

*The DRI reports are produced by the Food and Nutrition Board, Institute of Medicine of the National Academies, with active involvement of scientists from Canada.

Facilitating Nutrition Research and Policy: EAR

In addition to the RDA and AI, the DRI committee has established another set of values: **Estimated Average Requirements (EAR)**. These values establish average requirements for given life stage and gender groups that researchers and nutrition policymakers use in their work. Nutrition scientists may use the EAR as standards in research. Public health officials may use them to assess nutrient intakes of populations and make recommendations. The EAR values form the scientific basis on which the RDA are set.

Estimated Average Requirements (EAR): the average daily nutrient intake levels estimated to meet the requirements of half of the healthy individuals in a given age and gender group; used in nutrition research and policymaking and as the basis on which RDA values are set.

Establishing Safety Guidelines: UL

The DRI committee also establishes upper limits of intake for nutrients posing a hazard when consumed in excess. These values, the **Tolerable Upper Intake Levels (UL)**, are indispensable to consumers who take supplements. Consumers need to know how much of a nutrient is too much. The UL are also of value to public health officials who set allowances for nutrients that are added to foods and water. The UL values are listed on the inside front cover.

Tolerable Upper Intake Levels (UL): a set of values reflecting the highest average daily nutrient intake levels that are likely to pose no risk of toxicity to almost all healthy individuals in a particular life stage and gender group. As intake increases above the UL, the potential risk of adverse health effects increases.

Using Nutrient Recommendations

Each of the four DRI categories serves a unique purpose. For example, the EAR are most appropriately used to develop and evaluate nutrition programs for *groups* such as schoolchildren or military personnel. The RDA (or AI, if an RDA is not available) can be used to set goals for *individuals*. The UL help to keep nutrient intakes below the amounts that increase the risk of toxicity. With these understandings, professionals can use the DRI for a variety of purposes.

In addition to understanding the unique purposes of the DRI, it is important to keep their uses in perspective. Consider the following:

- The values are recommendations for safe intakes, not minimum requirements; except for energy, they include a generous margin of safety. Figure 1-3 presents an accurate view of how a person's nutrient needs fall within a range, with marginal and danger zones both below and above the range.
- The values reflect daily intakes to be achieved on average, over time. They assume that intakes will vary from day to day, and they are set high enough to ensure that body nutrient stores will meet nutrient needs during periods of inadequate intakes lasting a day or two for some nutrients and up to a month or two for others.
- The values are chosen in reference to specific indicators of nutrient adequacy, such as blood nutrient concentrations, normal growth, and reduction of certain chronic diseases or other disorders when appropriate, rather than prevention of deficiency symptoms alone.
- The recommendations are designed to meet the needs of most healthy people. Medical problems alter nutrient needs, as later chapters describe.
- The recommendations are specific for people of both genders as well as various ages and stages of life: infants, children, adolescents, men, women, pregnant women, and lactating women.

Estimated Energy Requirement (EER): the dietary energy intake level that is predicted to maintain energy balance in a healthy adult of a defined age, gender, weight, and physical activity level consistent with good health.

Setting Energy Recommendations

In contrast to the vitamin and mineral recommendations, the recommendation for energy, called the **Estimated Energy Requirement (EER)**, is not generous because excess energy cannot be excreted and is eventually stored as body fat. Rather, the key to the energy recommendation is balance. For a person who has a body weight, body composition, and physical activity level consistent with good health, energy intake from food should match energy expenditure, so the person achieves energy balance. Enough energy is needed to sustain a healthy, active life, but too much energy leads to obesity. The EER is therefore set at a level of energy intake predicted to maintain energy balance in a healthy adult of a defined age, gender, weight, height, and physical activity level.* Another difference

*The EER for children, pregnant women, and lactating women includes energy needs associated with the deposition of tissue or the secretion of milk at rates consistent with good health.

FIGURE 1-3 Naive versus Accurate View of Nutrient Intakes

The RDA or AI for a given nutrient represents a point that lies within a range of appropriate and reasonable intakes between toxicity and deficiency. Both of these recommendations are high enough to provide reserves in times of short-term dietary inadequacies, but not so high as to approach toxicity. Nutrient intakes above or below this range may be equally harmful.