



NUTRITION & DIET THERAPY

DeBruyne | Pinna | Whitney

NINTH EDITION

Ninth Edition

Nutrition & Diet Therapy

Linda Kelly DeBruyne

Kathryn Pinna

Ellie Whitney



Australia • Brazil • Japan • Korea • Mexico • Singapore • Spain • United Kingdom • United States

This is an electronic version of the print textbook. Due to electronic rights restrictions, some third party content may be suppressed. Editorial review has deemed that any suppressed content does not materially affect the overall learning experience. The publisher reserves the right to remove content from this title at any time if subsequent rights restrictions require it. For valuable information on pricing, previous editions, changes to current editions, and alternate formats, please visit www.cengage.com/highered to search by ISBN#, author, title, or keyword for materials in your areas of interest.

Important Notice: Media content referenced within the product description or the product text may not be available in the eBook version.

Nutrition & Diet Therapy, Ninth Edition
Linda Kelly DeBruyne, Kathryn Pinna,
Ellie Whitney

Product Director: Mary Finch
Senior Product Team Manager: Yolanda Cossio
Senior Product Manager: Peggy Williams
Content Developer: Elesha Hyde
Product Assistant: Chelsea Joy
Senior Media Developer: Miriam Myers
Marketing Manager: Tom Ziolkowski
Senior Content Project Manager: Carol Samet
Art Director: John Walker
Manufacturing Planner: Karen Hunt
Production and Composition Service:
MPS Limited
Photo Researcher: Lumina Datamatics
Text Researcher: Lumina Datamatics
Copy Editor: MPS Limited
Text Designer: Tani Hasegawa
Cover Designer: John Walker
Cover Image: Maximilian Stock Ltd./Getty

© 2016, 2012 Cengage Learning

WCN: 02-200-203

ALL RIGHTS RESERVED. No part of this work covered by the copyright herein may be reproduced, transmitted, stored, or used in any form or by any means graphic, electronic, or mechanical, including but not limited to photocopying, recording, scanning, digitizing, taping, Web distribution, information networks, or information storage and retrieval systems, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without the prior written permission of the publisher.

For product information and technology assistance, contact us at
Cengage Learning Customer & Sales Support, 1-800-354-9706.

For permission to use material from this text or product,
submit all requests online at **www.cengage.com/permissions.**
Further permissions questions can be e-mailed to
permissionrequest@cengage.com.

Library of Congress Control Number: 2014940083

ISBN-13: 978-1-305-11040-3

ISBN-10: 1-305-11040-4

Cengage Learning

20 Channel Center Street
Boston, MA 02210
USA

Cengage Learning is a leading provider of customized learning solutions with office locations around the globe, including Singapore, the United Kingdom, Australia, Mexico, Brazil, and Japan. Locate your local office at **www.cengage.com/global.**

Cengage Learning products are represented in Canada by Nelson Education, Ltd.

To learn more about Cengage Learning Solutions, visit **www.cengage.com.**

Purchase any of our products at your local college store or at our preferred online store **www.cengagebrain.com.**

Contents in Brief

- 1 **Overview of Nutrition and Health** 1
NUTRITION IN PRACTICE: FINDING THE TRUTH ABOUT NUTRITION 30
- 2 **Carbohydrates** 34
NUTRITION IN PRACTICE: THE GLYCEMIC INDEX IN NUTRITION PRACTICE 56
- 3 **Lipids** 60
NUTRITION IN PRACTICE: FIGURING OUT FATS 81
- 4 **Protein** 87
NUTRITION IN PRACTICE: VEGETARIAN DIETS 103
- 5 **Digestion and Absorption** 108
NUTRITION IN PRACTICE: FOOD SAFETY 125
- 6 **Metabolism, Energy Balance, and Body Composition** 133
NUTRITION IN PRACTICE: EATING DISORDERS 156
- 7 **Weight Management** 161
NUTRITION IN PRACTICE: FAD DIETS 185
- 8 **The Vitamins** 188
NUTRITION IN PRACTICE: PHYTOCHEMICALS AND FUNCTIONAL FOODS 217
- 9 **Water and the Minerals** 225
NUTRITION IN PRACTICE: VITAMIN AND MINERAL SUPPLEMENTS 253
- 10 **Fitness and Nutrition** 257
NUTRITION IN PRACTICE: SUPPLEMENTS AND ERGOGENIC AIDS ATHLETES USE 283
- 11 **Nutrition through the Life Span: Pregnancy and Lactation** 287
NUTRITION IN PRACTICE: ENCOURAGING SUCCESSFUL BREASTFEEDING 315
- 12 **Nutrition through the Life Span: Infancy, Childhood, and Adolescence** 318
NUTRITION IN PRACTICE: CHILDHOOD OBESITY AND THE EARLY DEVELOPMENT OF CHRONIC DISEASES 358
- 13 **Nutrition through the Life Span: Later Adulthood** 363
NUTRITION IN PRACTICE: HUNGER AND COMMUNITY NUTRITION 385
- 14 **Illness and Nutrition Care** 390
NUTRITION IN PRACTICE: NUTRITIONAL GENOMICS 415
- 15 **Medications, Diet-Drug Interactions, and Herbal Supplements** 419
NUTRITION IN PRACTICE: COMPLEMENTARY AND ALTERNATIVE THERAPIES 434
- 16 **Specialized Nutrition Support: Enteral and Parenteral Nutrition** 438
NUTRITION IN PRACTICE: INBORN ERRORS OF METABOLISM 465
- 17 **Foods and Food Consistency for Upper GI Disorders** 469
NUTRITION IN PRACTICE: NUTRITION AND ORAL HEALTH 490
- 18 **Fiber-Modified Diets for Lower Gastrointestinal Tract Disorders** 494
NUTRITION IN PRACTICE: PROBIOTICS AND INTESTINAL HEALTH 509

- 19 **Carbohydrate- and Fat-Modified Diets for Malabsorption Disorders** 512
NUTRITION IN PRACTICE: ANEMIA IN ILLNESS 527
- 20 **Nutrition Therapy for Liver and Gallbladder Diseases** 531
NUTRITION IN PRACTICE: ALCOHOL IN HEALTH AND DISEASE 549
- 21 **Carbohydrate-Controlled Diets for Diabetes Mellitus** 552
NUTRITION IN PRACTICE: THE METABOLIC SYNDROME 575
- 22 **Fat-Controlled, Mineral-Modified Diets for Cardiovascular Diseases** 578
NUTRITION IN PRACTICE: HELPING PEOPLE WITH FEEDING DISABILITIES 600
- 23 **Protein-, Mineral-, and Fluid-Modified Diets for Kidney Diseases** 603
NUTRITION IN PRACTICE: DIALYSIS 625
- 24 **Energy- and Protein-Modified Diets for Metabolic and Respiratory Stress** 628
NUTRITION IN PRACTICE: MULTIPLE ORGAN DYSFUNCTION SYNDROME 643
- 25 **Energy- and Protein-Modified Diets for Cancer and HIV Infection** 645
NUTRITION IN PRACTICE: ETHICAL ISSUES IN NUTRITION CARE 666

Contents

Preface xiii

About the Authors xix

1 Overview of Nutrition and Health 1

1.1 Food Choices 3

1.2 The Nutrients 6

Six Classes of Nutrients 6

kCalories: A Measure of Energy 7

1.3 Nutrient Recommendations 8

Dietary Reference Intakes 8

Acceptable Macronutrient Distribution Ranges (AMDR) 10

1.4 National Nutrition Surveys 11

Coordinating Nutrition Survey Data 11

National Health Goals 11

1.5 Dietary Guidelines and Food Guides 12

Dietary Ideals 12

Dietary Guidelines for Americans 13

The USDA Food Patterns 15

MyPlate 20

1.6 Food Labels 21

The Ingredient List 21

Nutrition Facts Panel 21

Claims on Labels 24

NUTRITION IN PRACTICE: FINDING THE TRUTH ABOUT NUTRITION 30

2 Carbohydrates 34

2.1 The Chemist's View of Carbohydrates 35

Monosaccharides 35

Disaccharides 36

Polysaccharides 36

2.2 Regulation of Blood Glucose 39

2.3 Health Effects of Sugars and Alternative Sweeteners 40

Sugars 40

Alternative Sweeteners: Sugar Alcohols 45

Alternative Sweeteners: Nonnutritive Sweeteners 45

2.4 Health Effects of Starch and Dietary Fibers 47

Carbohydrates: Disease Prevention and Recommendations 48

Carbohydrates: Food Sources 50

Carbohydrates: Food Labels and Health Claims 52

NUTRITION IN PRACTICE: THE GLYCEMIC INDEX IN NUTRITION PRACTICE 56

3 Lipids 60

3.1 Roles of Body Fat 61

3.2 The Chemist's View of Lipids 62

Triglycerides 62

Fatty Acids 63

Phospholipids 65

Sterols 66

3.3 Health Effects and Recommended Intakes of Fats 67

Fats and Heart Health 67

Recommendations 70

3.4 Fats in Foods 71

Finding the Fats in Foods 72

Cutting Solid Fats and Choosing

Unsaturated Fats 73

NUTRITION IN PRACTICE: FIGURING OUT FATS 81

4 Protein 87

4.1 The Chemist's View of Proteins 88

The Structure of Proteins 88

Nonessential and Essential Amino Acids 89

4.2 Protein Turnover and Nitrogen Balance 90

Protein Turnover 90

Nitrogen Balance 90

4.3 Roles of Body Proteins 91

4.4 Protein and Health	94		
Protein Deficiency	94		
Malnutrition	94		
Protein Excess	96		
Protein and Amino Acid Supplements	96		
Protein Recommendations and Intakes	97		
4.5 Protein in Foods	98		
Protein Quality	98		
Protein Sparing	99		
Protein on Food Labels	100		
		NUTRITION IN PRACTICE:	VEGETARIAN DIETS 103
5 Digestion and Absorption	108		
5.1 Anatomy of the Digestive Tract	109		
The Digestive Organs	109		
The Involuntary Muscles and the Glands	112		
5.2 The Process of Digestion	115		
Digestion in the Mouth	115		
Digestion in the Stomach	116		
Digestion in the Small and Large Intestines	116		
5.3 The Absorptive System	118		
The Small Intestine	118		
Absorption of Nutrients	118		
5.4 Transport of Nutrients	120		
The Vascular System	120		
The Lymphatic System	121		
Transport of Lipids: Lipoproteins	121		
The System at Its Best	123		
		NUTRITION IN PRACTICE:	FOOD SAFETY 125
6 Metabolism, Energy Balance, and Body Composition	133		
6.1 The Organs and Their Metabolic Roles	134		
The Principal Organs	134		
The Body's Metabolic Work	135		
6.2 The Body's Use of Fuels	136		
Energy Metabolism	137		
Glucose Production	138		
6.3 Energy Imbalance	140		
Feasting	140		
The Economics of Fasting	141		
6.4 Energy Balance	143		
Energy In	144		
Energy Out	144		
Estimating Energy Requirements	146		
6.5 Body Weight and Body Composition	147		
Defining Healthy Body Weight	148		
			Body Composition 149
			How Much Body Fat Is Too Much? 150
6.6 Health Risks of Underweight and Obesity	151		
		NUTRITION IN PRACTICE:	EATING DISORDERS 156
7 Weight Management	161		
7.1 Causes of Obesity	162		
Genetics and Weight	162		
Environmental Stimuli	164		
7.2 Obesity Treatment: Who Should Lose?	167		
7.3 Inappropriate Obesity Treatments	167		
Over-the-Counter Weight-Loss Products	167		
Other Gimmicks	168		
7.4 Aggressive Treatments of Obesity	168		
Obesity Drugs	168		
Surgery	169		
7.5 Reasonable Strategies for Weight Loss	170		
A Healthful Eating Plan	171		
Physical Activity	173		
Behavior and Attitude	175		
Weight Maintenance	177		
7.6 Strategies for Weight Gain	178		
		NUTRITION IN PRACTICE:	FAD DIETS 185
8 The Vitamins	188		
8.1 The Vitamins—An Overview	189		
8.2 The Fat-Soluble Vitamins	191		
Vitamin A and Beta-Carotene	191		
Vitamin D	196		
Vitamin E	199		
Vitamin K	200		
8.3 The Water-Soluble Vitamins	202		
The B Vitamins	202		
Thiamin	204		
Riboflavin	204		
Niacin	205		
Pantothenic Acid and Biotin	205		
Vitamin B ₆	206		
Folate	206		
Vitamin B ₁₂	207		
Non-B Vitamins	209		
Vitamin C	210		
		NUTRITION IN PRACTICE:	PHYTOCHEMICALS AND FUNCTIONAL FOODS 217

9 Water and the Minerals 225

9.1 Water and Body Fluids 226

- Water Balance 226
- Fluid and Electrolyte Balance 228
- Acid–Base Balance 228

9.2 The Major Minerals 229

- Sodium 230
- Chloride 231
- Potassium 232
- Calcium 232
- Phosphorus 235
- Magnesium 236
- Sulfate 237

9.3 The Trace Minerals 239

- Iron 239
- Zinc 243
- Selenium 245
- Iodine 245
- Copper 246
- Manganese 247
- Fluoride 247
- Chromium 248
- Other Trace Minerals 248

NUTRITION IN PRACTICE: VITAMIN AND MINERAL SUPPLEMENTS 253

10 Fitness and Nutrition 257

10.1 Fitness 258

- Benefits of Fitness 258
- Developing Fitness 261
- The Components of Fitness 261
- Cardiorespiratory Endurance 262
- Muscle Strength and Endurance 263
- A Balanced Fitness Program 263

10.2 The Active Body's Use of Fuels 264

- Glucose Use During Physical Activity 264
- Fat Use During Activity 267
- Protein Use During Activity 268

10.3 Vitamins and Minerals to Support Activity 270

- Supplements 270
- Nutrients of Special Concern 271

10.4 Fluids and Electrolytes in Physical Activity 272

- Temperature Regulation 273
- Fluid Needs during Physical Activity 273
- Sports Drinks 275

Enhanced Water 275

Other Beverages 276

10.5 Diets for Physically Active People 277

NUTRITION IN PRACTICE: SUPPLEMENTS AND ERGOGENIC AIDS ATHLETES USE 283

11 Nutrition through the Life Span: Pregnancy and Lactation 287

11.1 Pregnancy: The Impact of Nutrition on the Future 288

- Nutrition Prior to Pregnancy 288
- Prepregnancy Weight 288
- Healthy Support Tissues 289
- The Events of Pregnancy 290
- Nutrient Needs during Pregnancy 292
- Food Assistance Programs 297
- Weight Gain 297
- Weight Loss after Pregnancy 299
- Physical Activity 299
- Common Nutrition-Related Concerns of Pregnancy 300
- Problems in Pregnancy 301
- Practices to Avoid 303
- Adolescent Pregnancy 306

11.2 Breastfeeding 307

- Nutrition during Lactation 308
- Contraindications to Breastfeeding 309

NUTRITION IN PRACTICE: ENCOURAGING SUCCESSFUL BREASTFEEDING 315

12 Nutrition through the Life Span: Infancy, Childhood, and Adolescence 318

12.1 Nutrition of the Infant 319

- Nutrient Needs during Infancy 319
- Breast Milk 321
- Infant Formula 324
- The Transition to Cow's Milk 325
- Introducing First Foods 326
- Looking Ahead 328
- Mealtimes 328

12.2 Nutrition during Childhood 329

- Energy and Nutrient Needs 330
- Hunger and Malnutrition in Children 332
- Lead Poisoning in Children 334
- Food Allergy 334
- Hyperactivity 336
- Childhood Obesity 338

Mealtimes at Home	342	Physical Examinations	404
Nutrition at School	346	Determining Energy Requirements	405
12.3 Nutrition during Adolescence	348	14.3 Implementing Nutrition Care	407
Growth and Development during Adolescence	348	Dietary Modifications	407
Energy and Nutrient Needs	349	Approaches to Nutrition Care	409
Food Choices and Health Habits	350	Documenting Nutrition Care	410
NUTRITION IN PRACTICE: CHILDHOOD OBESITY AND THE EARLY DEVELOPMENT OF CHRONIC DISEASES	358	Improving Food Intake	411
		NUTRITION IN PRACTICE: NUTRITIONAL GENOMICS	415
13 Nutrition through the Life Span: Later Adulthood	363	15 Medications, Diet-Drug Interactions, and Herbal Supplements	419
13.1 Nutrition and Longevity	364	15.1 Medications in Disease Treatment	420
Slowing the Aging Process	365	Risks from Medications	420
Nutrition and Disease Prevention	367	Patients at High Risk of Adverse Effects	421
13.2 Nutrition-Related Concerns during Late Adulthood	368	15.2 Diet-Drug Interactions	423
Cataracts and Macular Degeneration	368	Drug Effects on Food Intake	423
Arthritis	369	Drug Effects on Nutrient Absorption	423
The Aging Brain	369	Dietary Effects on Drug Absorption	425
13.3 Energy and Nutrient Needs during Late Adulthood	372	Drug Effects on Nutrient Metabolism	425
Energy and Energy Nutrients	372	Dietary Effects on Drug Metabolism	426
Water	374	Drug Effects on Nutrient Excretion	427
Vitamins and Minerals	374	Dietary Effects on Drug Excretion	427
Nutrient Supplements for Older Adults	375	Diet-Drug Interactions and Toxicity	427
The Effects of Drugs on Nutrients	375	15.3 Herbal Supplements	429
13.4 Food Choices and Eating Habits of Older Adults	377	Effectiveness and Safety of Herbal Products	429
Individual Preferences	377	Use of Herbal Products in Illness	431
Meal Setting	377	NUTRITION IN PRACTICE: COMPLEMENTARY AND ALTERNATIVE THERAPIES	434
Depression	378		
Food Assistance Programs	378	16 Specialized Nutrition Support: Enteral and Parenteral Nutrition	438
Meals for Singles	378	16.1 Enteral Nutrition	439
NUTRITION IN PRACTICE: HUNGER AND COMMUNITY NUTRITION	385	Oral Supplements	439
		Candidates for Tube Feedings	440
14 Illness and Nutrition Care	390	Tube Feeding Routes	441
14.1 Nutrition in Health Care	391	Enteral Formulas	443
Effects of Illness on Nutrition Status	391	Administration of Tube Feedings	446
Responsibility for Nutrition Care	392	Medication Delivery during Tube Feedings	449
Nutrition Screening	393	Tube Feeding Complications	450
The Nutrition Care Process	393	Transition to Table Foods	450
14.2 Nutrition Assessment	395	16.2 Parenteral Nutrition	452
Historical Information	395	Candidates for Parenteral Nutrition	452
Food Intake Data	396	Venous Access	452
Anthropometric Data	399	Parenteral Solutions	453
Biochemical Analyses	401	Administering Parenteral Nutrition	456
		Managing Metabolic Complications	457

16.3 Nutrition Support at Home 459

Candidates for Home Nutrition Support 459

Planning Home Nutrition Care 460

Quality-of-Life Issues 460

NUTRITION IN PRACTICE: INBORN ERRORS OF METABOLISM 465

17 Foods and Food Consistency for Upper GI Disorders 469

17.1 Modifications in Food Texture and Consistency 470

Mechanically Altered Diets 470

Clear Liquid Diet 471

17.2 Conditions Affecting the Mouth and Esophagus 472

Dry Mouth 472

Dysphagia 472

Gastroesophageal Reflux Disease 476

17.3 Conditions Affecting the Stomach 477

Dyspepsia 477

Nausea and Vomiting 479

Gastritis 479

Peptic Ulcer Disease 480

17.4 Gastric Surgery 481

Gastrectomy 482

Bariatric Surgery 484

NUTRITION IN PRACTICE: NUTRITION AND ORAL HEALTH 490

18 Fiber-Modified Diets for Lower Gastrointestinal Tract Disorders 494

18.1 Modifying Dietary Fiber Intake 495

18.2 Disorders of Bowel Function 495

Constipation 496

Diarrhea 497

Irritable Bowel Syndrome 498

18.3 Inflammatory Bowel Diseases 500

18.4 Diverticular Disease of the Colon 503

18.5 Colostomies and Ileostomies 504

NUTRITION IN PRACTICE: PROBIOTICS AND INTESTINAL HEALTH 509

19 Carbohydrate- and Fat-Modified Diets for Malabsorption Disorders 512

19.1 Malabsorption Syndromes 513

Evaluating Malabsorption 513

Fat Malabsorption 514

Bacterial Overgrowth 516

19.2 Lactose Intolerance 517

19.3 Disorders of the Pancreas 518

Pancreatitis 518

Cystic Fibrosis 519

19.4 Disorders of the Small Intestine 521

Celiac Disease 521

Short Bowel Syndrome 523

NUTRITION IN PRACTICE: ANEMIA IN ILLNESS 527

20 Nutrition Therapy for Liver and Gallbladder Diseases 531

20.1 Fatty Liver and Hepatitis 532

Fatty Liver 532

Hepatitis 533

20.2 Cirrhosis 534

Consequences of Cirrhosis 535

Treatment of Cirrhosis 537

Nutrition Therapy for Cirrhosis 538

20.3 Liver Transplantation 541

20.4 Gallstone Disease 542

Types of Gallstones 543

Consequences of Gallstones 543

Risk Factors for Cholesterol Gallstones 544

Treatment of Gallstones 545

NUTRITION IN PRACTICE: ALCOHOL IN HEALTH AND DISEASE 549

21 Carbohydrate-Controlled Diets for Diabetes Mellitus 552

21.1 Overview of Diabetes Mellitus 553

Symptoms of Diabetes 553

Diagnosis of Diabetes 553

Types of Diabetes 554

Acute Complications of Diabetes Mellitus 556

Chronic Complications of Diabetes 557

21.2 Treatment of Diabetes Mellitus 558

Treatment Goals 559

Evaluating Diabetes Treatment 560

Nutrition Therapy: Dietary Recommendations 560

Nutrition Therapy: Meal-Planning Strategies 562

Insulin Therapy 565

Antidiabetic Drugs 567

Physical Activity and Diabetes Management 569

Sick-Day Management 569

21.3 Diabetes Management in Pregnancy 570

Pregnancy in Type 1 or Type 2 Diabetes 571

Gestational Diabetes 571

NUTRITION IN PRACTICE: THE METABOLIC SYNDROME 575

22 Fat-Controlled, Mineral-Modified Diets for Cardiovascular Diseases 578

22.1 Atherosclerosis 579

Consequences of Atherosclerosis 580

Causes of Atherosclerosis 581

22.2 Coronary Heart Disease 582

Evaluating Risk for Coronary Heart Disease 582

Lifestyle Management to Reduce CVD Risk 583

Vitamin Supplementation and CHD Risk 586

Lifestyle Changes for Hypertriglyceridemia 586

Drug Therapies for CHD Prevention 588

Treatment for Heart Attack 588

22.3 Stroke 590

Stroke Prevention 590

Stroke Management 590

22.4 Hypertension 591

Factors That Influence Blood Pressure 591

Factors That Contribute to Hypertension 591

Treatment of Hypertension 592

22.5 Heart Failure 595

Consequences of Heart Failure 595

Medical Management of Heart Failure 596

NUTRITION IN PRACTICE: HELPING PEOPLE WITH FEEDING DISABILITIES 600

23 Protein-, Mineral-, and Fluid-Modified Diets for Kidney Diseases 603

23.1 Nephrotic Syndrome 605

Consequences of the Nephrotic Syndrome 605

Treatment of the Nephrotic Syndrome 605

23.2 Acute Kidney Injury 608

Causes of Acute Kidney Injury 608

Consequences of Acute Kidney Injury 608

Treatment of Acute Kidney Injury 609

23.3 Chronic Kidney Disease 611

Consequences of Chronic Kidney Disease 611

Treatment of Chronic Kidney Disease 613

Kidney Transplants 617

23.4 Kidney Stones 619

Formation of Kidney Stones 620

Consequences of Kidney Stones 620

Prevention and Treatment of Kidney Stones 620

NUTRITION IN PRACTICE: DIALYSIS 625

24 Energy- and Protein-Modified Diets for Metabolic and Respiratory Stress 628

24.1 The Body's Responses to Stress and Injury 629

Hormonal Responses to Stress 629

The Inflammatory Response 630

24.2 Nutrition Treatment of Acute Stress 632

Determining Nutritional Requirements 632

Approaches to Nutrition Care in Acute Stress 634

24.3 Nutrition and Respiratory Stress 635

Chronic Obstructive Pulmonary Disease 635

Respiratory Failure 638

NUTRITION IN PRACTICE: MULTIPLE ORGAN DYSFUNCTION SYNDROME 643

25 Energy- and Protein-Modified Diets for Cancer and HIV Infection 645

25.1 Cancer 646

How Cancer Develops 646

Nutrition and Cancer Risk 647

Consequences of Cancer 649

Treatments for Cancer 650

Nutrition Therapy for Cancer 653

25.2 HIV Infection 657

Consequences of HIV Infection 657

Treatments for HIV Infection 659

Nutrition Therapy for HIV Infection 661

NUTRITION IN PRACTICE: ETHICAL ISSUES IN NUTRITION CARE 666

APPENDICES

A Table of Food Composition A-3

B WHO: Nutrition Recommendations; Canada: Guidelines and Meal Planning B-1

C Choose Your Foods: Food Lists for Diabetes C-1

D Physical Activity and Energy Requirements D-1

E Nutrition Assessment: Supplemental Information E-1

F Aids to Calculations F-1

G Enteral Formulas G-1

Glossary GL-1

H Answers to Self-Check Questions H-1

Index I-1

How To Features Appear on the Following Pages

Chapter 1

Calculate the Energy a Food Provides 8

Chapter 2

Reduce Intakes of Added Sugars 42

Chapter 3

Make Heart-Healthy Choices—by Food Group 74

Chapter 4

Calculate Recommended Protein Intakes 97

Chapter 6

Estimate Energy Requirements 147

Chapter 7

Apply Behavior Modification to Manage Body Fatness 176

Chapter 8

Estimate Dietary Folate Equivalents 208

Chapter 9

Cut Salt Intake 231

Add Calcium to Daily Meals 236

Add Iron to Daily Meals 243

Chapter 12

Protect against Lead Toxicity 335

Chapter 13

Turn Convenience Foods into Nutritious Meals 380

Stretch Food Dollars and Reduce Waste 387

Chapter 14

Measure Length and Height 399

Measure Weight 400

Estimate and Evaluate Changes in Body Weight 402

Estimate Appropriate Energy Intakes for Hospital Patients 406

Help Hospital Patients Improve Their Food Intakes 412

Chapter 15

Prevent Diet-Drug Interactions 428

Chapter 16

Help Patients Improve Intakes with Oral Supplements 440

Help Patients Cope with Tube Feedings 447

Plan a Tube Feeding Schedule 448

Administer Medications to Patients Receiving Tube Feedings 450

Calculate the Macronutrient and Energy Content of a Parenteral Solution 456

Chapter 17

Improve Acceptance of Mechanically Altered Foods 475

Manage Gastroesophageal Reflux Disease 478

Alter the Diet to Reduce Symptoms of Dumping Syndrome 484

Alter Dietary Habits to Achieve and Maintain Weight Loss after Bariatric Surgery 486

Chapter 19

Follow a Fat-Restricted Diet 516

Chapter 20

Help the Cirrhosis Patient Eat Enough Food 539

Chapter 21

Use Carbohydrate Counting in Clinical Practice 563

Chapter 22

Implement a Heart-Healthy Diet 587

Reduce Sodium Intake 594

Chapter 23

Help Patients Comply with a Renal Diet 618

Chapter 24

Estimate Energy Needs Using Disease-Specific Stress Factors 633

Chapter 25

Increase kcalories and Protein in Meals 653

Help Patients Handle Food-Related Problems 655

Case Study Features Appear on the Following Pages

Chapter 11

Woman in Her First Pregnancy 309

Chapter 12

Boy with Disruptive Behavior 337

Chapter 13

Elderly Man with a Poor Diet 378

Chapter 14

Nutrition Screening and Assessment 407

Implementing Nutrition Care 412

Chapter 16

Injured Hiker Requiring Enteral Nutrition Support 452

Patient with Intestinal Disease Requiring Parenteral Nutrition 459

Chapter 17

Woman with GERD 478

Nutrition Care after Gastric Surgery 484

Chapter 18

Young Adult with Irritable Bowel Syndrome 499

Chapter 19

Child with Cystic Fibrosis 520

Patient with Short Bowel Syndrome 524

Chapter 20

Man with Cirrhosis 541

Chapter 21

Child with Type 1 Diabetes 570

Woman with Type 2 Diabetes 572

Chapter 22

Patient with Cardiovascular Disease 595

Chapter 23

Woman with Acute Kidney Injury 611

Man with Chronic Kidney Disease 618

Chapter 24

Patient with a Severe Burn 635

Elderly Man with Emphysema 638

Chapter 25

Woman with Cancer 656

Man with HIV Infection 662

Preface

Numerous discoveries in nutrition science over the past few years have continued to benefit the field of health care. In revising this ninth edition of *Nutrition and Diet Therapy*, we have been pleased at the number of new findings we have been able to incorporate into these pages. As always, major goals of this textbook are to present both core nutrition information and guidelines about the prevention of, and care during, illness. Another mission is to help nutrition students evaluate information and products available from the media, colleagues, and the marketplace.

As in the previous edition of this book, Chapters 1 through 10 introduce basic concepts in nutrition and explain how sound nutrition supports health. Chapters 11 to 13 apply nutrition principles to individuals during different stages of life, from pregnancy and birth through old age. The second half of the book addresses the concerns of individuals who are at risk of illness or have medical conditions that require medical nutrition therapy. A hallmark of the text is the “Nutrition in Practice” section located at the end of every chapter: these sections provide coverage of current research topics, advanced subjects, or specialty areas.

Changes for This Edition

Each chapter of this book is based on current nutrition knowledge and the latest clinical practice guidelines, and features new learning objectives for each major section. Some major content changes in this edition include the following:

Chapter 1 Introduced the new MyPlate figure and discussion, added definitions of solid fats, added sugars, and nutrient profiling, added a brief discussion of nutrient profiling, included a new discussion of portion sizes, added a discussion and new figure of the proposed updated Nutrition Facts panel on food labels, added new figures of Facts Up Front and label claims, and added the definition of registered dietitian nutritionist in the Nutrition in Practice.

Chapter 2 Added a new figure showing glycogen and starch molecules and their branching, reorganized and enhanced the discussion of blood glucose regulation, reorganized the section “Health Effects of Sugars and Alternative Sweeteners,” added a discussion of sugar and heart disease, placed new emphasis on the term *nonnutritive sweeteners* rather than *artificial sweeteners* as per the Academy of Nutrition and Dietetics, added a new How To box: “How to Reduce Added Sugar Intake,” updated and reorganized the table of nonnutritive sweeteners, and added a little more information about glycemic load in the Nutrition in Practice.

Chapter 3 Added brief discussion and definition of conjugated linoleic acid, increased the emphasis on and explanation of solid fats, added a table of solid fats on food labels, and added a new figure about replacing saturated fat with unsaturated fat in the Nutrition in Practice.

Chapter 4 Enhanced the discussion of proteins as antibodies, reorganized the section on protein deficiency, introduced and defined the WHO term *severe acute malnutrition* and defined chronic malnutrition, added a table comparing severe acute malnutrition and chronic malnutrition, and enhanced the glossary of terms to describe vegetarian diets.

Chapter 5 Added the Food Safety Modernization Act to the discussion in the Nutrition in Practice and reorganized and shortened the foodborne illness table to include the pathogens that cause most foodborne illnesses.

Chapter 6 Deleted a margin note about the “3500-kcal rule” and downplayed its exactness in the text with references, included information from the American Heart Association/American College of Cardiology Guidelines for the Management of Overweight and Obesity in Adults, and added information about and a definition of RED-S (relative energy deficiency in sport) from the International Olympic Committee to replace the female athlete triad.

Chapter 7 Introduced and defined screen time, food deserts, satiation, and satiety, added a new section on “Neighborhood Obstacles to Physical Activity and Healthy Foods,” streamlined the obesity drug discussion and simplified and updated FDA-approved obesity drugs information, separated and enhanced tables of weight-loss and weight-gain strategies, addressed new thinking and research about the “3500-kcalorie rule,” enhanced and updated the table “Popular Diets Compared,” added a new table called “Tips for Identifying Fad Diets and Weight-Loss Scams,” and added a brief discussion of protein and calorie restriction.

Chapter 8 Added a new table comparing fat-soluble and water-soluble vitamins, updated figures of good sources of vitamins (A, folate, and C) using current USDA nutrient data, added definitions of vitamin D₂ and D₃, added a brief note about tocotrienols in the vitamin E discussion, and added a new table in the Nutrition in Practice providing tips for consuming phytochemicals.

Chapter 9 Added a new table, “Top Contributors of Sodium in the Diet,” added a section on potassium and hypertension, added more food sources of calcium, added information on magnesium and disease, added information on iron excess and oxidative stress, and added information on and a definition of hepcidin, the iron-regulating hormone.

Chapter 10 Reorganized and rewrote parts of the beginning of the chapter, added new tables comparing intensities of physical activity and symptoms of heat stroke and hypothermia, updated the hydration table, rewrote and reorganized the Nutrition in Practice, and added a discussion of beta-alanine to the Nutrition in Practice.

Chapter 11 Added a new table on the benefits of breastfeeding and personalized the table of strategies for successful breastfeeding.

Chapter 12 Added new tables listing protective factors in breast milk and providing tips for picky eaters, enhanced the table of food skills for preschoolers, added a figure to highlight MyPlate resources for children, included new National School Lunch/Breakfast requirements, added a table of new USDA standards for foods and beverages sold in schools, added a new table of physical activities for children and adolescents, and modified and simplified the feature “How to Protect against Lead Toxicity.”

Chapter 13 Added a new table comparing signs of Alzheimer’s and typical age-related changes, defined health care communities as per the Academy of Nutrition

and Dietetics, added a brief discussion of the obesity/food insecurity paradox in the Nutrition in Practice, and enhanced the feature about thrifty meal planning, “How to Stretch Food Dollars and Reduce Waste.”

Chapter 14 Reorganized the table on information included in a nutrition screening, included a discussion of the multiple-pass method for conducting a 24-hour dietary recall interview, added a paragraph about C-reactive protein in the section on biochemical analyses, revised the SOAP note figure, and updated names for diets in the “Modified Diets” section to more closely match current dietetics terminology.

Chapter 15 Modified the paragraph on isoniazid and vitamin B₆ in the “Diet-Drug Interactions” section, modified several paragraphs about the effectiveness and safety of herbal supplements, and modified and expanded the table listing examples of herb-drug interactions.

Chapter 16 Introduced oral supplements in the beginning of the chapter, reorganized the middle two sections of the chapter so that the discussion of tube feeding candidates and tube feeding routes precedes the section on enteral formulas, added new photos of a current feeding tube and transnasal tube placement in an adult, simplified the presentation of tube feeding initiation and advancement, introduced the term *cyclic feedings* in the section on formula delivery methods, revised the section on fluids and electrolytes in parenteral solutions, clarified the difference between continuous and cyclic parenteral nutrition, shortened the section on discontinuing parenteral nutrition, and expanded the section on hyperglycemia in parenteral nutrition. In the Nutrition in Practice on inborn errors, revised the introductory paragraph about PKU, added a photo showing phenylalanine-free formula, and updated the medical foods and treatments used in phenylketonuria.

Chapter 17 Modified the table of suggestions for managing dry mouth, expanded the discussion about food thickeners, updated the box that describes ways to improve acceptance of mechanically altered foods, updated the diet-drug interactions box, and modified the discussions on dumping syndrome and bariatric surgery. In the Nutrition in Practice about oral health, modified several sections and added a table listing suggestions for preventing oral diseases.

Chapter 18 Revised some paragraphs in the sections on inflammatory bowel diseases, irritable bowel syndrome, and diverticular disease of the colon; and updated the diet-drug interactions box.

Chapter 19 Replaced the Schilling test with the xylose absorption test in the section on evaluating malabsorption; revised some material in the sections on acute and chronic pancreatitis, cystic fibrosis, celiac disease, and short bowel syndrome; and updated the diet-drug interactions box.

Chapter 20 Revised the introduction to fatty liver and the descriptions of the different types of hepatitis viruses, modified several sections on cirrhosis complications and the table on stages of hepatic encephalopathy, revised the sections on the medical treatment and nutrition therapy for cirrhosis, introduced the *transjugular intrahepatic portosystemic shunt* and eliminated the *peritoneovenous shunt* in the discussion about ascites treatment, modified the section about risk factors for gallstone disease, and updated the diet-drug interactions box.

Chapter 21 Updated statistics throughout the chapter; expanded paragraphs on prediabetes, long-term glycemic control, and diabetic pregnancy; added a note about the types of insulin used in the Diabetes Control and Complications Trial; updated

sections on nutrition therapy according to newly released nutrition guidelines from the American Diabetes Association; reorganized the discussion about body weight concerns by moving the topic of weight gain in type 1 diabetes to the insulin therapy section and the topic on weight loss for type 2 diabetes to the nutrition therapy section; expanded the table on antidiabetic drugs; updated the diet-drug interactions box; and updated several sections in the Nutrition in Practice on metabolic syndrome.

Chapter 22 Reorganized the chapter introduction; revised several paragraphs on the causes of atherosclerosis; expanded and modified the discussions of CHD risk assessment and lifestyle management, including recent (2013) guidelines from the American Heart Association and American College of Cardiology; added a new discussion about cholesterol and egg intakes; modified the introduction to hypertension and some sections on the risk factors and treatment of hypertension, including recent guidelines by the Eighth Joint National Committee (JNC 8) released in 2013; and updated the diet-drug interactions box.

Chapter 23 Modified sections related to the nephrotic syndrome, 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, updated the table on food sources of oxalates, and updated the diet-drug interactions box.

Chapter 24 Modified the discussion about the systemic effects of inflammation, updated the discussion about the clinical effects of altering omega-6 and omega-3 fatty acid intakes based on recent analyses, revised the section about estimating energy needs during acute stress, added the concept of hypocaloric feedings for obese critical care patients, changed the table on using disease-specific stress factors for estimating energy needs to a “How to” box, and updated the diet-drug interactions box with current drug treatments for COPD.

Chapter 25 Rearranged 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, modified the introductory paragraphs in the HIV/AIDS section, rearranged and revised some sections related to the consequences of HIV infection, revised some sections related to the nutrition therapy for HIV infection, and updated the diet-drug interactions box.

Features of this Text

Throughout the book, the readable text and pedagogic features should help to facilitate students' understanding and retention of the material. For example, **definitions of key terms** appear in the margins. **“How to” skill boxes** help readers work through calculations or give practical suggestions for applying nutrition information. **Learning objectives** (new for this edition) and **“In Summary”** statements at the beginning and end of each major chapter section help students assimilate the material and assess reading comprehension.

Study tools include the **“Self Check”** at the end of each chapter, which helps readers test their understanding of the chapter material. **“Your Diet”** exercises ask students to apply nutrition information from each chapter to their own diets. **Case studies** in the later chapters challenge readers to apply chapter information to clinical situations.

“**Clinical Applications**” provide practice with mathematical calculations and help students understand the impact of nutrition-related issues on health care professionals and their clients.

“**Nutrition Assessment Checklists**” summarize assessment parameters relevant to different stages of the life cycle or groups of disorders. “**Diet-Drug Interaction**” boxes point out interactions relevant to the medications described in each chapter. The **appendixes** include a wealth of information on the contents of foods and enteral formulas, U.S. nutrient intake recommendations and the exchange system, Canadian guidelines and food guides, physical activity and energy requirements, additional information about nutrition assessment, and aids to calculations.

We hope that as you discover the many fascinating aspects of nutrition, you will enthusiastically apply the concepts in both your professional and your personal life. To access additional course materials including Course Mate, please visit **www.cengagebrain.com**. At the CengageBrain.com home page, search for the ISBN of your title (from the back cover of your book) using the search box at the top of the page. This will take you to the product page where these resources can be found.

Ancillaries

- **CourseMate** helps you make the grade. It includes an interactive eBook with highlighting, note taking, and search capabilities; interactive learning tools including quizzes, flash cards, and videos; and more! Go to cengagebrain.com to access these resources.
- A test bank is available through **Cengage Learning Testing Powered by Cognero**, a flexible online system that allows instructors to author, edit, and manage test bank content from multiple Cengage Learning solutions; create multiple test versions in an instant; and deliver tests from an LMS, a classroom, or wherever the instructor wants.
- The password-protected **Instructor Companion Site** offers everything an instructor needs for the 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, an instructor’s manual, videos, and more.

Acknowledgments

Among the most difficult words to write are those that express the depth of our gratitude to the many dedicated people whose efforts have made this book possible. A special note of appreciation to Sharon Rolfes for her numerous contributions to the chapters and Nutrition in Practice sections as well as to the Dietary Reference Intakes on the inside front cover and the appendices. Many thanks to Fran Webb for sharing her knowledge, ideas, and resources about the latest nutrition developments. Thanks also to David L. Stone for his assistance with multiple sections in the clinical chapters. Elesha Hyde’s critical eye, numerous suggestions, and unceasing support were especially helpful in revising both the normal nutrition and the clinical chapters. We also wish to acknowledge the efforts of the folks at Axya for their assistance in creating the food composition appendix. We are indebted to our editorial team, Peggy Williams and Elesha Hyde, and our production team, especially Carol Samet, for seeing this project through from start to finish. We would also like to acknowledge Tom Ziolkowski for his marketing efforts. To the many others involved in designing, indexing, typesetting, dummies, and marketing, we offer our thanks. We are especially grateful to our associates, family, and friends for their continued encouragement and support and to our reviewers who consistently offer excellent suggestions for improving the text.

Reviewers

Dr. Suman Ahuja
Lincoln University

Heather T. Casale, MS, RD, CNSC
Merritt College

Dr. Julie K. Collins
Eastern Oklahoma State College

Kelly K. Eichmann, PhD, RD
University of Phoenix

Deborah A. Hutcheon, MS, RD, LD
Bob Jones University

About the Authors

Linda Kelly DeBruyne, M.S., R.D., received her B.S. in 1980 and her M.S. in 1982 in nutrition and food science at Florida State University. She is a founding member of Nutrition and Health Associates, an information resource center in Tallahassee, Florida, where her specialty areas are life cycle nutrition and fitness. Her other publications include the textbooks *Nutrition for Health and Health Care*, and *Health: Making Life Choices* and a multimedia CD-ROM called *Nutrition Interactive*. She is a registered dietitian and maintains a professional membership in the Academy of Nutrition and Dietetics.

Kathryn Pinna, Ph.D., R.D., received her M.S. and Ph.D. degrees in nutrition from the University of California at Berkeley. She has taught nutrition, food science, and human biology courses in the San Francisco Bay Area for over 25 years and has also worked as an outpatient dietitian, Internet consultant, and freelance writer. Her other publications include the textbooks *Understanding*

Normal and Clinical Nutrition and *Nutrition for Health and Health Care*. She is a registered dietitian and a member of the American Society for Nutrition and the Academy of Nutrition and Dietetics.

Ellie Whitney, Ph.D., grew up in New York City and received her B.A. and Ph.D. degrees in English and biology at Radcliffe/Harvard University and Washington Universities, respectively. She has taught at both Florida State University and Florida A&M University, has written newspaper columns on environmental matters for the *Tallahassee Democrat*, and has authored almost a dozen college textbooks on nutrition, health, and related topics, many of which have been revised multiple times over the years. In addition to teaching and writing, she has spent the past three-plus decades exploring outdoor Florida and studying its ecology. Her latest book is *Priceless Florida: The Natural Ecosystems* (Pineapple Press, 2004).

Dedication

*To my husband Tom, Can't wait to see where the
next part of our journey takes us.*

—Linda Kelly DeBruyne

*To David Stone, who shares my passion for nutrition, science,
old-time fiddle music, and swallowtail butterflies.*

—Kathryn Pinna

*To the memory of my parents, Edith Tyler Noss and Henry H. B. Noss,
who supported me with love, discipline, and pride.*

—Ellie Whitney

1

Overview of Nutrition and Health

1.1 Food Choices

LO 1.1 Describe how various factors influence personal food choices.

1.2 The Nutrients

LO 1.2 Name the six major classes of nutrients and identify which are organic and which yield energy.

1.3 Nutrient Recommendations

LO 1.3 Define the four categories of the DRI, the Estimated Energy Requirement (EER), and the Acceptable Macronutrient Distribution Ranges (AMDR), and explain their purposes.

1.4 National Nutrition Surveys

LO 1.4 Describe the kinds of information researchers collect from nutrition surveys and explain how the information is used.

1.5 Dietary Guidelines and Food Guides

LO 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 Patterns help make diet planning easier.

1.6 Food Labels

LO 1.6 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

LO 1.7 Recognize misinformation and describe how to identify reliable nutrition information.

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 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: 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 13 chapters of this text emphasize the nutrition concerns of people in good health; therefore, the term *client* is used in these chapters.

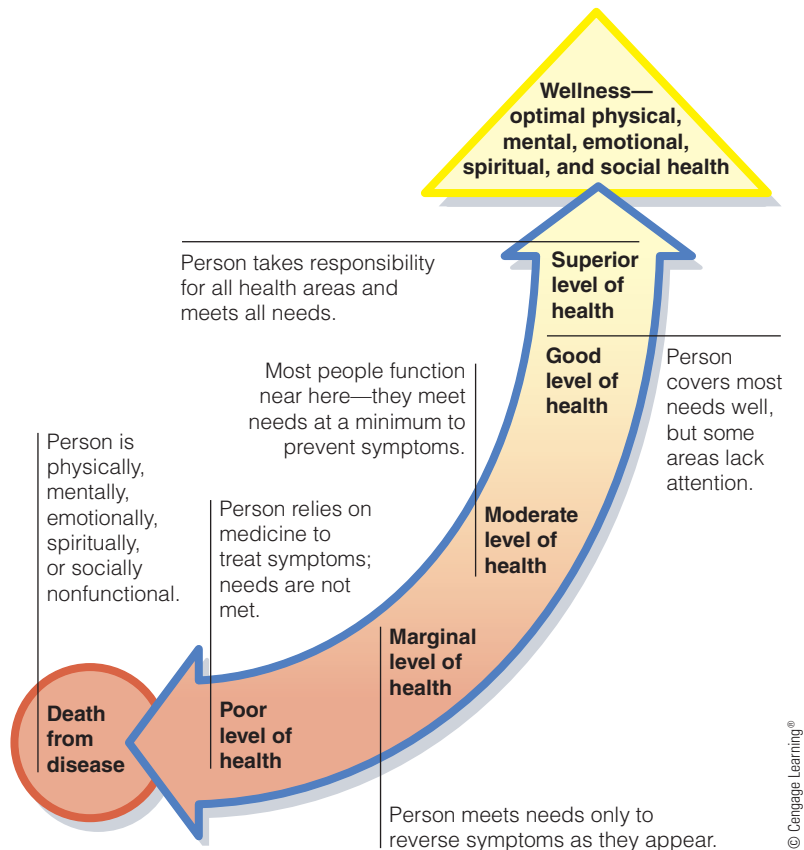


FIGURE 1-1 The Health Line

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 and reduce disease risks. The later chapters emphasize medical nutrition therapy and its role in supporting health and treating diseases and symptoms.

1.1 Food Choices

LO 1.1 Describe how various factors influence personal 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

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.

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 like Cajun and TexMex blend the traditions of several cultures. Table 1-1 (p. 4) 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



© iafoto/Shutterstock.com

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

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  <small>Becky Luigart-Stayner/CORBIS</small>	Millet, rice, rice or wheat noodles	Amaranth, baby corn, bamboo shoots, bok choy, cabbages, mung bean sprouts, scallions, seaweed, snow peas, straw mushrooms, water chestnuts, wild yam	Kumquats, loquats, lychee, mandarin oranges, melons, pears, persimmon, plums	Pork, poultry, fish and other seafood, squid, soybeans, tofu, duck eggs, cashews, peanuts	Soy milk
Mediterranean  <small>Photodisc/Getty Images</small>	Bulgur, couscous, focaccia, Italian bread, pastas, pita pocket bread, polenta, rice	Cucumbers, eggplant, grape leaves, onions, peppers, tomatoes	Dates, figs, grapes, lemons, melons, olives, raisins	Beef, gyros, lamb, pork, sausage, chicken, fish and other seafood, fava beans, lentils, almonds, walnuts	Feta, goat, mozzarella, parmesan, provolone, and ricotta cheeses; yogurt
Mexican  <small>Photodisc/Getty Images</small>	Taco shells, tortillas (corn or flour), rice	Cactus, cassava, chayote, chilies, corn, jicama, onions, tomatoes, tomato salsa, yams	Avocado, bananas, guava, lemons, limes, mango, oranges, papaya, plantain	Beef, chorizo, chicken, fish, refried beans, eggs	Cheese, flan (caramel custard)

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 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 social events, and the sharing of food is part of hospitality. It is often considered rude to refuse food or drink being shared by a group or offered by a host. 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.⁵ 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



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

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, cook meals ahead at storefront meal preparation sites, 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.⁶ They are less likely to buy higher-priced convenience foods and more likely to 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 calories, sodium, total fat, 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

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.

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.

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; meats, seafood, poultry, eggs, nuts, and seeds; and low-fat milk products are among the healthiest choices a person can make.

IN SUMMARY

- 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.

1.2 The Nutrients

LO 1.2 Name the six major classes of nutrients and identify which are organic and which yield energy.

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.

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

[†]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 (CO₂).

these four (carbohydrates, fats, and proteins) provide energy the body can use.[‡] These **energy-yielding nutrients** continually replenish the energy you spend 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.

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 each nutrient 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 on p. 8 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, whether from carbohydrate, fat, or protein, 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 20 discusses alcohol's effects on nutrition.

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

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

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.

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).

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:

$$\begin{aligned}16 \text{ g carbohydrate} \times 4 \text{ kcal/g} &= 64 \text{ kcal} \\7 \text{ g protein} \times 4 \text{ kcal/g} &= 28 \text{ kcal} \\9 \text{ g fat} \times 9 \text{ kcal/g} &= 81 \text{ kcal} \\ \text{Total} &= 173 \text{ kcal}\end{aligned}$$

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:

$$81 \text{ fat kcal} \div 173 \text{ total kcal} = 0.468 \text{ (rounded to 0.47)}$$

Then multiply by 100 to get the percentage:

$$0.47 \times 100 = 47\%$$

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.

IN SUMMARY

- 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.

1.3 Nutrient Recommendations

LO 1.3 Define the four categories of the DRI, the Estimated Energy Requirement (EER), and the Acceptable Macronutrient Distribution Ranges (AMDR), and explain their purposes.

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.*¹⁰ The inside front covers of this book present the DRI values.

*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.

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.

(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.

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.

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.

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 (p. 10) 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

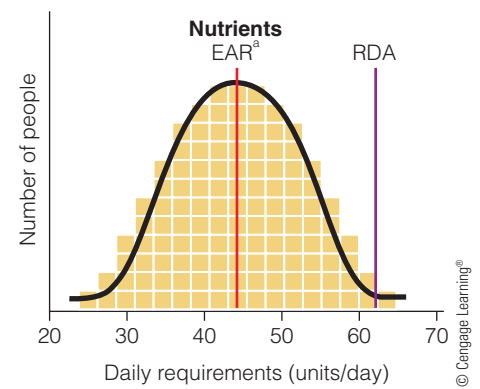


FIGURE 1-2 Nutrient Intake Recommendations

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

*Estimated Average Requirement

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.

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.

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.