

NUTRITION

&

**DIAGNOSIS-
RELATED
CARE**

Ninth Edition

SYLVIA ESCOTT-STUMP

MA, RDN, LDN, FAND

**eat
right.**

Academy of Nutrition
and Dietetics

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TABLE OF CONTENTS

<i>Alphabetical List of Topics</i>	vii
<i>Reviewers</i>	x
<i>Preface</i>	xi
<i>Acknowledgments</i>	xii
<i>Common Abbreviations</i>	xiv
<i>Publisher's Note on Gender-Inclusive Language</i>	xvi

Food Allergy and Foodborne Illness	
Food Allergy	130
Food Poisoning and Foodborne Illness	140

SECTION 3 Pediatrics: Birth Defects and Genetic and Acquired Disorders

SECTION 1 Normal Life Stages

Overview of Normal Nutrition and Noncommunicable Disease	2
Pregnancy and Lactation	
Pregnancy	7
Lactation	18
Infancy, Childhood, and Adolescence	
Infant (0 to 6 Months)	28
Infant (6 to 12 Months)	33
Childhood	38
Adolescence	46
Stages of Adulthood	
Adulthood	51
Nutrition in Aging	69
Fitness and Lifestyle	
Sports Nutrition	79
Vegetarianism	87

SECTION 2 Oral, Sensory, Skin Conditions, and Adverse Reactions to Food

Overview of Microbiome	92
Orofacial Conditions	
Dental and Oral Conditions	93
Periodontal Disease and Gingivitis	101
Temporomandibular Joint Dysfunction	104
Sensory Impairment	
Sensory Impairments: Vision, Coordination, Chewing, Taste, Smell, and Hearing	106
Autoimmune Inner Ear Disease (Ménière Disease)	113
Skin Conditions, Pressure Injuries, and Vitamin Deficiencies	
Skin Disorders	115
Pressure Injuries	121
Vitamin Deficiencies	126

Overview of Nutrition in Pediatric Disorders	149
Abetalipoproteinemia	155
Achondroplasia	157
Attention Deficit Disorders	160
Autism Spectrum Disorder	163
Biliary Atresia	167
Bronchopulmonary Dysplasia	170
Carbohydrate Metabolic Disorders	173
Cerebral Palsy	178
Cleft Lip and Palate	182
Congenital Heart Disease	185
Cystinosis and Fanconi Syndrome	189
Down Syndrome	191
Faltering Growth or Failure to Thrive	194
Fatty Acid Oxidation Disorders	198
Fetal Alcohol Syndrome	201
Hirschsprung Disease (Congenital Megacolon)	204
HIV Infection, Pediatric	207
Homocystinuria and Inborn Errors of Cobalamin and Folate	211
Leukodystrophies	214
Low Birth Weight or Premature Birth	217
Macrosomia (Large for Gestational Age)	222
Maple Syrup Urine Disease	225
Mucopolysaccharidoses	228
Necrotizing Enterocolitis	231
Neural Tube Defects: Spina Bifida and Melomeningocele	234
Obesity, Childhood	238
Otitis Media	245
Phenylketonuria	248
Prader-Willi Syndrome	252
Rickets	255
Small for Gestational Age and Intrauterine Growth Restriction	258
Tay-Sachs Disease	261
Turner Syndrome	263

Tyrosinemia	266
Urea Cycle Disorders	268
Wilson Disease	272

SECTION 4 Neuropsychiatric Disorders

Overview of Neuropsychiatric Disorders 276

Neurologic Disorders

Alzheimer Disease and Dementias	284
Amyotrophic Lateral Sclerosis	290
Brain Trauma	293
Cerebral Aneurysm	296
Disorders of Consciousness	298
Epilepsy and Seizure Disorders	301
Guillain-Barré Syndrome and the Zika Virus	305
Huntington Disease	308
Migraine	312
Multiple Sclerosis	316
Myasthenia Gravis and Neuromuscular Junction Disorders	319
Parkinson Disease	322
Sleep and Circadian Rhythm Disorders	327
Spinal Cord Injury and Paralysis	330
Stroke (Cerebrovascular Accident)	335
Trigeminal Neuralgia	340

Eating Disorders

Anorexia Nervosa	342
Avoidant/Restrictive Food Intake Disorder	347
Binge Eating Disorder	350
Bulimia Nervosa	352

Other Psychiatric Disorders

Bipolar Disorder	357
Depression	361
Schizophrenia	365
Substance Use Disorder and Addiction	371
Tardive Dyskinesia	375

SECTION 5 Pulmonary Disorders

Overview of the Pulmonary System 380

Asthma	382
Bronchiectasis	388
Bronchitis	391
Chronic Obstructive Pulmonary Disease	394
Chylothorax	400
Cor Pulmonale	402
Cystic Fibrosis	404
Interstitial Lung Disease	410
Lung Transplantation	413
Pneumonia	416
Pulmonary Embolism	420
Respiratory Distress Syndrome	423

Respiratory Failure and Mechanical Ventilation	425
Sarcoidosis	429
Sleep Apnea	432
Thoracic Empyema	435
Tuberculosis	437

SECTION 6 Cardiovascular Disorders

Overview of Cardiovascular Disease 444

Angina Pectoris and Ischemic Heart Disease	453
Arteritis and Vasculitis	456
Atherosclerotic Cardiovascular Disease	459
Cardiac Cachexia	465
Cardiomyopathies	468
Heart Failure	472
Heart or Heart-Lung Transplantation	479
Heart Valve Disorders	483
Hypertension	486
Myocardial Infarction	492
Pericarditis and Cardiac Tamponade	496
Peripheral Artery Disease	499
Thromboembolism and Phlebitis	502

SECTION 7 Gastrointestinal Disorders

Overview of the Gastrointestinal System 506

Upper Gastrointestinal Tract Disorders

Dysphagia	511
Esophageal Disorders	516
Esophageal Varices	519
Esophagitis, Gastroesophageal Reflux, and Hiatal Hernia	521

Stomach Disorders

Dyspepsia, Indigestion, and Bezoar Formation	525
Gastrectomy and Vagotomy	527
Gastritis and Gastroenteritis	530
Gastroparesis and Gastric Retention	533
Giant Hypertrophic Gastritis and Ménétrier Disease	535
Peptic Ulcer Disease	537
Vomiting, Pernicious	543

Lower Gastrointestinal Tract Disorders

Carcinoid Syndrome	546
Celiac Disease and Gluten Intolerance	548
Constipation	553
Diarrhea, Dysentery, and Traveler's Diarrhea	557
Diverticular Diseases	562
Fat Malabsorption Syndrome	565
Inflammatory Bowel Disease: Crohn's Disease	569
Inflammatory Bowel Disease: Ulcerative Colitis	574
Intestinal Failure and Transplantation	577
Intestinal Fistula	581

Intestinal Lymphangiectasia	583	Hyperosmolar Hyperglycemic State	734
Irritable Bowel Syndrome	586	Hypoglycemia	737
Lactose Maldigestion	589	Hypoglycemia With Hyperinsulinism	740
Megacolon	593	Metabolic Syndrome	743
Ostomy: Colostomy	596	Preeclampsia and Hypertension in Pregnancy	747
Ostomy: Ileostomy	599		
Peritonitis	602	Pituitary, Ovary, and Adrenal Disorders	750
Short Bowel Syndrome	604	Acromegaly	750
Tropical Sprue	610	Cushing Syndrome	752
Whipple Disease (Intestinal Lipodystrophy)	612	Diabetes Insipidus	755
		Hypopituitarism	757
		Syndrome of Inappropriate Antidiuretic Hormone	760
		Polycystic Ovarian Syndrome	763
		Adrenocortical Insufficiency and Addison Disease	766
		Hyperaldosteronism	770
		Pheochromocytoma	772

Rectal Disorders

Fecal Incontinence	614
Hemorrhoids	618
Proctitis	620

SECTION 8 Hepatic, Pancreatic, and Biliary Disorders**Overview of Hepatic, Biliary, and Pancreatic Disorders** 624**Liver Disorders**

Alcoholic Liver Disease	627
Ascites and Chylous Ascites	631
Hepatitis	634
Hepatic Cirrhosis	638
Liver Failure, Encephalopathy, and Coma	645
Liver Transplantation	650
Nonalcoholic Fatty Liver Disease	655

Pancreatic Disorders

Pancreatic Insufficiency	658
Pancreatitis, Acute	661
Pancreatitis, Chronic	664
Pancreatic Transplantation	668
Zollinger-Ellison Syndrome (Gastrinoma)	671

Biliary Disorders

Cholangitis	674
Cholestasis	676
Gallbladder Disease	679

Thyroid Disorders

Hyperthyroidism	775
Hypothyroidism	779
Hypoparathyroidism and Hypocalcemia	783
Hyperparathyroidism and Hypercalcemia	785

SECTION 10 Malnutrition: Overnutrition and Undernutrition**Overview of Malnutrition** 790

Overnutrition, Overweight, and Obesity	798
Undernutrition	813
Malnutrition in Children and Adults	819
Refeeding Syndrome	827

SECTION 11 Musculoskeletal and Collagen Disorders**Overview of Rheumatic and Bone Disorders** 832

Fibromyalgia and Polymyalgia Rheumatica	837
Gout	840
Immobilization	844
Lupus	847
Muscular Dystrophy	851
Osteoarthritis	856
Osteomyelitis	861
Osteomalacia	864
Osteopenia and Osteoporosis	867
Paget Disease (Osteitis Deformans)	873
Polyarteritis Nodosa	876
Rhabdomyolysis	878
Rheumatoid Arthritis	881
Ruptured Disk and Radiculopathy	888
Scleroderma and Systemic Sclerosis	890
Spondyloarthritis	894

SECTION 9 Endocrine Disorders**Overview of Endocrine Disorders** 685**Diabetes Mellitus**

Gestational Diabetes Mellitus	696
Prediabetes	701
Type 1 Diabetes Mellitus	705
Type 2 Diabetes Mellitus in Adults	718
Type 2 Diabetes Mellitus in Children and Teens	724

Diabetes Complications and Related Conditions

Diabetic Gastroparesis	728
Diabetic Ketoacidosis	731

SECTION 12 Hematology: Anemias and Blood Disorders**Overview of Blood and Anemias 898****Anemias**

Anemia of Inflammation	902
Anemias in Neonates	905
Anemia of Renal Disease	907
Aplastic Anemia and Fanconi Anemia	910
Copper-Deficiency Anemia	913
Folic Acid–Deficiency Anemia	917
Hemolytic Anemias	921
Iron-Deficiency Anemia	923
Malaria and Parasitic Anemias	929

Megaloblastic Anemias

Pernicious and Vitamin B12-Deficiency Anemias	933
---	-----

Hemoglobinopathies

Sickle Cell Disease	937
Sideroblastic Anemias	941
Thalassemias	943

Other Blood Disorders

Bleeding Disorders: Hemorrhage and Hemophilia	946
Hemochromatosis and Iron Overload	949
Polycythemia Vera	953
Thrombocytopenia	956

SECTION 13 Cancer**Overview of Cancer 960****General Cancer Types**

Bone Marrow or Hematopoietic Stem Cell Transplantation	975
Bone Cancers	979
Brain Tumors	982
Colorectal Cancer	985
Esophageal, Head and Neck, and Thyroid Cancers	991
Gastric Cancer	996
Liver Cancer	1000
Lung Cancers	1003
Pancreatic Cancer	1007
Skin Cancers	1010
Urinary Bladder and Renal Cancers	1014

Hormonal Cancers

Breast Cancer	1017
Choriocarcinoma	1022
Endometrial Cancer	1025
Ovarian Cancer	1027
Prostate Cancer	1030

Hematological Cancers

Leukemias	1034
Lymphomas	1038
Myeloma	1041

SECTION 14 Surgery and Nutrition Support**Overview of General Surgery Guidelines 1047**

Perioperative Nutrition	1050
-------------------------	------

Gastrointestinal Surgeries

Bariatric Surgery	1064
Bowel Surgeries	1070

Nutrition Support

Nutrition Support	1075
Enteral Nutrition	1079
Parenteral Nutrition	1087

SECTION 15 Immunology and Critical Care**Overview of Nutrition and Immunocompetence 1092**

AIDS and HIV Infection	1105
Burn Injury	1112
Fractures	1118
Intestinal Parasite Infections	1122
Multiple Organ Dysfunction Syndrome	1127
Sepsis	1131
Trauma	1135

SECTION 16 Kidney Disorders**Overview of Kidney Disorders 1140**

Chronic Kidney Disease and Acute Kidney Injury	1144
Dialysis	1154
Glomerular and Autoimmune Kidney Diseases	1161
Glomerular Basement Membrane Disorders and Alport Syndrome	1164
Kidney Stones (Nephrolithiasis)	1167
Nephrotic Syndrome	1171
Renal Metabolic Disorders: Hypophosphatemic Rickets and Hartnup Disorder	1175
Polycystic Kidney Disease	1178
Kidney Transplantation	1180
Urinary Tract Infections	1186

APPENDIX A Basic Nutrition Principles, Nutrients, and Dietary Supplements

Dietary Reference Intakes	1190
Nutrients and Metabolism	1190
Carbohydrates and Fiber	1190
Lipids and Fatty Acids	1191
Proteins and Amino Acids	1194
Minerals	1198
Major Minerals	1198
Trace Minerals	1203

Ultra-Trace Minerals	1204
Less-Studied Ultra-Trace Minerals	1206
Vitamins	1207
Fat-Soluble Vitamins	1207
Water-Soluble Vitamins	1212
Prebiotics, Probiotics, and Synbiotics	1217
Antioxidants	1217
Dietary Supplements: Botanicals and Other Supplements	1221

APPENDIX **B** Nutrition Assessment Tools and Forms

Intake Records	1234
Nutrition Assessment and Documentation Forms	1235
Nutrition-Focused Physical Examination and Micronutrient Deficiencies	1236
Calculation of Energy and Protein Requirements	1239
Biochemical Assessment	1239
Food–Nutrient–Drug Interactions	1250
Clinical Case Documentation	1252

APPENDIX **C** Culturally Sensitive and Inclusive Nutrition Care, Education, and Counseling

Understanding Cultural Humility and Competence	1254
Practice-Based Cultural Humility and Competence	1254
Culturally Sensitive and Inclusive Nutrition Care and Counseling	1256
Nutrition Education and Counseling	1261

APPENDIX

D

The Practice of Nutrition and Dietetics: Nutrition Services and Management

The Practice of Nutrition and Dietetics	1268
Role Definition	1268
Standards of Practice and Standards of Professional Performance	1268
External Standards and Regulations for Safe Practice	1268
Scope of Practice	1268
Nutrition Care Process	1268
Interprofessional Collaboration	1271
Medical Nutrition Therapy and Reimbursement for Services	1271
Continuum of Care	1271
Research and Evidence-Based Practice	1271
Medical Classification Systems	1272
Accountability	1272
Competence and Autonomy	1273
Order-Writing Privileges	1275
Excellence in Practice	1275
Technology	1275
Client Satisfaction	1275
Business and Nutrition Services Management	1276
Consulting and Private Practice	1276
<i>Index</i>	<i>1278</i>

ALPHABETICAL LIST OF TOPICS

- Abetalipoproteinemia, 155
Achondroplasia, 157
Acromegaly, 750
Adolescence, 46
Adrenocortical Insufficiency and Addison Disease, 766
Adulthood, 51
AIDS and HIV Infection, 1105
Alcoholic Liver Disease, 627
Alzheimer Disease and Dementias, 284
Amyotrophic Lateral Sclerosis, 290
Anemia of Inflammation, 902
Anemia of Renal Disease, 907
Anemias in Neonates, 905
Angina Pectoris and Ischemic Heart Disease, 453
Anorexia Nervosa, 342
Aplastic Anemia and Fanconi Anemia, 910
Arteritis and Vasculitis, 456
Ascites and Chylous Ascites, 631
Asthma, 382
Atherosclerotic Cardiovascular Disease, 459
Attention Deficit Disorders, 160
Autism Spectrum Disorder, 163
Autoimmune Inner Ear Disease (Ménière Disease), 113
Avoidant/Restrictive Food Intake Disorder, 347
Bariatric Surgery, 1064
Biliary Atresia, 167
Binge Eating Disorder, 350
Bipolar Disorder, 357
Bleeding Disorders: Hemorrhage and Hemophilia, 946
Bone Cancers, 979
Bone Marrow or Hematopoietic Stem Cell Transplantation, 975
Bowel Surgeries, 1070
Brain Trauma, 293
Brain Tumors, 982
Breast Cancer, 1017
Bronchiectasis, 388
Bronchitis, 391
Bronchopulmonary Dysplasia, 170
Bulimia Nervosa, 352
Burn Injury, 1112
Carbohydrate Metabolic Disorders, 173
Carcinoid Syndrome, 546
Cardiac Cachexia, 465
Cardiomyopathies, 468
Celiac Disease and Gluten Intolerance, 548
Cerebral Aneurysm, 296
Cerebral Palsy, 178
Childhood, 38
Cholangitis, 674
Cholestasis, 676
Choriocarcinoma, 1022
Chronic Kidney Disease and Acute Kidney Injury, 1144
Chronic Obstructive Pulmonary Disease, 394
Chylothorax, 400
Cleft Lip and Palate, 182
Colorectal Cancer, 985
Congenital Heart Disease, 185
Constipation, 553
Copper-Deficiency Anemia, 913
Cor Pulmonale, 402
Cushing Syndrome, 752
Cystic Fibrosis, 404
Cystinosis and Fanconi Syndrome, 189
Dental and Oral Conditions, 93
Depression, 361
Diabetes Insipidus, 755
Diabetes Mellitus, Type 1, 705
Diabetes Mellitus, Type 2 in Adults, 718
Diabetes Mellitus, Type 2 in Children and Teens, 724
Diabetic Gastroparesis, 728
Diabetic Ketoacidosis, 731
Dialysis, 1154
Diarrhea, Dysentery, and Traveler's Diarrhea, 557
Disorders of Consciousness, 298
Diverticular Diseases, 562
Down Syndrome, 191
Dyspepsia, Indigestion, and Bezoar Formation, 525
Dysphagia, 511
Endometrial Cancer, 1025
Enteral Nutrition, 1079
Epilepsy and Seizure Disorders, 301
Esophageal Disorders, 516
Esophageal Varices, 519
Esophageal, Head and Neck, and Thyroid Cancers, 991
Esophagitis, Gastroesophageal Reflux, and Hiatal Hernia, 521
Faltering Growth or Failure to Thrive, 194
Fat Malabsorption Syndrome, 565
Fatty Acid Oxidation Disorders, 198
Fecal Incontinence, 614
Fetal Alcohol Syndrome, 201
Fibromyalgia and Polymyalgia Rheumatica, 837
Folic Acid-Deficiency Anemia, 917
Food Allergy, 130
Food Poisoning and Foodborne Illness, 140
Fractures, 1118
Gallbladder Disease, 679
Gastrectomy and Vagotomy, 527
Gastric Cancer, 996
Gastritis and Gastroenteritis, 530
Gastroparesis and Gastric Retention, 533
Gestational Diabetes Mellitus, 696
Giant Hypertrophic Gastritis and Ménétrier Disease, 535
Glomerular and Autoimmune Kidney Diseases, 1161
Glomerular Basement Membrane Disorders and Alport Syndrome, 1164
Gout, 840
Guillain-Barré Syndrome and the Zika Virus, 305
Heart Failure, 472
Heart or Heart-Lung Transplantation, 479
Heart Valve Disorders, 483
Hemochromatosis and Iron Overload, 949
Hemolytic Anemias, 921
Hemorrhoids, 618
Hepatic Cirrhosis, 638
Hepatitis, 634
Hirschsprung Disease (Congenital Megacolon), 204
HIV Infection, Pediatric, 207
Homocystinuria and Inborn Errors of Cobalamin and Folate, 211
Huntington Disease, 308
Hyperaldosteronism, 770

- Hyperosmolar Hyperglycemic State, 734
 Hyperparathyroidism and Hypercalcemia, 785
 Hypertension, 486
 Hyperthyroidism, 775
 Hypoglycemia, 737
 Hypoglycemia With Hyperinsulinism, 740
 Hypoparathyroidism and Hypocalcemia, 783
 Hypopituitarism, 757
 Hypothyroidism, 779
 Immobilization, 844
 Infant (0 to 6 Months), 28
 Infant (6 to 12 Months), 33
 Inflammatory Bowel Disease: Crohn's Disease, 569
 Inflammatory Bowel Disease: Ulcerative Colitis, 574
 Interstitial Lung Disease, 410
 Intestinal Failure and Transplantation, 577
 Intestinal Fistula, 581
 Intestinal Lymphangiectasia, 583
 Intestinal Parasite Infections, 1122
 Iron-Deficiency Anemia, 923
 Irritable Bowel Syndrome, 586
 Kidney Stones (Nephrolithiasis), 1167
 Lactation, 18
 Lactose Maldigestion, 589
 Leukemias, 1034
 Leukodystrophies, 214
 Liver Cancer, 1000
 Liver Failure, Encephalopathy, and Coma, 645
 Liver Transplantation, 650
 Low Birth Weight or Premature Birth, 217
 Lung Cancers, 1003
 Lung Transplantation, 413
 Lupus, 847
 Lymphomas, 1038
 Macrosomia (Large for Gestational Age), 222
 Malaria and Parasitic Anemias, 929
 Malnutrition in Children and Adults, 819
 Maple Syrup Urine Disease, 225
 Megacolon, 593
 Metabolic Syndrome, 743
 Migraine, 312
 Mucopolysaccharidoses, 228
 Multiple Organ Dysfunction Syndrome, 1127
 Multiple Sclerosis, 316
 Muscular Dystrophy, 851
 Myasthenia Gravis and Neuromuscular Junction Disorders, 319
 Myeloma, 1041
 Myocardial Infarction, 492
 Necrotizing Enterocolitis, 231
 Nephrotic Syndrome, 1171
 Neural Tube Defects: Spina Bifida and Melomeningocele, 234
 Nonalcoholic Fatty Liver Disease, 655
 Nutrition in Aging, 69
 Obesity, Childhood, 238
 Osteoarthritis, 856
 Osteomalacia, 864
 Osteomyelitis, 861
 Osteopenia and Osteoporosis, 867
 Ostomy: Colostomy, 596
 Ostomy: Ileostomy, 599
 Otitis Media, 245
 Ovarian Cancer, 1027
 Overnutrition, Overweight, and Obesity, 798
 Paget Disease (Osteitis Deformans), 873
 Pancreatic Cancer, 1007
 Pancreatic Insufficiency, 658
 Pancreatic Transplantation, 668
 Pancreatitis, Acute, 661
 Pancreatitis, Chronic, 664
 Parenteral Nutrition, 1087
 Parkinson Disease, 322
 Peptic Ulcer Disease, 537
 Pericarditis and Cardiac Tamponade, 496
 Periodontal Disease and Gingivitis, 101
 Peripheral Artery Disease, 499
 Peritonitis, 602
 Pernicious and Vitamin B12-Deficiency Anemias, 933
 Phenylketonuria, 248
 Pheochromocytoma, 772
 Pneumonia, 416
 Polyarteritis Nodosa, 876
 Polycystic Kidney Disease, 1178
 Polycystic Ovarian Syndrome, 763
 Polycythemia Vera, 953
 Prader-Willi Syndrome, 252
 Prediabetes, 701
 Preeclampsia and Hypertension in Pregnancy, 747
 Pregnancy, 7
 Pressure Injuries, 121
 Proctitis, 620
 Prostate Cancer, 1030
 Pulmonary Embolism, 420
 Refeeding Syndrome, 827
 Renal Metabolic Disorders: Hypophosphatemic Rickets and Hartnup Disorder, 1175
 Renal Transplantation, 1180
 Respiratory Distress Syndrome, 423
 Respiratory Failure and Mechanical Ventilation, 425
 Rhabdomyolysis, 878
 Rheumatoid Arthritis, 881
 Rickets, 255
 Ruptured Disk and Radiculopathy, 888
 Sarcoidosis, 429
 Schizophrenia, 365
 Scleroderma and Systemic Sclerosis, 890
 Sensory Impairments: Vision, Coordination, Chewing, Taste, Smell, and Hearing, 106
 Sepsis, 1131
 Short Bowel Syndrome, 604
 Sickle Cell Disease, 937
 Sideroblastic Anemias, 941
 Skin Cancers, 1010
 Skin Disorders, 115
 Sleep and Circadian Rhythm Disorders, 327
 Sleep Apnea, 432
 Small for Gestational Age and Intrauterine Growth Restriction, 258
 Spinal Cord Injury and Paralysis, 330
 Spondyloarthritis, 894
 Sports Nutrition, 79
 Stroke (Cerebrovascular Accident), 335
 Substance Use Disorder and Addiction, 371
 Syndrome of Inappropriate Antidiuretic Hormone, 760
 Tardive Dyskinesia, 375
 Tay-Sachs Disease, 261
 Temporomandibular Joint Dysfunction, 104
 Thalassemias, 943
 Thoracic Empyema, 435
 Thrombocytopenia, 956
 Thromboembolism and Phlebitis, 502
 Trauma, 1135
 Trigeminal Neuralgia, 340
 Tropical Sprue, 610
 Tuberculosis, 437
 Turner Syndrome, 263
 Tyrosinemia, 266
 Undernutrition, 813
 Urea Cycle Disorders, 268
 Urinary Tract Infections, 1186
 Urinary Bladder and Renal Cancers, 1014
 Vegetarianism, 87
 Vitamin Deficiencies, 126
 Vomiting, Pernicious, 543
 Whipple Disease (Intestinal Lipodystrophy), 612
 Wilson Disease, 272
 Zollinger-Ellison Syndrome (Gastrinoma), 671

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PREFACE

The field of nutrition and dietetics continues

to be a focus for health promotion and disease prevention. Evidence-based guidelines have solidified the role of nutrition as therapy for many health conditions, beyond meeting basic daily requirements. The registered dietitian nutritionist (RDN) is expected to provide nutrition care in a practical, efficient, timely, and effective manner regardless of setting. Different environments provide unique and special considerations.

Nutrition and Diagnosis-Related Care has evolved since its first edition in 1985 to serve as a key reference for quickly assimilating and implementing medical nutrition therapy (MNT) through use of the Nutrition Care Process (NCP) in all care settings. This ninth edition updates and clarifies nutrition therapy and guidance throughout. Designed for both students and practitioners, this guide can also be used to write protocols, establish nutrition priorities, and demonstrate cost-effective therapies. Nutrition interventions are presented that may decrease complications, morbidity, and lengthy hospital stays.

The format of the book promotes easy navigation and use. Over 270 conditions are covered in 16 sections, grouped by life stage, diagnosis, or disease state. Because inflammation and the microbiome are major factors in both acute and chronic disorders, this edition continues the **Hot Boxes** to address evolving knowledge related to these important topics. The text is presented with the assumption that the reader has an adequate background in nutrition and food sciences, physiology and pathophysiology, medical terminology, biochemistry, basic pharmacotherapy, and interpretation of biochemical data to best understand the abbreviations, objectives, and interventions in this book. **Appendix A** addresses some basic nutrition principles and nutrients, with corresponding requirements, functions, and food sources.

Key recommendations for navigating and using this text:

1. For each of the 16 sections, **Chief Assessment Factors**—presented as possible signs, symptoms, and related conditions—are important for practitioners to understand when providing nutrition care for the conditions covered. An **Overview** for each section presents basic knowledge and research related to the body system, disease state, or general topic relevant to the conditions covered in that section.
2. **Definitions and Background** for each condition addresses key terms, general information about prevalence, cause, and diagnosis of the disease or disorder, and the role of nutrition intervention. Boxes and tables are designed for quick retrieval of information, and figures are included where appropriate for enhanced understanding.
3. Collecting condition-specific anthropometrics, biochemical indices, clinical/history data, dietary factors, and genetic markers is part of the **Assessment, Monitoring, and Evaluation** section. These categories are critical to implementation of the Nutrition Care Process. Physical changes and signs of

malnutrition should always be noted during assessments and reassessments. **Appendix B** offers helpful nutrition assessment forms and tools, including a guide to performing a nutrition-focused physical exam.

4. The **Intervention** section for each condition provides comprehensive care information, including evidence-based guidelines when available, with key objectives for nutrition care, food and nutrition interventions (weight and energy, macronutrients, micronutrients, and fluid requirements), food-drug-herb interactions, and nutrition education, counseling, and care management. Important factors to keep in mind:
 - a. An individualized drug history review is essential for all patients. Common drugs are included within the text; however, new drugs become available and some drugs may be removed from the market. Check with a pharmacist for the most current perspectives and guidance.
 - b. Herbs, botanicals, and dietary supplements are often used without prior consultation with a dietitian or a physician. They can have side effects as well as real or perceived benefits. Talking to patients about any type of supplement use is critical. Potential benefits and side effects of selected dietary supplements are addressed in Appendix A.
 - c. Nutrition education and counseling are critical components of nutrition care and must be customized for the patient's clinical needs, preferences, and cultural background, as well as food safety education. **Appendix C** addresses practice-based culturally sensitive and inclusive nutrition care, education, and counseling, along with general tips for counseling and behavior change.
5. **Nutrition Care Process Mini Case Studies** are provided for each condition to illustrate how to apply the Nutrition Care Process and standardized language in a practical example.
6. **References** and **For More Information** sections provide support and resources for the material covered for each condition.
7. **Appendix D** offers practice-based resources to address what busy practitioners need to know about nutrition services and management.
8. To complement this text, a current diet manual, such as the Academy's Nutrition Care Manual, should be consulted for developing condition-specific food lists, diet modifications, and sample menu plans.
9. Where genetic testing is available, the skilled RDN can provide personalized nutrition advice that considers the ethical, legal, economic, and social implications for the patient/client and family.
10. It is essential to use current standardized nutrition language, as terms and definitions may change as the profession evolves. Access the latest electronic Nutrition Care Process Terminology (eNCPT) at: www.ncpro.org



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Finally, this book is dedicated to my family (Russ, Matthew, Katie, Lindsay, Zac, Ellie, and our grandchildren) and to students, interns, and colleagues around the globe. As said in Latin, *scientia potentia est*—knowledge is power. We must use our knowledge to make it a better world.

Sylvia Escott-Stump, MA, RDN, LDN, FAND

COMMON ABBREVIATIONS

25(OH)D	25-hydroxyvitamin D, vitamin D2, also known as calcidiol	GFR	glomerular filtration rate
A1C	glycated hemoglobin, glycohemoglobin, HbA1C	GH	growth hormone
AAA	aromatic amino acid	GI	gastrointestinal
a/g ratio	albumin to globulin ratio	Gluc	glucose
ACTH	adrenocorticotrophic hormone	GTT	glucose tolerance test
Alb	albumin	HCl	hydrochloric acid
ALP	alkaline phosphatase	Hct	hematocrit
ALT	alanine aminotransferase	HDL	high-density lipoprotein cholesterol
AST	aspartate aminotransferase	Hgb	hemoglobin
BCAA	branched-chain amino acid	H&H	hemoglobin and hematocrit
BIA	bioelectrical impedance analysis	Ht	height
BMI	body mass index	ICU	intensive care unit
BNP	B-type natriuretic peptide	IF	intrinsic factor
BP	blood pressure	INR	international normalized ratio (coagulation)
BUN	blood urea nitrogen	I&O	intake and output
Ca⁺⁺	calcium	K⁺	potassium
CBC	complete blood count	LDH	lactate dehydrogenase
CHI	creatinine-height index	LDL	low-density lipoprotein cholesterol
Chol or TC	cholesterol, total serum cholesterol	LFT	liver function test
Cl⁻	chloride	LH	luteinizing hormone
CoQ10	coenzyme Q10	MAC	midarm circumference
CPK	creatine phosphokinase	MAMC	midarm muscle circumference
CrCl	creatinine clearance	MCH	mean cell hemoglobin
Creat	creatinine	MCT	medium-chain triglycerides
CRP	C-reactive protein	MCV	mean cell volume
CT	computed tomography	Mg⁺⁺	magnesium
Cu⁺⁺	copper	MRI	magnetic resonance imaging
DXA	dual-energy x-ray absorptiometry	N	nitrogen
ECG, EKG	electrocardiogram	Na⁺	sodium
EEG	electroencephalogram	NFPE	nutrition focused physical exam
FBG	fasting blood glucose	N/V or N&V	nausea and vomiting
Fe⁺⁺	iron	O₂	oxygen
FSH	follicle-stimulating hormone	OGTT	oral glucose tolerance test
		pCO₂	partial pressure of carbon dioxide

PET	positron emission tomography
pO₂	partial pressure of oxygen
PO₄	phosphorus or phosphate
PT	prothrombin time
PTH	parathyroid hormone
RBC	red blood cell count
RBP	retinol binding protein
Se	selenium
SOB	shortness of breath
T3	triiodothyronine
T4	thyroxine
TFN	transferrin
tHcy	total homocysteine
TIBC	total iron-binding capacity
TLC	total lymphocyte count
TP	total protein
Trig (or TG)	triglycerides
TSF	triceps skinfold
TSH	thyroid stimulating hormone
TTR	transthyretin (prealbumin)
UA	uric acid
UBW	usual body weight
UGI	upper gastrointestinal (GI)
UUN	urinary urea nitrogen
Vitamin D2	25-hydroxyvitamin D [25(OH)D], also known as calcidiol
Vitamin D3	physiologically active 1,25-dihydroxyvitamin D [1,25(OH) ₂ D], also known as calcitriol
VLDL	very low-density lipoprotein cholesterol
WBC	white blood cell count
Wt	weight
Zn	zinc

PUBLISHER'S NOTE ON GENDER-INCLUSIVE LANGUAGE

The Academy of Nutrition and Dietetics encourages diversity and inclusion by striving to recognize, respect, and include differences in ability, age, creed, culture, ethnicity, gender, gender identity, political affiliation, race, religion, sexual orientation, size, and socioeconomic characteristics in the nutrition and dietetics profession.¹

As part of our commitment to diversity and inclusion, all new and updated editions of professional books and practitioner resources published by the Academy of Nutrition and Dietetics will transition to the use of inclusive language. As appropriate, gender-neutral language, such as person/persons, individual/individuals, or patient/patients, is used to respect and recognize the spectrum of gender identities, including transgender and nonbinary identities. Where gender or sex is referred to in this book, it is important to note that data on sex assigned at birth or gender identity were not further specified for study participants, and specific recommendations or data for transgender and gender-diverse people were not provided.

Existing guidelines for nutrition assessment and interventions rely primarily on gender-specific values and recommendations. As research continues to explore the unique health and nutrition needs of transgender and gender-diverse people, nutrition and health practitioners can expand their knowledge and understanding by reviewing available resources that provide general guidance for person-centered nutrition care of gender-diverse individuals.²⁻⁴ The use of inclusive language is consistent with the American Medical Association's *AMA Manual of Style*⁵ as well as other health professional groups and government organizations. The Academy of Nutrition and Dietetics will continue to evolve to adopt consensus best practices related to nutrition care of gender-diverse individuals that maximize inclusivity and improve equitable and evidence-based care.

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SECTION 5

Pulmonary Disorders

CONTENTS

<i>Overview of the Pulmonary System</i>	380
Asthma	382
Bronchiectasis	388
Bronchitis	391
Chronic Obstructive Pulmonary Disease	394
Chylothorax	400
Cor Pulmonale	402
Cystic Fibrosis	404
Interstitial Lung Disease	410
Lung Transplantation	413
Pneumonia	416
Pulmonary Embolism	420
Respiratory Distress Syndrome	423
Respiratory Failure and Mechanical Ventilation	425
Sarcoidosis	429
Sleep Apnea	432
Thoracic Empyema	435
Tuberculosis	437

CHIEF ASSESSMENT FACTORS

The following factors are possible signs, symptoms, and related conditions specific to pulmonary disorders of which practitioners should be aware when providing nutrition care to patients with the conditions covered in this section. Additional nutrition-related assessment factors are noted for each condition.

- Altered respirations
- Anorexia
- Blood gases: partial pressures of oxygen and carbon dioxide
- Clubbing of nail beds
- Confusion, somnolence
- Cough, especially with chest pain
- Cyanosis of lips or nail beds
- Dizziness
- Elevated blood pressure
- Engorged eye veins
- Fever or chills
- Flaring nostrils; red, swollen nose
- Hemoptysis (coughing up blood)
- Hoarseness
- Orthopnea, tachypnea
- Pain (chest, abdominal)
- Pallor; ashen or gray coloring
- Poor tolerance of exercise or activity
- Rapid breathing, excessive perspiration
- Restlessness, irritability
- Shortness of breath (dyspnea)
- Stridor (crowing sound on inhalation)
- Wheezing (whistling, musical sound from obstructed airways)

OVERVIEW

THE PULMONARY SYSTEM

The respiratory system involves a complex but effective method for oxygenating tissues and removing carbon dioxide waste. The primary structures include the trachea; bronchial tubes that pass air into the lungs; and bronchioles, which are smaller passages that end in tiny air sacs, the alveoli. Figure 5.1 depicts the respiratory system.

After oxygen is sent to the bloodstream, it goes to the heart and is pumped throughout the body. As the cells use the oxygen, they produce carbon dioxide, which must be returned to the lungs for exhalation. This gas exchange is aided by the muscular diaphragm. In addition, tiny cilia sweep the airways to remove harmful substances. When any of these structural components malfunctions, the respiratory system is compromised. In addition, lung disease can be aggravated by other medical conditions; Figure 5.2 shows some of the comorbidities of chronic lung disorders.

Pulmonary surfactant is a highly active material composed of lipids and proteins that is found in the fluid lining the alveolar surface of the lungs. It protects the lungs from injuries and infections caused by inhaled particles and microorganisms. Biochemical surfactant abnormalities are found in conditions such as asthma, bronchiolitis, chronic obstructive pulmonary disease, lung transplantation, cystic fibrosis, pneumonia, respiratory distress syndrome, pulmonary edema, chronic lung disease of prematurity, and interstitial lung diseases.

A healthy diet provides important nutrients for lung health. Fruits and vegetables protect against airway inflammation (Hosseini et al, 2017). Intakes of vitamins A, C, D, E, and B12; carotenoids; flavonoids; curcumins; resveratrol; magnesium; and omega-3 fatty acids all show protective effects against loss of lung function (Zhai et al, 2018). Flavonoids, such as quercetin and resveratrol, in apples, onions, oranges, berries, and red wine are

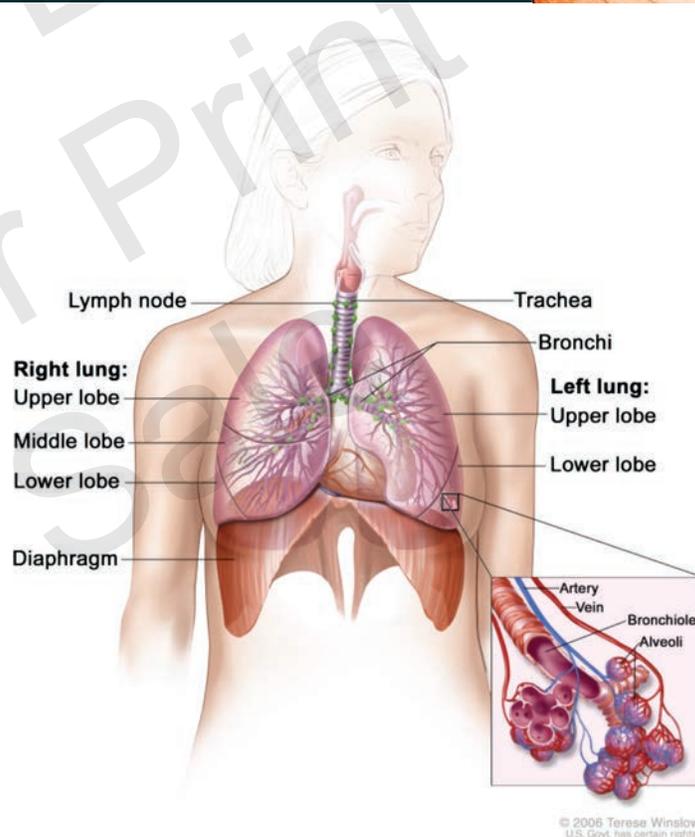


Figure 5.1 The respiratory system

Reproduced from the National Cancer Institute. PDQ Cancer Information Summaries (Internet). Published 2002. Accessed December 1, 2020. www.ncbi.nlm.nih.gov/books/NBK65917/figure/CDR0000062956__292

especially beneficial. Foods rich in vitamin C, β -carotene, selenium, and vitamin E should be included. For example, almonds, mango, sunflower seeds, vegetable oils, and whole grains are good dietary sources of vitamin E.

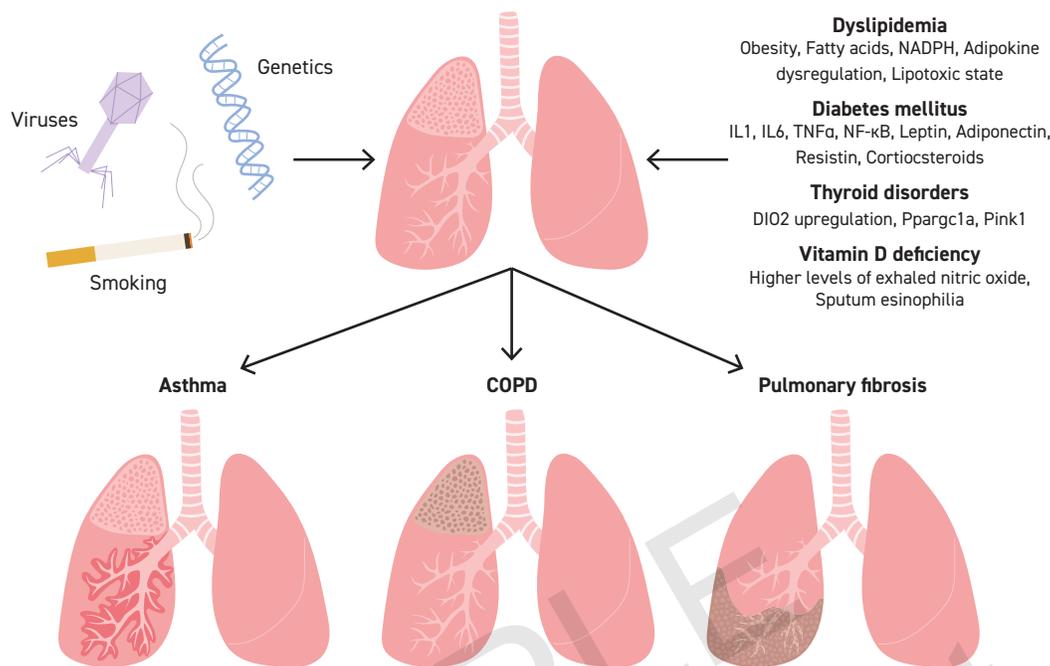


Figure 5.2 Metabolic comorbidities found with chronic lung disorders

Abbreviations: NADPH, Nicotine adenine dinucleotide phosphate hydrogen; IL-1 and IL-6, interleukins; TNF, tumor necrosis factor; NF-κB, nuclear factor kappa B; DIO2, 2-iodothyronine deiodinase; Ppargc1a, peroxisome proliferator-activated receptor gamma coactivator 1-alpha; PINK 1, PTEN-induced putative kinase; COPD, chronic obstructive lung disease.

Adapted under CC BY 4.0 from Papaioannou O, Karampitsakos T, Barbayianni I, et al. Metabolic disorders in chronic lung diseases. *Front Med (Lausanne)*. 2018;4:246.

Box 5.1. Respiratory Quotient and Substrate

The respiratory quotient (RQ) is the ratio of carbon dioxide produced to oxygen consumed while food is being metabolized. It is a measure of fuel used.

$$RQ = \text{CO}_2 \text{ eliminated} / \text{O}_2 \text{ consumed}$$

RQ from fat = 0.7

RQ from protein = 0.8

RQ from carbohydrates = 1.0

Source: Open Anesthesia: Respiratory Quotient – Energy Sources. Accessed December 1, 2020. www.openanesthesia.org/aba_respiratory_quotient_-_energy_sources

Nutrition therapy with high calorie intake helps to maintain and improve muscle strength and exercise tolerance. Dietitians must monitor the intakes of specific macronutrients and micronutrients. In theory, high carbohydrate intake increases carbon dioxide output more than fat intake. In practice, higher-fat specialty pulmonary enteral nutrition formulas have no greater effectiveness than traditional products in reducing time on a ventilator (Brown et al, 2015).

Indirect calorimetry (IC) determines resting energy expenditure in critically ill patients by measuring oxygen consumption and carbon dioxide production (Rehal et al, 2016). When IC is not available, predictive equations are used. Unfortunately, the inaccuracy of the commonly used predictive equations can introduce error in the design of a nutritional therapy regimen (McClave et al, 2013).

Hot Topic: Inflammation

In chronic lung diseases, there is an interplay among genetic predisposition, injurious environmental stimuli, spillover of reactive oxygen species, and pro-inflammatory mediators (Papaioannou et al, 2018). *Inflammasomes* are inflammatory signaling molecules that detect toxic or microbial substances and environmental insults as part of the immune system (Howrylak et al, 2017). When inflammasomes are excessively activated, they can promote chronic inflammation that aggravates severe asthma and chronic obstructive pulmonary disease (Pinkerton et al, 2017). While researchers continue to study the role of inflammation in lung health for all ages, it is important to encourage breastfeeding for early lung development. Human milk contains many immunomodulatory compounds, including oligosaccharides that provide prebiotics to support healthy lungs (Jeurink et al, 2013).

Chronic inflammation leads to undernutrition and pulmonary cachexia (Itoh et al, 2013). The use of corticosteroids also complicates metabolic management and alters quality of life. Box 5.2 lists factors that contribute to malnutrition in this population.

The *respiratory quotient* (RQ) obtained from IC is affected by extremes of substrate use by the body; see Box 5.1. Underfeeding promotes the use of endogenous fat stores, which should decrease the RQ. Overfeeding, which results in lipogenesis, should cause increases in the RQ. Marked increases in carbon dioxide (elevated RQ) in response to overfeeding may cause

Box 5.2. Causes of Malnutrition in Patients With Pulmonary Disease

Aerophagia and rapid breathing	Increased workload of the heart
Anemia (low oxygen-carrying capacity)	Inflammation
Anorexia of chronic illness	Lack of exposure to sunlight (vitamin D)
Cellular hypoxia	Lung cancer
Chronic debility	Malabsorption, as in cystic fibrosis
Decreased lung immunity	Medications causing nausea and anorexia
Decreased lung surfactant and elasticity	Pneumonia
Depression, anxiety with anorexia	Polypharmacy
Difficulty in eating with continuous dyspnea	Poor respiratory muscle strength and endurance
Fever	Restricted diet
Gastric hypomotility	Right-sided heart failure
Hypermetabolism in chronic obstructive pulmonary disease	Tissue hypoxia
Increased mechanical work of breathing	Vitamin deficiency, leading to poor epithelial integrity and weak lung muscles

added respiratory compromise (Rehal et al, 2016). Thus, variation in the RQ in response to the feeding regimen may indicate inappropriate feeding. Dietitians can review the RQ to validate values if metabolic monitors are within the appropriate range (0.67 to 1.3, according to the American Society for Parenteral and Enteral Nutrition). Note that some patients are hypometabolic, contradicting the traditional notion that critical illness increases energy expenditure.

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For More Information

- American Lung Association: Lung Disease Lookup www.lung.org/lung-health-and-diseases/lung-disease-lookup
- Canadian Lung Association www.lung.ca
- National Heart, Lung, and Blood Institute: How the Lungs Work www.nhlbi.nih.gov/health-topics/how-lungs-work

Asthma



DEFINITIONS AND BACKGROUND

Bronchial asthma involves paroxysmal dyspnea accompanied by wheezing and is caused by spasms of the bronchial tubes or swelling of their mucous membranes. Bronchial asthma differs from the wheezing caused by heart failure (*cardiac asthma*), in which

an x-ray shows fluid in the lungs. Exercise-induced bronchospasm is much less common. Box 5.3 lists the warning signs of asthma.

Asthma is the most common chronic lung disease of childhood, affecting approximately 6 million children in the United States (Zahran et al, 2018). Many infants with wheezing have transient conditions that resolve; respiratory syncytial viruses and rhinoviruses are triggers. Children who are exposed to indoor allergens or secondhand smoke may have chronic coughs or symptoms of asthma. Exposure to microbial products in early life, particularly

Box 5.3. Early Warning Signs of Asthma

Head/eyes	Feverish; pale, sweaty face. Blue lips. Dark circles under eyes.
Mouth/throat/nose	Difficulty talking. Shortness of breath. Grunting. Signs of a cold, upper respiratory infection, or allergies (sneezing, runny nose, cough, congestion, sore throat, and headache). Nostrils flaring.
Chest/lungs	Fast heartbeat and rapid breathing; downward trend in peak flow numbers. Severe wheezing when breathing both in and out. Coughing that will not stop. Chest pain or pressure. Tightened neck and chest muscle retractions.
Behavior/mood	Feelings of anxiety or panic. Sleeplessness and fatigue.
Exercise tolerance	Poor tolerance for exercise; sweating; easy fatigue.

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in farm environments, may protect against asthma later (Martínez et al, 2013).

Over 18 million US adults have asthma. Some asthma deaths are attributable to occupational exposures (dust, gases, fumes) in food, beverage, and tobacco product manufacturing and in community and social services occupations (Patel et al, 2018). Thus, awareness and prevention of workplace exposures are important public health measures.

Asthma is inherited in two-thirds of cases. Genome-wide association studies have identified several genes that slightly increase the risk of disease. Two main types of bronchial asthma are recognized: *allergic (extrinsic)* and *nonallergic (intrinsic or infectious)*. The two types have different phenotypes (Takejima et al, 2017). There is a phenotype with overlapping characteristics between asthma and chronic obstructive pulmonary disease (COPD); this *asthma–COPD overlap syndrome* has inflammation as a primary characteristic (Lacedonia et al, 2017).

Severe asthma requires treatment with high-dose inhaled corticosteroids plus another controller. Long-term steroid use can lead to vitamin D deficiency, as well as other side effects, which may include hyperglycemia, increased appetite, and weight gain.

Asthma is considered brittle when there are repeated, severe attacks. Therapy-resistant asthma is different from temporary but severe asthmatic attacks. Every emergency consultation for asthma is considered severe until proven otherwise.

Near-fatal asthma (NFA) is another subtype of asthma with many different causes. NFA may lead to *status asthmaticus (SA)*. SA is severe asthma that does not respond well to immediate care. It requires hospitalization and can be life-threatening. Onset may be gradual, over several days, or sudden. Respiratory failure can lead to hypoxia, carbon dioxide retention, and acidosis. Fungal exposure is one risk factor, such as inhalation of the yeast *Candida albicans* or fungal overgrowth, which may result from the use of broad-spectrum antibiotics and high-dose glucocorticoids.

Dietary antioxidants (vitamin E, vitamin C, carotenoids, selenium, and polyphenols), polyunsaturated fatty acids (PUFAs), and vitamin D are protective, but not in supplemental forms. An enriched diet containing vitamin E, vitamin C, β -carotene, and phenolic substances may reduce disease-related oxidative stress.

Increased serum vitamin A and 25-hydroxyvitamin D3 levels are associated with good pulmonary function and good quality of life in children with stable asthma (Bai et al, 2018). For chronic cases, intravenous treatment with multiple nutrients may be of benefit; pulmonary function improves progressively with longer treatment. Box 5.4 lists various nutrients for overall lung health and asthma prevention.

The vitamin D pathway is involved in maintaining lung health. Poor asthma control in pregnancy is strongly associated with the onset of childhood asthma in the offspring. If a pregnant person is at risk of having a child with asthma, supplementation with 4,400 IU of vitamin D per day may be warranted (Litonjua et al, 2016). Pregnant persons should also increase consumption of foods rich in vitamin E, selenium, zinc, and PUFAs (Grieger et al, 2013).

Obese children are at increased risk of developing asthma. Greater airflow obstructions are noted with obesity. Dietary excess is an inflammatory stimulus (Papoutsakis et al, 2013). Asthmatic symptoms can be controlled by avoiding or reducing exposure to asthma triggers (allergens and irritants) and by following recommendations for asthma education and appropriate medical care (Zahrán et al, 2018). Sublingual immunotherapy is moderately effective for allergic asthma (Lin et al, 2013). A multidisciplinary approach is required.



ASSESSMENT, MONITORING, AND EVALUATION

See Appendix B for support information.

ANTHROPOMETRICS

- Height
- Weight
- BMI
- Fat-free mass index

Box 5.4. Nutrients and Their Potential Mechanisms in Asthma

Nutrient	Activity and Potential Mechanisms of Effect
Carotenoids, vitamins C and E	Antioxidants for protection against endogenous and exogenous oxidant inflammation
Vitamin C	Prostaglandin inhibition
Vitamin D	Modulation of T-cell responses
Vitamin E	Membrane stabilization; inhibition of immunoglobulin E production
Flavones, flavonoids	Antioxidants; mast cell stabilization
Magnesium	Smooth muscle relaxation; mast cell stabilization
Selenium	Antioxidant cofactor in glutathione peroxidase
Copper, zinc	Antioxidant cofactors in superoxide dismutase; zinc modulates T-cell responses
Omega-3 fatty acids	Leukotriene substitution, stabilization of inflammatory cell membranes. Polyunsaturated fatty acids modulate T-cell responses
Omega-6 polyunsaturated/trans fatty acids	Increased eicosanoid production; increased inflammation and worsening of respiratory function
Sodium	Increased smooth muscle contraction; reduced intake may increase airway responsiveness

BIOCHEMICAL

- Alb, TTR
- Bilirubin (total, direct)
- Ca⁺⁺, Mg⁺⁺
- Chol, Trig
- CRP
- Fe⁺⁺, ferritin
- Gluc
- H&H
- pCO₂, pO₂
- TFN
- UA
- Vitamin D3

CLINICAL/HISTORY

- Allergy testing
- Anxiety
- BP; hypotension
- Breath sounds (decreased)
- Cough (hard, dry)
- Cyanosis
- Dehydration
- Distended neck veins
- Gastroesophageal reflux disease
- Nasal polyps
- Pulmonary edema
- Respiratory rate (elevated)

- Spirometry test
- Tachycardia
- Temperature
- Wheezing, audible

DIETARY FACTORS

- Allergies to food, sulfites
- Anorexia, nausea
- Diet and nutritional history
- I&O

GENETIC MARKERS

Haplotype HLA-DPA1*03 DQA*05 is associated with allergic asthma, whereas the simultaneous presence of HLA-DPA1*03 and absence of HLA-DQA*05 is associated with nonallergic asthma (Takejima et al, 2017).

INTERVENTION

OBJECTIVES

General

- Prevent distention of the stomach from large meals, resulting in distress, gastrointestinal reflux, or aggravation of asthma.
- Promote improved resistance against infection and inflammation.

Hot Topic: Inflammation

Asthma involves inflammation of the lining of the airways, obstruction, and increased airway sensitivity. Breastfeeding provides immunological protection while the infant's immune system is immature. Longer-duration breastfeeding is more protective. Surfactant protein D is an innate immune molecule that also protects against inflammation (Qaseem et al, 2013).

Recent research has focused on *inflammasomes*, intracellular innate immune multiprotein complexes that form following interactions with noxious stimuli. Activated inflammasomes release the cytokine interleukin-1 β , which initiates acute-phase pro-inflammatory responses (Pinkerton et al, 2017). Chronic inflammation then leads to conditions such as asthma.

Later in life, diet affects the pathophysiology of asthma by altering immunity, antioxidant activity, and airway inflammation. Fiber is fermented to short-chain fatty acids that bind G-protein-coupled receptors for gut homeostasis and regulation of inflammatory responses (McKenzie et al, 2017). Gut microbial dysbiosis is associated with malfunctioning of the immune responses to these short-chain fatty acids.

- For allergic asthma, identify and control allergen exposure from the environment.
- Encourage a health maintenance program, including physical activity when possible.

Weight and Energy

Correct weight problems if needed. Obesity and overweight may lead to less effective therapy from inhaled corticosteroid treatments.

Protein, Carbohydrate, and Fat

- Optimize nutritional status; modify macronutrient intake as appropriate.
- Increase omega-3 fatty acids if tolerated.

Vitamins and Minerals

Ensure adequate food sources of vitamins C, B6, D, and E; selenium; and magnesium.

Fluids

Promote adequate hydration to liquefy secretions.

FOOD AND NUTRITION

- Promote exclusive breastfeeding of infants to reduce the risk of asthma in susceptible families.
- Provide balanced, small meals that are nutrient dense (high-quality protein, vitamins, and minerals) to reduce risk of infections.
- Encourage weight loss through reduced energy intake if needed.

- Encourage extra fluids unless contraindicated.
- Promote use of caffeinated beverages in adults. Caffeine relaxes muscles and opens the airways; 2 to 3 cups of coffee daily can be helpful.
- Theobromine in cocoa tends to increase blood flow to the brain and reduce coughing.
- Highlight foods rich in vitamins A and C, magnesium, and zinc. Use more broccoli, grapefruit, oranges, sweet peppers, kiwi, tomato juice, and cauliflower for vitamin C.
- Encourage use of quercetin from apples, pears, onions, oranges, and berries (five or more servings per week). Other nutrients that support immunocompetence should also be included.
- Omit specific food allergens for children if identified, such as milk, eggs, seafood, tree nuts, peanuts, fish, wheat, or soy. For adults, tree nut, peanut, fish, and shellfish allergies tend to persist and may aggravate some forms of asthma.
- Offer a salicylate-free diet for those individuals who have a medically documented aspirin-exacerbated response to salicylates. About 7% of asthmatics experience this condition (Rajan et al, 2015). Many fruits and some vegetables, spices, and nuts contain salicylates. Because the diet can be very restrictive, referral to an allergy clinic may be needed.
- Sulfite sensitivity is seen in 5% to 10% of people with asthma, especially adults with severe disease (More, 2018). In these cases, sulfite-containing foods or beverages should be avoided. The highest levels are found in dried fruits, bottled lemon and lime juices, wine, molasses, and sauerkraut (More, 2018).
- Omega-3 fatty acids from fish oils, walnuts, and flaxseed are useful. Intake of fish two to three times per week may reduce leukotriene synthesis (Yang et al, 2013).
- If tolerated, encourage consumption of nuts to increase vitamin E intake; Brazil nuts also contain selenium.

FOOD-DRUG-HERB INTERACTIONS

Common Drugs and Nutrition Implications

- β_2 agonists are considered the most effective agents; intermittent use is recommended.
- Box 5.5 highlights commonly used medications and their potential side effects.

Supplements, Herbs, and Botanicals

- Many patients with asthma use alternative therapies. Antioxidant and natural anti-inflammatory and immunomodulatory remedies may prove beneficial.
- Originating as a traditional Chinese medicine formula, a combination of three herbal extracts (called antiasthma simplified herbal medicine intervention or ASHMI) may be used in antiasthma intervention. Seaweed may be used to treat asthma in Vietnamese and oriental cultures. No clinical trials have proven their efficacy in asthma.
- Dietary fatty acids such as γ -linolenic acid (also sold as the supplement borage seed oil) modulate endogenous inflammatory mediators without side effects.

Box 5.5. Medications Used in Asthma

Medication	Description and Potential Side Effects
Antibiotics	Long-term use can cause diarrhea and other gastrointestinal distress. Penicillin should not be taken with fruit juices.
Anticholinergics (ipratropium bromide [Atrovent HFA, Combivent Respimat])	Quick-relief asthma medications. Dry mouth is common side effect.
β -Agonists (metaproterenol, albuterol, levalbuterol, salbutamol)	Relax smooth muscles around airways. Side effects include shakiness, rapid heart rate, nervousness, and elevated blood glucose. Metaproterenol sulfate (Metaprel, Alupent) may alter taste and cause nausea or vomiting. Albuterol (Ventolin HFA, Proventil HFA) may have cardiac side effects or may cause nausea or diarrhea.
Bronchodilators (theophylline [Theo-Dur, Slo-Bid, Slo-Phyllin, Theolair, Uniphyll])	No longer the first choice for asthma. Nausea, vomiting, and sleeplessness are potential side effects. Theophylline metabolism is affected by protein and carbohydrate availability; avoid extreme changes in protein and carbohydrate intake. Because caffeine is a methylxanthine, avoid extreme variations in intake. Theophylline depresses levels of vitamin B6.
Corticosteroids (methylprednisolone [Medrol], prednisone [Deltasone], prednisolone [Orapred, Prelone])	Many side effects, including fluid retention, low serum potassium, gastrointestinal distress, excess sodium retention, and hyperglycemia. Monitor carefully, especially if used over a long period of time. Flunisolide (AeroBid) contains an anti-inflammatory steroid and is inhaled; it may cause nausea, vomiting, or diarrhea. Bone mineral density is often decreased after long-term use of inhaled corticosteroids.
Epinephrine	May be required for emergencies. Intravenous administration of epinephrine results in a prolonged increase in resting energy expenditure as measured by respiratory quotient.
Expectorants	Potassium iodide loosens congestion by helping the lungs secrete thinner mucus. Potassium iodide should not be used by pregnant persons or individuals who have hyperthyroidism.
Long-term control medications	<p>Anti-immunoglobulin E reduces histamine release; may be useful with allergic form of asthma.</p> <p>Combination therapy (fluticasone propionate/salmeterol [Advair]) combines an inhaled corticosteroid with a long-lasting β_2 agonist to provide consistent relief for people with asthma.</p> <p>Cromolyn (Intal) and nedocromil (Tilade) are inhaled medications that are useful for asthma triggered by cold weather, exercise, and allergies.</p> <p>Inhaled nasal steroids, such as flunisolide (AeroBid), triamcinolone acetonide (Azmacort), fluticasone propionate (Flovent), budesonide (Pulmicort), and beclomethasone dipropionate HFA (Qvar), prevent inflammation and reduce swelling inside airways; they also reduce mucus production.</p> <p>Leukotriene modifiers, such as zafirlukast (Accolate), montelukast (Singulair), and zileuton (Zyflo) relax the smooth muscle around airways and reduce inflammation.</p> <p>Salmeterol xinafoate (Serevent), fluticasone propionate/salmeterol inhalation powder (Advair), and formoterol fumarate (Oxis Turbuhaler, Foradil Aerolizer) can worsen asthma or cause death. Formoterol may deplete potassium levels and cause heart palpitations.</p>
Omega-3 fatty acid supplements	Omega-3 fatty acid supplements may decrease inflammation and improve lung function in adults with asthma, but there is no conclusive evidence for quantity, type, or frequency of use.

Sources:

- Drugs.com. Medications for asthma. Accessed December 1 2020. www.drugs.com/condition/asthma.html
- Mayo Clinic. Asthma medications: know your options. Updated September 26, 2018. Accessed December 1, 2020. www.mayoclinic.com/health/asthma-medications/AP00008
- DerSarkissian C. Asthma Medications. WebMD. Accessed December 1, 2020. www.webmd.com/asthma/guide/asthma-medication

- Ephedra (ma huang) is an effective bronchodilator, but it increases blood pressure significantly. Problems with blood glucose, arrhythmias, increased heart rate, and central nervous system stimulation can also occur. The US Food and Drug Administration has removed ephedra from the market, but some forms are still available.
- St. John's wort can inhibit theophylline's effectiveness.

NUTRITION EDUCATION, COUNSELING, CARE MANAGEMENT

- Mild, chronic asthma can be a warning; if untreated, it can lead to acute exacerbation. Encourage patients to contact their medical provider.

- Pregnant persons, with or without asthma themselves, should be taught how to include good dietary sources of antioxidants, vitamin D, and omega-3 fatty acids.
- Waiting to introduce solids to an infant does not necessarily protect against the onset of asthma and allergy.
- All medications should be taken as directed by the physician. An emergency pack often contains a rescue inhaler and, if needed, an epinephrine injection device and a chewable antihistamine tablet.
- Work with the patient and family to avoid precipitating triggers, such as pet dander, food allergens, and secondhand smoke. Discuss exercise, rest, and nutrition.
- Interventions for obese children should encourage daily physical activity, weight loss, correction of any nutrient deficiencies, and monitoring of complications such as hypertension and sleep apnea.
- Massage therapy enhances relaxation, decreases anxiety, and promotes better lung function.

Patient Education—Foodborne Illness

Careful food handling and hand washing are essential.

NUTRITION CARE PROCESS MINI CASE STUDY

Excessive Carbohydrate Intake

Assessment Data

12-year-old male with asthma. BMI^a >90th percentile for age. Complains of heartburn and GERD^b after meals. Asthma triggered by allergies. Diet history showing frequent intake of 2 desserts every day and an average of 4 high-sugar snacks between meals (candy, cookies, chocolate-covered pretzels). Mom reports that the patient does not always eat all of his main meals secondary to feeling full from the snacks that he eats. He also consumes only ~4 servings of fruit weekly.

Nutrition Diagnoses (PES)

Excessive carbohydrate intake related to undesirable food choices as evidenced by BMI >90th percentile for age and dietary recall

Interventions

Food and nutrient delivery: Encourage a decreased simple carbohydrate diet: reduce number of desserts to no more than 1 daily, encourage substitution of whole fruit and other healthy snacks for high sugary snacks.

Education: Discuss appropriate energy intake for age and activity. Educate about the role of weight management and asthma.

Counseling: Counsel on simple, low-sugar alternative snacks with a mix of protein, carbohydrates, and fats. Provide recipes for healthy snacks. Encourage behavioral change from 2 desserts each day to increased intake of whole fruit.

Coordination of care: Collaborate with interdisciplinary team (endocrinology to check blood sugar levels and HbA1c^c as patient is at risk for diabetes).

Monitoring and Evaluation

Monitoring: Quality of meals/snacks in 24 hours: Observe mealtime behavior, patient tries new foods to substitute high-sugar snacks (dislikes strawberries but likes apples, enjoys peanut butter on crackers), consumes 1 dessert and 1 high-sugar snack, overall improved quality of intake at main meals.

Evaluation: *After 3 months:* BMI 85th percentile. Consumes 1 dessert daily. Consumes 2 healthy snacks in between meals consisting of a complex carbohydrate and protein (whole fruit with cheese, whole grain crackers with peanut butter, etc). Patient reports improved confidence in choosing healthier snack options and trying new healthy foods.

^aBMI = body mass index

^bGERD = gastroesophageal reflux disease

^cHbA1c = glycated hemoglobin

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For More Information

- Allergy & Asthma Network
www.allergyasthmanetwork.org
- American Academy of Allergy, Asthma & Immunology
www.aaaai.org
- Asthma and Allergy Foundation of America
www.aafa.org/asthma
- Mayo Clinic: Asthma
www.mayoclinic.org/diseases-conditions/asthma/symptoms-causes/syc-20369653
- Medline Plus: Asthma
<https://medlineplus.gov/asthma.html>
- National Asthma Education and Prevention Program (NAEPP)
www.nhlbi.nih.gov/science/national-asthma-education-and-prevention-program-naepp
- National Heart, Lung, and Blood Institute: Asthma
www.nhlbi.nih.gov/health-topics/asthma
- National Jewish Health: Asthma
www.nationaljewish.org/healthinfo/conditions/asthma

Bronchiectasis



DEFINITIONS AND BACKGROUND

Bronchiectasis (BX) is an irreversible thickening of portions of the bronchi resulting from inflammation or infection that damages the bronchial wall. It may occur with recurrent bronchitis or pneumonia. Formerly regarded as a rare disease, BX was underdiagnosed and is actually quite common (Chalmers et al, 2015).

The typical acquired cause is acute respiratory illness in patients with chronic obstructive pulmonary disease. Other causes include cystic fibrosis, measles, whooping cough, tuberculosis, fungal infection, inhaled object, lung tumor, ciliary dyskinesia, immunoglobulin deficiency syndromes, rheumatoid arthritis, ulcerative colitis, HIV infection, and heroin abuse.

BX secondary to primary immunodeficiency in childhood is not always progressive. It is possible to slow its progression with appropriate treatment. Mucus stasis causes bacterial colonization, requiring therapies that enhance airway clearance (McShane et al, 2013). Non-cystic fibrosis bronchiectasis (NCFB) is a cause of significant morbidity in adults (McShane et al, 2013). In NCFB, airway obstruction changes over time.

Relapse can be controlled with antibiotics, chest physiotherapy, inhaled bronchodilators, proper hydration, and good nutrition. Two disease-specific clinical prediction tools have been developed: the Bronchiectasis Severity Index and the FACED score stratify patients into severity risk categories (McDonnell et al, 2016). The FACED tool evaluates forced expiratory volume, age, chronic colonization (usually *Pseudomonas*), extension (spread), and dyspnea.

Treatment goals include pathogen eradication, as well as long-term management of antibiotics, anti-inflammatories, mucoactive drugs, and bronchodilators (Polverino et al, 2017). There is a benefit to long-term macrolide therapy with pulmonary rehabilitation

(Chalmers et al, 2015). Self-management programs also have merit (Kelly et al, 2018). However, surgical resection or bilateral lung transplantation may eventually be needed to improve quality of life.



ASSESSMENT, MONITORING, AND EVALUATION

See Appendix B for support information.

ANTHROPOMETRICS

- Height
- Weight history
- BMI

BIOCHEMICAL

- Alb, TTR
- BUN, Creat
- Ca⁺⁺, Mg⁺⁺
- Chol, Trig
- CRP
- Fe⁺⁺, ferritin
- Gluc
- H&H
- Na⁺, K⁺
- pCO₂, pO₂
- RBP
- TFN
- UA

Hot Topic: Inflammation

Mucociliary dysfunction is implicated in bronchiectasis (Shoemark et al, 2013). Disruption of the lung microbial ecosystem by infection, inflammation, or antibiotic therapy creates dysbiosis. The resulting excessive natural killer cell activation creates a highly inflammatory lung environment (Boyton et al, 2013). Eicosanoids are inflammatory modulators, and thromboxanes and leukotrienes tend to be potent mediators of inflammation. Omega-3 fatty acids may be useful to ameliorate inflammation.

CLINICAL/HISTORY

- Bloody sputum
- BP
- Breath sounds (decreased)
- Chest high-resolution CT
- Chest x-ray
- Chronic cough
- Early-morning paroxysmal cough
- Fatigue
- Fever
- Pneumonia
- Respiratory rate (altered)
- Skin (pale or blue)
- SOB
- Sputum culture: profuse, foul, or purulent
- Weight loss

DIETARY FACTORS

- Anorexia
- Diet and nutritional intake history
- Food intake pattern
- I&O

GENETIC MARKERS

Congenital BX usually affects infants and children and is related to problems with lung development but is not genetic in origin. It has a gene–environment relationship.



INTERVENTION

OBJECTIVES

- Improve weight status, when necessary.
- Support lung function with antioxidant foods.
- Improve physical functioning and quality of life.

General

- Promote recovery through airway mucus clearance and adjunctive therapies.
- Avoid fatigue associated with mealtimes.

Weight and Energy

Correct unintended weight loss. Support growth in children.

Protein, Carbohydrate, and Fat

Optimize nutritional status to prepare patient for surgery, if necessary.

Vitamins and Minerals

Correct any nutrient deficiencies.

Fluids

Prevent or correct dehydration.

FOOD AND NUTRITION

- Use a diet with extra protein and calories to meet elevated metabolic requirements, as appropriate for age and sex.
- Small, frequent feedings are better tolerated. Use oral nutritional supplements if intake is poor.
- Fluid intake of 2 to 3 L daily is important for thinning of mucus, unless contraindicated for other medical reasons.
- Intravenous lipid emulsions may be beneficial if the patient requires long-term parenteral nutrition.
- Promote use of the Mediterranean diet (Oliveira et al, 2014).
- Enhance intake of omega-3 fatty acids by including salmon, tuna, sardines, walnuts, and flaxseed. Supplements may also be useful.
- Offer foods rich in potassium, vitamins C and E, and selenium.

FOOD-DRUG-HERB INTERACTIONS

Common Drugs and Nutrition Implications

- Low-dose, chronic macrolide therapy decreases exacerbation frequency and airway inflammation (Melani et al, 2018).
- Inhaled antibiotics such as azithromycin reduce the bacterial burden (McShane et al, 2013). For patients with NCFB, long-term inhaled antibiotics can effectively reduce the bacterial density of the sputum but may result in a higher risk of wheeze and bronchospasm (Yang et al, 2016).
- Expectorants help bring up the mucus. Mucus thinners help make it easier to cough.
- Bronchodilators open the airways, and corticosteroids reduce airway swelling and inflammation. Monitor side effects according to the specific drugs used.

Supplements, Herbs, and Botanicals

No clinical trials have proven the efficacy of herbs or botanicals in BX.

NUTRITION EDUCATION, COUNSELING, CARE MANAGEMENT

- Discuss the role of nutrition in health and recovery. Emphasize quality proteins and nutrient-dense foods, especially if the patient is anorexic.
- Emphasize fluid intake, perhaps juices or calorie-containing beverages instead of plain water if nutritional intake is poor.

- Discuss healthy food choices: olive oil, fruits, vegetables, and foods containing omega-3 fatty acids.

Patient Education—Foodborne Illness

Careful food handling and hand washing are essential.

NUTRITION CARE PROCESS MINI CASE STUDY

Inadequate Fluid Intake

Assessment Data

A 57-year-old female with bronchiectasis. Upon physical examination, patient is found to have significantly poor skin turgor. She has lost ~7 lb (3.2 kg), 5% from her UBW^a of 130 lb (59.1 kg), over the past month. The patient has chronic coughing, making drinking liquids difficult. She drinks only 1–2 cups of water daily and complains of dry mouth and constipation. Upon reviewing I&O,^b the patient is found to have a total urine output of <200 mL over the past 24 hours. Her urine has been dark yellow colored.

Nutrition Diagnoses (PES)

Inadequate fluid intake related to difficulty drinking beverages as evidenced by poor skin turgor, dry mouth, an intake of less than 2 cups fluid daily, and a total urine output of <200 mL over the past 24 hours

Interventions

Food and nutrient delivery: Ensure patient is receiving 2 drink servings (eg, 1 iced tea and 1 orange juice) with each meal tray, add extra fluid to foods, and start IV^c fluids with NaCl^d until oral fluid intake ≥6 cups fluid daily.

Education: Discuss appropriate fluid intake for age and activity. Educate about the role of optimal fluid intake and management of

skin turgor, dry mouth, and urine/stool patterns. Discuss which foods have a high water content.

Counseling: Counsel on adding fluid to solid foods and choosing beverage options that patient enjoys. Provide recipes for adding fluid to solid foods (soups, thinning gravies/sauces with water, adding milk to casseroles, etc). Encourage behavioral change from 1–2 cups fluid each day to ≥8 cups.

Coordination of care: Collaborate with interdisciplinary team (nursing to ensure adequate fluid intake and monitoring/documentation of urine output and coloration; speech–language pathologist to evaluate for possible aspiration risk/swallowing function secondary to coughing and possible need for thickened liquids; primary care physician to help manage coughing).

Monitoring and Evaluation

Monitoring: Quality of intake in 24 hours: IV fluids with NaCl is started, patient drinks 3 cups of fluid (iced tea, orange juice, water), and medications are prescribed to aid with coughing.

Evaluation: After 3 months: Patient drinks at least 8 cups of fluid daily. Patient reports fewer episodes of coughing and dry mouth, appropriate skin turgor, urine light yellow colored and output >800 mL daily, and improved bowel movements.

^aUBW = usual body weight

^bI&O = intake and output

^cIV = intravenous

^dNaCl = sodium chloride

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For More Information

- American Lung Association: Learn about Bronchiectasis www.lung.org/lung-health-and-diseases/lung-disease-lookup/bronchiectasis/learn-about-bronchiectasis
- Merck Manual: Bronchiectasis www.merckmanuals.com/professional/pulmonary-disorders/bronchiectasis-and-atelectasis/bronchiectasis

- National Heart, Lung, and Blood Institute: Bronchiectasis www.nhlbi.nih.gov/health-topics/bronchiectasis

Bronchitis



DEFINITIONS AND BACKGROUND

Bronchitis is inflammation of the air passages. Acute bronchitis is an acute respiratory infection that is manifested by cough and sputum production that lasts for no more than 3 weeks. The acute form may follow a cold or other upper respiratory infection, producing hemoptysis, sore throat, nasal discharge, slight fever, cough, and back and muscle pain. Figure 5.3 depicts the effects of bronchitis on the airways of the lungs.

Causes include viruses; exposure to strong acids, ammonia, or chlorine fumes; and exposure to air pollution, ozone, or nitrogen dioxide. Bacterial causes are rare; antibiotics when not needed could do more harm than good. Risks for acute bronchitis are much higher in smokers. Implementation of a decision support strategy for acute bronchitis is suggested (Gonzales et al, 2013).

Acute viral bronchiolitis differs from bronchitis. It is a common respiratory infectious disease of infancy. Respiratory syncytial virus is the main causative agent (Jartti et al, 2017). Infants with bronchiolitis who receive high-flow oxygen therapy improve faster than those who receive standard oxygen therapy (Franklin et al,

2018). Longer duration of breastfeeding is also associated with better clinical outcomes. If enteral nutrition is required, monitor for aspiration or for interruptions that decrease total nutritional intake (Sochet et al, 2017).

Chronic bronchitis can result in breathing difficulty, wheezing, blueness, fits of coughing, and sputum production. Chronic bronchitis is diagnosed when a cough and mucus are present most days for at least 3 months a year for 2 years in a row; it is one form of chronic obstructive pulmonary disease.



ASSESSMENT, MONITORING, AND EVALUATION

See Appendix B for support information.

ANTHROPOMETRICS

- Height
- Weight
- Weight changes
- BMI

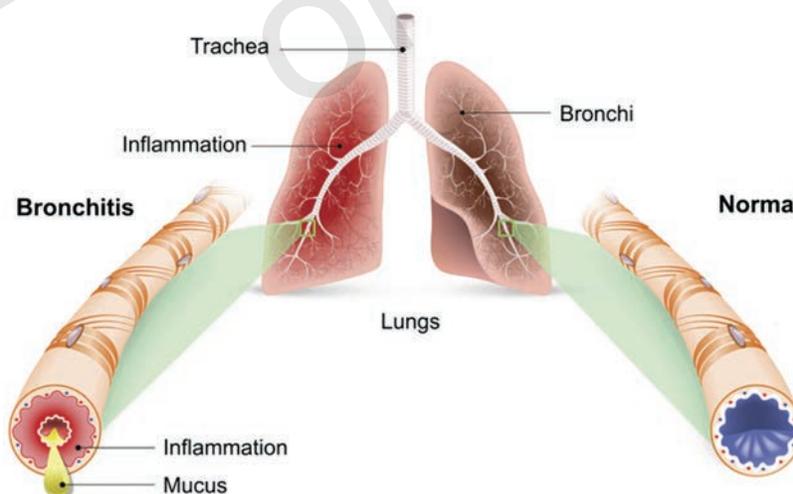


Figure 5.3 Bronchitis

Reproduced from Centers for Disease Control and Prevention. Accessed December 1, 2020. www.cdc.gov/antibiotic-use/community/images/bronchitis-lg.jpg

BIOCHEMICAL

- Alb, TTR
- Ca⁺⁺, Mg⁺⁺
- Fe⁺⁺
- Gluc
- H&H
- Na⁺, K⁺
- O₂ saturation

CLINICAL/HISTORY

- Breathing difficulty
- Chest x-ray
- Dehydration
- Edema
- Productive cough lasting longer than 3 weeks
- Sputum (green or yellow)

DIETARY FACTORS

- Anorexia, nausea
- Dietary and nutritional intake
- I&O

GENETIC MARKERS

Tachykinins neurokinin receptors, substance P, T lymphocytes, and neurokinin A appear to influence human airway health and susceptibility to bronchitis.



INTERVENTION

OBJECTIVES

General

- Normalize body temperature when there is fever. Basal needs are increased with each degree of fever.
- Allow ample rest before and after meals or enteral feedings.
- Relieve discomfort from shortness of breath.
- Prevent or correct pneumonia.

Weight and Energy

Achieve or maintain a healthy body weight.

Protein, Carbohydrate, and Fat

Promote intake from a healthy diet. A typical Western diet rich in saturated fat and protein may increase the risk of respiratory disease in children (Lin et al, 2016).

Vitamins and Minerals

- Replenish nutrients depleted in respiratory distress.
- Support lung function through consumption of high-antioxidant foods.

Fluids

Prevent complications such as dehydration. Avoid infections; extra fluids are needed.

FOOD AND NUTRITION

- Provide a regular or high-calorie diet, specific to the patient's needs.
- Although milk does not thicken mucus secretions, skim milk may be preferred and is important for adequate calcium consumption.
- A healthy diet should be recommended, highlighting fruits and vegetables. Include foods rich in vitamins C and E, selenium, and potassium.
- Increase intake of fluids (2 to 3 L), unless contraindicated.
- Omega-3 fatty acid intake may be beneficial to reduce inflammation.
- A reduced energy intake may be needed after the acute phase to promote weight loss, achieve a desirable body mass index, and promote a healthier level of respiratory functioning.

FOOD-DRUG-HERB INTERACTIONS

Common Drugs and Nutrition Implications

- Methylated xanthines (methylxanthines) include caffeine, theophylline, and theobromine (Monteiro et al, 2016). They promote bronchodilation. Bronchodilators can cause gastric irritation if not taken with milk or food.
- Theophylline can be toxic, so serum levels must be monitored regularly. This drug interacts with antibiotics, birth control pills, anticonvulsants, antacids, and other medications. Avoid caffeine from coffee, tea, cocoa, yerba mate, and cola unless the physician permits.
- Generalized use of antibiotics for the treatment of acute bronchitis is not justified. There is limited evidence of clinical benefit (Smith et al, 2017).
- Inhaled saline is more effective than inhaled racemic adrenaline (Skjerven et al, 2013).

Supplements, Herbs, and Botanicals

- No clinical trials have proven the efficacy of eucalyptus, mullein, horehound, stinging nettle, or marshmallow in bronchitis.
- Belladonna leaf and root are respiratory antispasmodic agents. They should not be used with tricyclic antidepressants, some antihistamines, phenothiazines, or quinidine. Sedation, dry mouth, and difficult urination may occur.

NUTRITION EDUCATION, COUNSELING, CARE MANAGEMENT

- Explain to patient that adequate hydration is one of the best ways to liquefy secretions. The doctor may suggest use of saline nose sprays, cough syrup, and other products.
- Encourage patient to maintain body weight within a healthy range.
- Promote a healthy diet that includes a balance of nutrients, with antioxidant-rich foods.

Patient Education—Foodborne Illness

Careful food handling and hand washing are essential to reduce exposure to viruses and bacteria.

NUTRITION CARE PROCESS MINI CASE STUDY

Inadequate Fluid Intake

Assessment Data

An 81-year-old male with bronchitis admitted from long-term care facility. Upon physical examination, patient is found to have significantly poor skin turgor. He has lost ~11 lb (5 kg), 7% from his UBW^a of 164 lb (74.5 kg), over the past 3 months. The patient also has dementia and signs of altered mental status, making fluid intake difficult for him to remember to drink liquids. He drinks only 1 cup of juice in the morning, 1 cup of milk at lunch, and 1 cup of water at dinner. He complains of dry mouth, constipation, and fatigue. Upon reviewing I&O,^b the patient is found to have a total urine output of <300 mL over the past 24 hours. His urine has been dark yellow colored.

Nutrition Diagnoses (PES)

Inadequate fluid intake related to dementia as evidenced by poor skin turgor, dry mouth, constipation, an intake of 3 cups of fluid daily, and a total urine output of <300 mL over the past 24 hours

Interventions

Food and nutrient delivery: Ensure patient is receiving 2 drink servings (eg, 1 iced tea and 1 orange juice) with each meal tray, add extra fluid to foods, and start IV^c fluids with NaCl^d until oral fluid intake ≥ 6 cups fluid daily. Provide assistance with meals.

Education: If mental status improves, have discussion about appropriate fluid intake for age and activity. Educate about the role of optimal fluid intake and management of skin turgor, dry mouth, and urine/stool patterns. Discuss which foods have a high water content.

Counseling: If mental status improves, provide counseling about adding fluid to solid foods and choosing beverage options that patient enjoys. Encourage behavioral change from 3 cups fluid each day to ≥ 8 cups.

Coordination of care: Collaborate with interdisciplinary team (nursing to ensure adequate fluid intake, assistance with meals, and monitoring/documentation of urine output and coloration; long-term care facility to ensure adequate fluid intake and assistance with meals as needed).

Monitoring and Evaluation

Monitoring: Quality of intake in 24 hours: IV fluids with NaCl is started, patient drinks 4 cups of fluid (orange juice, milk, soda), and skin turgor improving.

Evaluation: *After 3 months:* Patient drinks at least 8 cups of fluid daily, and long-term care staff notice improvements in urine (light yellow colored and output >800 mL daily) and stool patterns. Patient reports fewer episodes of dry mouth.

^a UBW = usual body weight

^b I&O = intake and output

^c IV = intravenous

^d NaCl = sodium chloride

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For More Information

- American Lung Association: Acute Bronchitis www.lung.org/lung-health-and-diseases/lung-disease-lookup/acute-bronchitis
- MedlinePlus: Acute Bronchitis <https://medlineplus.gov/acutebronchitis.html>
- WebMD: What Is Bronchitis www.webmd.com/lung/understanding-bronchitis-basics#1

Chronic Obstructive Pulmonary Disease



DEFINITIONS AND BACKGROUND

Chronic obstructive pulmonary disease (COPD) may result from a history of emphysema, asthma, or chronic bronchitis with persistent lower airway obstruction. COPD is the third leading cause of death worldwide (Austin et al, 2016). Figure 5.4 shows the four stages of COPD.

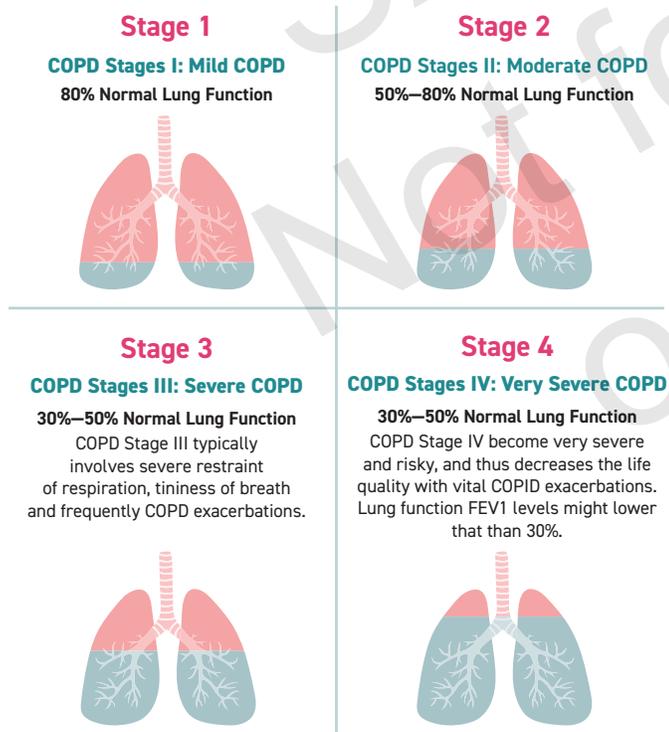
Smoking is the most common cause of COPD. Nonsmoking causes of COPD include α -1-antitrypsin deficiency, connective tissue diseases, and HIV infection. Symptoms and signs of COPD include dyspnea upon exertion, frequent hypoxemia, decreased forced expiratory volume in 1 second, and destruction of the alveolar capillary bed. In COPD, total air quantity is exhaled more rapidly.

Chronic bronchitis (“blue bloater”) patients have inflamed bronchial tubes, excess mucus production, chronic cough (2 years or longer), shortness of breath (SOB), and no weight loss. Cardiac enlargement with heart failure is common. COPD with heart failure is associated with older age, more comorbidities, reduced exercise capacity, and increased hospitalizations (Mentz et al, 2013).

Emphysema (“pink puffer”) patients have wheezing, chronic mild cough, weight loss, and thinness without heart failure. Emphysema

Hot Topic: Inflammation

The microbiome has a role in respiratory diseases such as chronic obstructive pulmonary disease. Gut microbiomes modulate systemic immune responses and can be modified by diet and antibiotic treatment (Chotirmall et al, 2017). The human respiratory tract is also inhabited by niche-specific bacterial communities that resist colonization by respiratory pathogens (Man et al, 2017). Chronic obstructive pulmonary disease is characterized by muscular impairment and wasting, oxygen deprivation, nutritional depletion, and systemic inflammation. Elevated resting and activity-related energy expenditure, reduced dietary intake, accelerated negative nitrogen balance, medication effects, and a systemic inflammatory response all contribute to weight loss. The pathologic mechanisms involve neutrophil granulocytes, cytotoxic T-cells, macrophages, and mast cells. Chronic obstructive pulmonary disease–related systemic inflammation and oxidative stress promote cerebral vascular dysfunction and platelet hyperactivity, causing cardiovascular comorbidities, particularly stroke (Austin et al, 2016). Interventions aimed at controlling cytokine production may be required to reverse cachexia.



is characterized by tissue destruction, distention, and destruction of pulmonary air spaces. Nutritional depletion is significantly greater in these patients than in those who have chronic bronchitis. Serious weight loss occurs from anorexia, secondary to significant SOB and gastrointestinal (GI) distress. Starvation itself can lead to emphysema.

Approximately 75% of patients with COPD suffer from weight loss. Individuals with COPD and low body weight have impaired pulmonary status, reduced diaphragmatic mass, lower exercise capacity, and higher mortality than those who are adequately nourished (Ferreira et al, 2012). COPD may also be found with new-onset type 2 diabetes mellitus. This risk comes from inflammation, oxidative stress, insulin resistance, weight gain, and altered adipokine metabolism (Cazzola et al, 2017). Cardiovascular disease and asthma are other common comorbidities.

Hospitalization for *acute exacerbation of chronic obstructive pulmonary disease* is associated with a high risk of mortality and complications. Low body weight, recent weight loss, and depleted lean body mass (LBM) are predictors of the need for mechanical ventilation. Self-management interventions that include a COPD exacerbation action plan are associated with improvements in quality of life and reduce respiratory-related hospital admissions (Lenferink et al, 2017).

Because only a small subset of smokers develop COPD, the individual’s environment may either offer protection against or increase the likelihood of COPD through exposures to infection, inflammation, environmental pollutants, protease and antiprotease imbalance, and oxidative stressors that overwhelm antioxidant defenses (Fischer et al, 2015). It is likely that dietary antioxidants are of benefit. Fruit and vegetable antioxidants may protect the lungs from oxidative damage and prevent COPD (Kaluza et al, 2017). High fiber intake may also be protective (Kaluza et al, 2018).

Figure 5.4 The stages of chronic obstructive pulmonary disease (COPD)

Abbreviation: FEV1, forced expiratory volume in 1 second.

Adapted with permission from *Anatomical Chart Company Atlas of Pathophysiology*. 3rd ed. Lippincott Williams & Wilkins; 2009.

Cachexia is a problem in many older adults who have COPD (Jones et al, 2015). Sarcopenia is also common and correlates with systemic inflammation (Byun et al, 2017). This low-grade systemic inflammation often precedes COPD mortality; an altered serum albumin/globulin ratio is one indicator to monitor (Qin et al, 2018).

Nutrition support is a mainstay of the therapeutic approach because of the high incidence of progressive malnutrition, which increases the likelihood of infections. Because less oxygen is available for energy production, the patient is less active, and there is less blood flow to the GI tract and muscles. Consider nutritional enhancements (supplements or tube feeding) to prevent progressive weight loss and to maintain or enhance LBM (Sanders et al, 2016).

Oral supplements should be part of a rehabilitation program that also incorporates structured exercise. Above all, nutritional quality is a very important factor in this population.



ASSESSMENT, MONITORING, AND EVALUATION

See Appendix B for support information.

ANTHROPOMETRICS

- Height
- Weight
- BMI
- Handgrip strength

BIOCHEMICAL

- a/g ratio (<1.37 yields longer length of stay)
- Alb, TTR
- Ca⁺⁺, Mg⁺⁺
- Chol, Trig
- CRP
- Fe⁺⁺, ferritin
- Gluc
- Hct (>48% in chronic hypoxemia)
- Hgb
- Na⁺, K⁺
- pCO₂ (>50 mm Hg)
- pH
- pO₂ (<50 mm Hg)
- TLC
- Vitamin D3

CLINICAL/HISTORY

- Ascites
- BP
- Chest x-ray
- COPD assessment test
- Depression
- DXA

- ECG
- Edema
- Excessive mucus production
- Expiratory airflow limitation
- Pulmonary function tests
- Respirations
- Restless leg syndrome
- Sleep apnea
- SOB
- Spirometry
- Temperature
- Wheezing

DIETARY FACTORS

- Anorexia
- Diet and nutritional intake history
- Dry mouth
- I&O
- Taste changes

GENETIC MARKERS

Several new genes have been suggested to play a role in COPD.



INTERVENTION

OBJECTIVES

General

- Screen soon after medical diagnosis; correct any malnutrition.
- Overcome anorexia from slowed peristalsis and digestion.
- Improve ventilation before meals with intermittent positive-pressure breathing and overall physical conditioning to strengthen respiratory muscles.
- Prevent respiratory infections or respiratory acidosis from decreased elimination of carbon dioxide.
- Alleviate difficulty in chewing or swallowing related to SOB. Patients with COPD have disrupted coordination of breathing and swallowing and are at high risk for aspiration. Suggest breathing carefully, eating slowly, and resting when the meal is finished.
- Avoid distention from large meals or gaseous foods. Have patients eat slowly while sitting upright.
- Ensure adequate flavor of foods because taste is often impaired. Foods such as meats, vegetables, and coffee may taste bland.
- Medical food supplement choices should be influenced by the patient's preference (Academy of Nutrition and Dietetics, 2019).
- Assess and help improve quality of life, especially related to the ability to obtain, prepare, and consume food to meet nutritional needs (Academy of Nutrition and Dietetics, 2019).

Weight and Energy

- Provide medical nutrition therapy (MNT) with a special focus on prevention and treatment of weight loss (Academy of Nutrition and Dietetics, 2019).
- Lessen work efforts by encouraging loss of excess weight if needed.
- Use BMI and weight change to assess body composition and calorie needs.

Protein, Carbohydrate, and Fat

- Encourage intake of high-quality protein.
- Ensure adequate energy intake from carbohydrate and fatty acids. Choose nutrient-dense foods.

Vitamins and Minerals

Promote intake of a nutrient-dense diet that is rich in antioxidant foods.

Fluids

- Prevent or correct dehydration, which thickens mucus.
- Avoid constipation and prevent straining with defecation.

FOOD AND NUTRITION

- A high-protein, high-calorie diet is necessary for malnourished patients (Schols et al, 2014). Start with 30 to 35 kcal/kg, depending on current weight; modify as needed.
- Avoid tough or stringy foods.
- Omit gas-forming vegetables if they cause discomfort. An antireflux regimen may also be useful with heartburn.
- Increase use of omega-3 fatty acids from salmon, haddock, mackerel, tuna, and other fish sources. Reduce use of processed meats (Kaluza et al, 2016).
- Encourage a Mediterranean diet that meets dietary reference intakes for antioxidant vitamins A, C, and E. Use more citrus fruits, whole grains, and nuts.
- Encourage high fluid intake, especially if the patient is febrile. Use 1 mL/kcal as a basic guideline. This may translate to 8 cups or more of fluid daily. With dyspnea, encourage patient to consume liquids between meals to increase his or her ability to consume nutrient-dense foods at mealtimes.
- Limit salt intake. Excess sodium can cause fluid retention or peripheral edema, both of which interfere with breathing.
- Ensure adequate fiber intake. Increase gradually, perhaps through use of psyllium, crushed bran, prune juice, or extra fruits and vegetables.
- Use small, concentrated feedings at frequent intervals to lessen fatigue. For example, offer small cups of eggnog or a milkshake between meals.
- Enhance breakfast; it may be the best meal of the day as patients may experience fatigue as the day progresses.
- Consider tube feeding for malnourished patients. Reserve parenteral nutrition for patients for whom enteral nutrition is not possible.
- Box 5.6 provides tips for adding calories to the diet; Box 5.7 provides tips for adding protein.

FOOD-DRUG-HERB INTERACTIONS

Common Drugs and Nutrition Implications

- Most bronchodilators (eg, ipratropium bromide [Atrovent], theophylline [Theo-Dur]) contain a xanthine derivative. They liquefy secretions, treat infections, and dilate the bronchi but can cause gastric irritation and ulceration.
- Antibiotics, steroids, expectorants, antihistamines, diuretics, anticholinergics, and other drugs may be used. Monitor side effects accordingly.
- Roflumilast, an orally active selective phosphodiesterase inhibitor, has been introduced into clinical practice for the treatment of severe COPD but is dose-limited by GI side effects (Spina et al, 2017).

Supplements, Herbs, and Botanicals

Ephedra (ma huang) is a bronchodilator, but it increases BP significantly. Avoid taking with digoxin, hypoglycemic agents for diabetes, monoamine oxidase inhibitors, antihypertensive medications, oxytocin, theophylline, caffeine, and dexamethasone steroids. The US Food and Drug Administration has banned its use in the United States, but it can still be accessed from online sources.

NUTRITION EDUCATION, COUNSELING, CARE MANAGEMENT

- Concentrate protein and calories in five to six meals a day rather than three large ones.
- Support efforts to shop, cook, and eat meals; refer to assistance programs when needed.
- To conserve energy, provide recipes and foods that are easy to prepare. Try having the main meal early in the day. Encourage slow eating and rest periods before and after meals.
- Explain that excessively hot or cold foods and beverages may cause coughing spells.
- Limit fluid intake at mealtimes to lessen early satiety and decreased food intake.
- Schedule treatments to mobilize mucus (postural drainage, aerosol treatment) 1 hour before and after meals to prevent nausea.
- Improve physical conditioning with strengthening exercises and dancing.
- Use of oral nutritional supplements may be beneficial (Parsons et al, 2017).
- If using oxygen, be sure that the cannula is worn during and after meals. Eating and digestion require both energy and oxygen.
- Maintain a relaxed atmosphere and serve attractive meals to make mealtimes enjoyable.
- Promote good oral hygiene; periodontal disease is common.
- MNT should be coordinated with the team to integrate patient self-management and regular exercise (Academy of Nutrition and Dietetics, 2019).
- Evaluate changes and promote doctor visits for comorbid conditions, including endocrine, cardiovascular, metabolic, and sleep disorders.

Patient Education—Foodborne Illness

Careful food handling and hand washing are essential.

Box 5.6. Suggestions for Adding Calories

Food	Selected tips
Fats	<p>Add calories with butter or margarine, cream, sour cream, gravies, salad dressings, olive oil, nut butters, and shortening.</p> <p>Mix butter and olive oil into hot foods such as soups and vegetables, mashed potatoes, cooked cereals, and rice.</p> <p>Serve hot bread with extra butter, or dip bread in olive oil.</p> <p>Toss pasta with olive oil before adding sauce.</p> <p>Add nuts to breads and muffins; use peanut butter on crackers.</p> <p>Add guacamole to salads or avocado slices to sandwiches.</p> <p>Add mayonnaise to salads or sandwiches.</p> <p>Sour cream or yogurt can be used on vegetables such as potatoes, beans, carrots, and squash or added to gravies and sauces.</p> <p>Top fruit with yogurt or sour cream.</p> <p>Drink whole milk and eat full-fat yogurt.</p> <p>Add whipped cream (60 kcal/tbsp) to pies, fruits, pudding, hot chocolate, gelatin, eggnog, and other desserts.</p> <p>Fry the entrée (eg, chicken, meat, fish) and sauté vegetables in butter or oil.</p> <p>Spread cream cheese on sandwiches, fruit slices, tortillas, and crackers.</p> <p>Add cream cheese to eggs or vegetables.</p>
Sweets	<p>Spread jelly, nut butters, or honey on toast or cereal; mix honey in tea.</p> <p>Add marshmallows to hot chocolate.</p> <p>Carry a candy bar for a quick treat.</p> <p>Sprinkle on nuts and add syrups and whipped cream to ice cream.</p>
Snacks	<p>Have ready-to-eat snacks, such as trail mix, nuts, dried fruits, candy, buttered popcorn, crackers and cheese, granola, ice cream, and popsicles.</p>
Beverages	<p>Drink milkshakes made with premium ice cream.</p> <p>Use sweetened beverages such as carbonated beverages, coffees with whipped cream and sugar, whole milk with syrup, and sugar-sweetened fruit- or milk-based drinks.</p> <p>Drink fruit smoothies with calorie-rich ingredients, such as cream, nut butters, syrup, honey, and ice cream.</p>

Source: UCSF Medical Center. Healthy ways to increase calories and protein. Accessed December 1, 2020. www.ucsfhealth.org/education/healthy_ways_to_increase_calories_and_protein

Box 5.7. Suggestions for Adding Protein^a

Food	Selected tips
Meats or meat substitutes	<p>Add diced or ground meat to soups and casseroles. Serve a chef salad with cheese, ham, turkey, and sliced egg. Eat chicken salad as an entrée, in a sandwich, or on crackers. Use proteins in omelets, soufflés, quiches, sandwich fillings, and chicken and turkey stuffing.</p>
Eggs	<p>Add chopped, hard-cooked eggs to salads and dressings, vegetables, casseroles, and creamed meats. Add an extra egg to French toast, pancake batter, or baked goods.</p>
Nuts	<p>Peanut butter can be spread on crackers, apples, pears, and bananas. Nuts are a good snack, containing both fat and protein.</p>
Milk, fluid	<p>Add milk to hot or cold cereals, scrambled eggs, mashed potatoes, soups, gravies, ground meats (eg, meat patties, meatballs, meatloaf), casserole dishes, and baked goods. Use milk or half-and-half instead of water when making soups, cereals, instant puddings, cocoa, and canned soups. Use in cream sauces with vegetables and other appropriate dishes. Use milk as the liquid in bread and tortilla recipes.</p>

Continued on next page.

Box 5.7. Suggestions for Adding Protein^a (continued)

Food	Selected tips
Milk, powdered	Add whey protein or dry milk powder to the regular amount of milk used in recipes or to beverages such as eggnog or milkshakes. Use in casseroles, meatloaf, tortillas, cream soups, custards, puddings, and cocoa. For double-strength milk, mix 1 cup of dry milk powder into 1 quart of fluid milk and allow to stand overnight for four servings with 286 kcal and 15 g of protein per serving.
Cheese	Add grated cheese or cheese chunks to sauces, vegetables, beans, rice, noodles, soups, casseroles, hot crab dip, and mashed potatoes. Add extra cheese to pizza. Melt cheese on sandwiches and hamburgers, tortillas, eggs, and meatloaf. Mix cheese into breads or muffins before baking.
Yogurt	Use yogurt as a fruit dip. Add yogurt to sauces and gravies. Sandwich frozen yogurt between two cookie layers or cake slices.
Cottage cheese	Mix cottage cheese with fruits or vegetables. Add to casseroles or egg dishes such as quiche and scrambled eggs. Add to spaghetti or noodles; use in gelatin, pudding-type desserts, or cheesecake. Add to pancakes.
Protein powder	Add protein powder to casseroles, soups, sauces, gravies, milkshakes, and egg-nogs. One scoop may have 4 to 5 g of protein, depending on the brand. Some do not stir in as well as others; some dissolve better in hot foods.
Beverages	Use instant breakfast mixes instead of milk with meals or as snacks; one 8-oz glass provides 280 kcal.
Oral supplements	Choose products that are high in protein; use with or between meals or with medication. Consume supplemental drinks; the “plus” versions have about 6 to 8 more grams of protein than the regular kind.
Desserts	Choose dessert recipes that contain eggs such as sponge cake, angel food cake, egg custard, bread pudding, and rice pudding.
Vegetable protein	Use soybeans, dried beans, split peas, and garbanzo beans in salads and entrées. Make milkshakes or pudding pies with silken tofu.

^aProtein can be added to many foods without having to increase the number of foods eaten.

Sources:

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NUTRITION CARE PROCESS MINI CASE STUDY

Unintended Weight Loss

Assessment Data

82-year-old female with COPD.^a Per dietary recall, she consumes ~1,200 kcal daily. She states that she gets tired easily and feels full after eating ½ of the food on her plate. She also has problems with coordination between breathing and swallowing. She has lost 20 lb (9.1 kg), 15% of UBW,^b in past 3 months. She was admitted from home and lives alone.

Nutrition Diagnoses (PES)

Unintended weight loss related to early satiety and problems with coordination between breathing and swallowing as evidenced by 15% weight loss over past 3 months, consuming ~1,200 kcal daily, and fatigue at mealtimes

Interventions

Food and nutrient delivery: Encourage frequent small meals of easily digested foods with added fats/protein. Provide calorie-dense oral nutrition supplements. Provide assistance at mealtimes.

Education: Educate patient on how to enhance recipes and foods with extra protein and kcals (add peanut butter, butter/oil, yogurt, sauces/gravies, etc). Encourage snack options that are high kcal/protein (hard boiled eggs, granola bars, peanut butter

crackers, tuna/chicken salad with crackers, calorie-dense oral nutrition supplements, etc).

Counseling: Counsel on including foods/supplements that are high kcal/protein. Encourage behavioral change from 3 large meals to 6 smaller meals each day.

Coordination of care: Collaborate with interdisciplinary team (nursing to assist at mealtimes; speech-language pathologist to assess for aspiration risk and safe food/liquid textures; social worker for discharge planning and possible move to a long-term care facility).

Monitoring and Evaluation

Monitoring: Quality of intake in 24 hours: Patient consumes ~1,600 kcal. She drinks 1-calorie-dense oral nutrition supplement at 2 PM. Is receiving a daily multivitamin. Nursing provides assistance at mealtimes. Discharge plans in place for transition to long-term care facility.

Evaluation: After 3 months: Patient regains ~10 lb (4.5 kg), long-term care staff have noted improvement in total calorie intake (average ~1,600 kcal daily) and less fatigue while eating. Breakfast is best meal (eats 100%). Drinks 6 oz oral nutritional supplements at 2 PM and 8 PM.

^a COPD = chronic obstructive pulmonary disease

^b UBW = usual body weight

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For More Information

- National Emphysema Treatment Trial (NETT)
www.nhlbi.nih.gov/science/national-emphysema-treatment-trial-nett
- Your Lung Health
www.yourlunghealth.org



SECTION 11

Musculoskeletal and Collagen Disorders

CONTENTS

<i>Overview of Rheumatic and Bone Disorders</i>	832
Fibromyalgia and Polymyalgia Rheumatica	837
Gout	840
Immobilization	844
Lupus	847
Muscular Dystrophy	851
Osteoarthritis	856
Osteomyelitis	861
Osteomalacia	864
Osteopenia and Osteoporosis	867
Paget Disease (Osteitis Deformans)	873
Polyarteritis Nodosa	876
Rhabdomyolysis	878
Rheumatoid Arthritis	881
Ruptured Disk and Radiculopathy	888
Scleroderma and Systemic Sclerosis	890
Spondyloarthropathies	894

CHIEF ASSESSMENT FACTORS

The following factors are possible signs, symptoms, and related conditions specific to musculoskeletal and collagen disorders that practitioners should understand when providing nutrition care to patients with the conditions covered in this section. Additional nutrition-related assessment factors are noted for each condition.

- Actual height, measured annually
- Anthropometrics, serial measurements (eg, triceps skinfold, midarm muscle circumference)
- Arthritis warning signs and symptoms lasting for longer than 2 weeks: early-morning stiffness; swelling in one or more joints; redness and warmth in a joint; unexplained weight loss, fever, or weakness combined with joint pain
- Bone density assessment
- Bone formation: procollagen type 1 N-terminal propeptide
- Bone quality test: high-resolution peripheral quantitative computed tomography
- Bone turnover: β -cross-linked C-terminal telopeptide of type I collagen
- Bone-wasting medications
- Contractures
- Corticosteroid therapy
- Depression, insomnia
- Diabetes assessment (glucose, A1C)
- Easy fatigue
- Edema
- Extremity weakness
- Handgrip strength
- Inflammation of joints
- Inflammatory markers (eg, C-reactive protein)
- Laboratory assessments for malnutrition and renal function
- Movement problems, stiffness
- Pain in muscles, joints, bones, or spine
- Psoriasis
- Unsteady gait and propensity to fall
- Vitamin D3
- Weight loss, anorexia

OVERVIEW

RHEUMATIC AND BONE DISORDERS

RHEUMATIC DISORDERS

Rheumatic disorders include osteoarthritis, rheumatoid arthritis (RA), juvenile idiopathic arthritis, bursitis, tendonitis, infectious arthritis, spondyloarthropathies, polymyositis, psoriatic arthritis, systemic lupus erythematosus, scleroderma, polymyalgia rheumatica, polyarteritis nodosa, giant cell arteritis, gout, and fibromyalgia. Typically, the treatment team for these disorders includes a rheumatologist who specializes in the treatment of disorders that affect joints, soft tissues, and connective tissues. Some rheumatic conditions involve connective tissues; others may be caused by *autoimmune disorders*, in which the body attacks its own healthy cells and tissues (see Box 11.1).

Arthritis represents a group of more than 100 different rheumatic diseases that cause stiffness, pain, and swelling in the joints, muscles, ligaments, tendons, or bones. *Spondylosis* is osteoarthritis of the spine. *Infectious arthritis* is infection of a joint that is usually caused by a bacterial invasion spread through the bloodstream or introduced directly through a penetrating wound. Autoimmune disorders, Crohn's disease, and psoriasis may cause *seronegative arthritis*. *Mixed connective tissue disease* shows features of RA, cutaneous systemic sclerosis, inflammatory myopathies, and Raynaud phenomenon.

Early recognition of these disorders is important to prevent skeletal pathologies and inflammatory atherosclerosis. *Osteoimmunology* is a multipronged approach that links the skeletal system with the immune system. Within this context, nutrition should be part of the treatment of rheumatic disorders. High-quality antioxidant polyphenols (in cocoa, extra-virgin olive oil, resveratrol, green tea, tomatoes, blueberries, and so on) help to lower inflammation. Figure 11.1 shows some of these beneficial foods and, in contrast, a few that are pro-inflammatory.

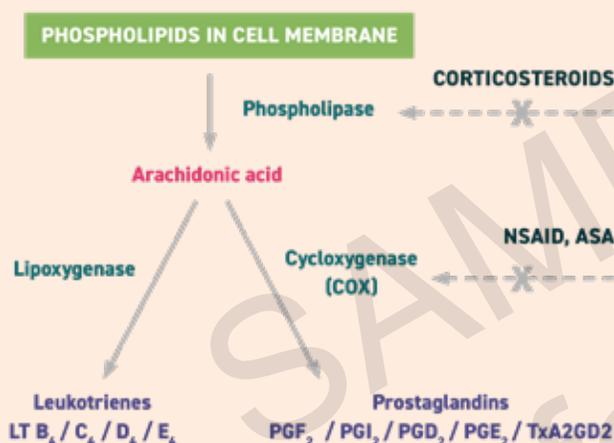
In many rheumatic conditions, nonsteroidal anti-inflammatory drugs, tumor necrosis factor α antagonists, and salicylates are used. These products may have side effects, including gastrointestinal bleeding. Patients may also perceive relief when using complementary therapies, either because the treatment truly works or because of placebo effects. However, controlled scientific studies are needed to determine whether a treatment is beneficial. Some individuals claim results from using vitamin C; vitamin D; and nutraceuticals such as glucosamine, chondroitin, and avocado-soybean unsaponifiables. However, these products should be used only after medical consultation. The important consideration is that the treatment should do no harm. See Box 11.2 for more information about the effects of some dietary factors on rheumatic disorders.

Three major types of omega-3 fatty acids are ingested in foods: α -linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). EPA and DHA are readily used by the body, whereas ALA must first be converted to DHA. In general, eicosanoids derived from omega-6 polyunsaturated fatty acids are pro-inflammatory (see Figure 11.2). However, because linoleic acid and ALA are essential fatty acids, it is important to consume sources of both each day.

Hot Topic: Inflammation

Tumor necrosis factor α and activated nuclear transcription factor κB are linked to arthritis, osteoporosis, and psoriasis. The process of inflammation is virtually the same in these different disorders. However, the various molecular pathways require different therapeutic treatments to modify the effects of different cytokines.

Prostaglandins are eicosanoids, produced from the fatty acid arachidonic acid by molecular pathways. Cyclooxygenase-2 becomes selectively upregulated during inflammation. Aspirin is used to inhibit cyclooxygenase-1 and cyclooxygenase-2 by 95% or more; all other nonsteroidal anti-inflammatory agents produce variable cyclooxygenase inhibition.



Abbreviations: ASA, acetylsalicylic acid; LT, leukotriene; NSAID, nonsteroidal anti-inflammatory drug; PG, prostaglandin; PGI₂, prostacyclin; TxA₂, thromboxane A₂. Adapted under GNU FDL 1.2 from JFDwolff. Eicosanoid Synthesis. Wikimedia Commons.

The best nutrition strategy for promoting optimal health and reducing the risk of chronic disease is to choose a wide variety of highly nutritious foods. Phytochemicals known for their ability to protect tissues may also block enzymes that trigger inflammation in joints. Dietetics practitioners must keep up to date on efficacy, safety, and regulatory issues to provide the best advice regarding nutrients, herbs, and botanicals in individuals with rheumatic conditions. See Appendix A for more guidance.

BONE DISORDERS

Bones are living, growing, and changing parts of the body. The human skeletal system consists of bones, cartilage, ligaments, and tendons and accounts for about 20% of a person's body weight. There are 206 bones in the adult skeleton. Figure 11.3 depicts the main bones of the human skeleton.

Osteoblasts are the bone-forming cells, *osteoclasts* resorb or break down bone, and *osteocytes* are mature bone cells. The osteoblast is an endocrine cell type. Bone strength is derived from both bone quantity (density and size) and bone quality (structure, consistency,

Box 11.1. Body Systems Affected by Autoimmune Disorders

Body system	Autoimmune disorder(s)
Blood and blood vessels	Lupus Polyarteritis nodosa Temporal arteritis and polymyalgia rheumatica
Digestive tract and mouth	Scleroderma Sjögren syndrome
Eyes	Graves disease Sjögren syndrome Uveitis (some forms)
Heart	Ankylosing spondylitis Lupus Rheumatic fever Scleroderma
Joints	Ankylosing spondylitis Lupus Osteoarthritis Rheumatoid arthritis
Kidneys	Gout Lupus
Lungs	Lupus Rheumatoid arthritis Scleroderma
Muscles	Polymyositis
Nerves and brain	Guillain-Barré syndrome Lupus Myasthenia gravis
Pancreas	Diabetes, type 1
Skin	Alopecia areata Dermatomyositis Lupus Psoriasis Scleroderma Vitiligo

Source: National Institute of Arthritis and Musculoskeletal and Skin Diseases. Autoimmune diseases. Accessed January 21, 2021. www.niams.nih.gov/health-topics/autoimmune-diseases

Benefits of Eating More Anti-Inflammatory Foods



Examples of Anti-Inflammatory Foods



Inflammatory Foods to Avoid



Figure 11.1 Choose a high-quality diet to reduce chronic inflammation

Adapted with permission from Maggie Gama, MD, and Synergy Lifestyle Medicine. 2018. www.synergylifestylemedicine.com/resources/foods-for-fighting-inflammation-infographic

and turnover). Bone mass is dependent on individual genetic background. There are two types of bone tissue, namely, compact and spongy, and they differ in density.

Adequate intake of bone-supportive nutrients is needed from birth to achieve maximal bone mass and to prevent osteoporosis later in life. Bone formation requires protein, calcium, fluoride, magnesium, phosphorus, potassium, and vitamin D. Overall, bone health also requires the intake of boron, copper, iron, manganese, and zinc, as well as vitamins A, B-complex, and C. Thus, a balanced, healthful diet helps to prevent osteoporosis. See Box 11.3 for other recommendations.

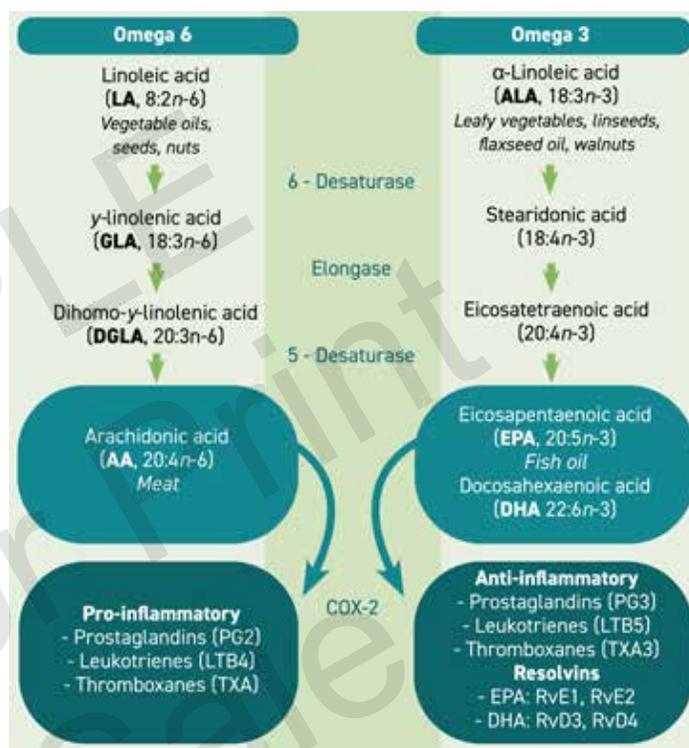


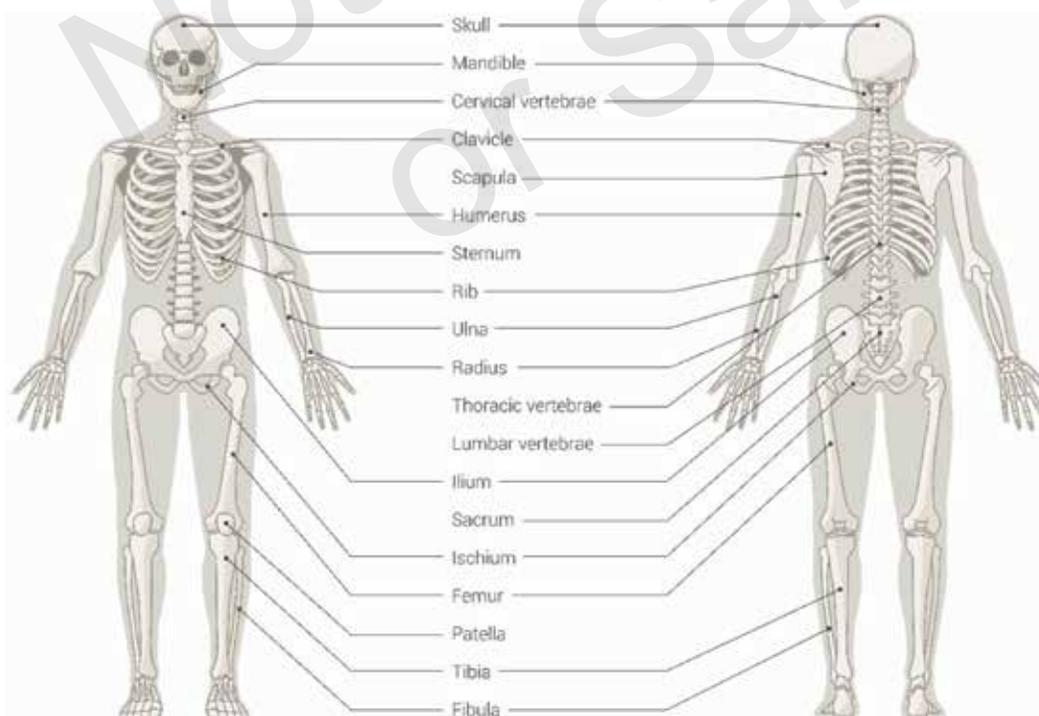
Figure 11.2 Essential fatty acids: Elongation and chain saturation, dietary sources, and inflammatory effects

Abbreviations: COX-2, cyclooxygenase-2; Rv, resolvin.

Adapted under CC BY 4.0 from Thomas S, Browne H, Mobasheri A, Rayman MP. What is the evidence for a role for diet and nutrition in osteoarthritis? *Rheumatology (Oxford)*. 2018;57(Suppl 4):iv61-iv74.

Box 11.2. Phytochemicals and Dietary Factors Affecting Rheumatic Disorders

Food or ingredient	Component(s)	Possible role
Avocados, nuts	Monounsaturated fatty acids, vitamins E and K, magnesium	Anti-inflammatory role
Cruciferous vegetables: broccoli, cauliflower, cabbage, bok choy	Sulforaphane	Boost phase 2 enzymes
Dairy products	Calcium, vitamin D	Protective factors against gout
Fruits: pomegranates, cranberries, apples, cherries, grapes, red wine	Anthocyanins, tannins, ellagic acid, resveratrol, quercetin, vitamins A and C, selenium	Potent anti-inflammatory activity
Green tea	Epigallocatechin-3-gallate	Anti-inflammatory role
Long-chain polyunsaturated fatty acids	Eicosapentaenoic acid and docosahexaenoic acid from salmon, tuna, etc	Replace arachidonic acid as an eicosanoid substrate, inhibiting arachidonic acid metabolism
Mediterranean diet	Resveratrol, olive oil, low intake of red meat	Protects against severity of rheumatoid arthritis
Soy	Genistein	Suppresses tumor necrosis factor and interleukin-6
Spices	Turmeric (curcumin) Red pepper (capsaicin) Cloves (eugenol) Ginger (gingerol) Cumin, anise, and fennel (anethole) Basil, rosemary (ursolic acid) Garlic (diallyl sulfide, ajoene, S-allylmercaptocysteine)	Spices interrupt the pathway for nuclear transcription factor κ B
Vitamin D3	Milk, fortified foods	Needed for healthy immune system, gene expression, strong bones

**Figure 11.3** Bones of the skeletal system

Box 11.3. Recommendations for the Prevention of Osteoporosis

Get the recommended amounts of calcium and vitamin D3 for age and sex. Spend some time in the sun each day when possible; fair-skinned individuals may need sunscreen after 20 min.

Maintain a healthy weight.

Adults should be physically active for at least 30 min per day (≥ 60 min per day for children), including weight-bearing activities to improve strength and balance.

Minimize the risk of falls by removing items that might cause tripping. Improve lighting. Encourage regular vision tests. Promote exercise to improve balance and coordination.

Risks for patients of all ages should be evaluated. Obtain bone density tests for females over the age of 65 years and for any person who suffers even a minor fracture after the age of 50 years. "Red flags" for someone at risk include a history of multiple fractures, use of certain medications (see image below), and a disease that can lead to bone loss.



Medications
that can cause bone loss and contribute to osteoporosis

Medication	✓ Impact on bone	Used for	Common brands
Steroids or corticosteroids	Negatively affects bone building process	rheumatoid arthritis, asthma, Crohn's disease,	Prednisone, prednisolone, Medrol, Deltasone, Decadron, cortisone, Cortel, Celestone, Aristocort, beclomethasone
Thyroid	Interferes with bone-repair and bone-building	Hyperthyroidism	Synthroid, Levothyroid, Levoxyl, Unithroid
Antacids with aluminum	Negatively affects calcium and phosphate absorption	heartburn, acid reflux, indigestion, Stomach ulcers, excess stomach acidity	Aludros, Amphojel, Gaviscon, Gelusil, Kolantyl, Maalox, Mylanta, Riopan
Proton Pump Inhibitors	inhibits calcium absorption	acid reflux, stress gastritis, peptic ulcers	Zantac, Protonix, Prilosec, Aciphex, Dexliant, Axid, Nexium
Some Antibiotics	impairs healthy bone structure and function	bacterial infections	Declomycin, Dynacin, Terramycin, Achromycin
Anticonvulsants	Inhibits vitamin D metabolism in liver	seizures	Dilantin, Phenobarbital, Depakote
Loop Diuretics	Induce calcium, Potassium and Magnesium excretion	high blood pressure, congestive heart failure	Lasix, Aldactone, Dyazide, Bumex, Diamox and Edecrin
Blood thinners	Inhibit calcium absorption and bone-building	heart and vascular disease	Heparin, Coumadin, warfarin
Lithium	Increases parathyroid which increases bone resorption	bipolar disorder	Eskalith, Eskalith- CR, Lithobid,
Chemotherapy /Methotrexate	Prevents bone formation	rheumatoid arthritis, psoriasis, breast cancer	Rheumatrex Dose Pack, Trexall, Adriamycin, Adriamycin RDF, Rubex, Adriamycin PFS
Progestin-based contraceptives	May increase bone destruction	injectable contraceptive	Depo-Provera
Premenopausal	May cause increased bone destruction	Synthetic antiestrogen used for breast cancer	Tamoxifen
Thiazolidinedione	inhibits bone formation	Type II diabetes	Actos and Avandia

Image reproduced with permission from American Bone Health. Medications that cause bone loss. https://americanbonehealth.org/wp-content/uploads/2016/07/BONESENSE-on-medications-that-cause-bone-loss_V0060419.pdf

A bone mineral density test is used to detect osteoporosis before fractures occur, predict the chances of future fractures, or determine the rate of bone loss and monitor the effects of treatment. The dual-energy x-ray absorptiometry scan is most common for spine and hip evaluation.

Normal bone mineral density: within 1 standard deviation of the mean value for a healthy young-adult reference population.

Low bone mass (osteopenia): bone mineral density is between 1 and 2.5 standard deviations below the mean value for the reference population.

Osteoporosis: BMD is 2.5 SD or more below the mean value for the reference population.

For More Information

- American Academy of Orthopaedic Surgeons
www.aaos.org
- American Academy of Physical Medicine and Rehabilitation
www.aapmr.org
- American Autoimmune-Related Diseases Association
www.aarda.org
- American College of Rheumatology
www.rheumatology.org
- American Osteopathic Association
www.osteopathic.org
- American Society for Bone and Mineral Research
www.asbmr.org
- Arthritis Foundation
www.arthritis.org
- Journal of Immunology
www.jimmunol.org
- Quackwatch: Guide to Quackery, Health Fraud, and Intelligent Decisions
www.quackwatch.com

Fibromyalgia and Polymyalgia Rheumatica



DEFINITIONS AND BACKGROUND

Myofascial pain syndrome is a chronic disorder characterized by aches, pain, and stiffness in soft tissues, including muscles, tendons, and ligaments. The pain can be felt at the site where the trigger point is located, or it can be felt away from that place (referred pain) when the muscle is pressed. Such pain typically occurs after a muscle has been contracted repetitively, by repetitive motions or by stress-related muscle tension.

Fibromyalgia (FM), or fibrositis, is a central sensitivity syndrome with abnormalities in the peripheral, central, and sympathetic nervous systems, as well as the hypothalamic–pituitary–adrenal axis stress response system. FM is estimated to occur in 2% to 8% of adults in the United States (Clauw, 2014). It is the second most common disorder, after osteoarthritis, for which patients are referred to rheumatology subspecialists (McCarthy, 2016).

FM is not from an autoimmune, inflammation, joint, or muscle disorder, but it may run in families. It causes widespread pain and stiffness either throughout the body or localized along the spine. Persistent symptoms may be disruptive but are not life-threatening. Symptoms include sleep disturbance, depression, fatigue, headaches, irritable bowel syndrome, numbness in the hands and feet, and mood disorders.

Corticotropin-releasing hormone and substance P (SP) are found in increased levels in the cerebral spinal fluid of patients with FM. Serotonin and dopamine levels may be lower than normal. Acupuncture may offer long-term improvements in clinical outcomes and pain neuromediator values (ie, serum serotonin and SP levels) (Karatay et al, 2018).

Polymyalgia rheumatica (PMR) affects adults older than 50 years of age (Buttgereit et al, 2016). It causes aching, severe muscle stiffness, and pain. Symptoms start suddenly and may affect several areas in the neck, shoulders, hips, and thighs. PMR usually goes away with treatment but may reoccur. Symptoms can occur quickly, with joint stiffness and swelling, face pain, anemia, extreme fatigue, unintentional weight loss, and anorexia.

Although the cause of PMR is not known, research has identified inflammation in the shoulder and hip joints, as well as the

bursae around them, as signs of the disorder. Tissue inflammation is due to aberrant activation of the innate immune system without autoantibody production or T-lymphocyte activation (Floris et al, 2018). Many people with PMR also have giant cell arteritis, with double vision, severe headaches, or vision loss.

Low-dose corticosteroids may be needed for up to 1 year. The following factors are assessed for improvement: laboratory markers of systemic inflammation, pain, stiffness, physical function, and fatigue (Mackie et al, 2017). Overall, the best multidisciplinary team includes a rheumatologist, physical therapist, exercise therapist, massage therapist, and dietitian.

Treatment of myofascial pain syndrome may include exercise, medications such as glucocorticoids and nonsteroidal anti-inflammatory drugs, a healthy diet rich in antioxidants, and adequate rest. Warm-water swimming can decrease interleukin-8, interferon γ , and C-reactive protein levels. Massage and cognitive behavior therapy (CBT) may be helpful in pain management; acupuncture improves pain and stiffness. A phytochemical-rich diet provides natural sources of antioxidants (quercetin, cetyl myristoleate [Myristin], and kaempferol), β - and α -carotenes, lycopene, lutein, and vitamins C and E.



ASSESSMENT, MONITORING, AND EVALUATION

See Appendix B for support information.

ANTHROPOMETRICS

- Height
- Weight
- BMI

BIOCHEMICAL

- Adrenomedullin (high in polymyalgia rheumatica)
- Alb, TTR
- ALP

- BUN, Creat
- Ca⁺⁺
- CRP (elevated)
- Cyclic citrullinated peptide antibody test
- Erythrocyte sedimentation rate (high)
- Gluc
- Mg⁺⁺
- Na⁺, K⁺
- Rheumatoid factor
- Thyroid function tests
- Trig, Chol
- Vitamin D3

CLINICAL/HISTORY

- Carpal tunnel syndrome (in polymyalgia rheumatica)
- Chronic widespread pain (pain in 11 of 18 trigger points)
- Deep muscle pain
- Depression, mood disorders
- Fatigue
- Fibromyalgia Impact Questionnaire
- Headache (sudden onset)
- History of irritable bowel syndrome
- Morning stiffness
- Nonrestorative sleep
- Tender areas: back, shoulder, pelvis, hip

DIETARY FACTORS

- Dietary intake
- Food allergies or sensitivities
- I&O

GENETIC MARKERS

- Individualize pain therapy according to the patient's genotype. For example, *DRD2* polymorphisms decrease the functioning of the dopaminergic reward system; this could cause an individual to require more pain medicine.
- Individuals with FM may have the genetic tendency toward lower pain thresholds (Tour et al, 2017). The translocator protein is upregulated in patients with chronic pain (Kosek et al, 2016).

- Correct any underlying problems such as hypertension.
- Support lifestyle changes, including stress reduction, relaxation techniques, and dietary changes.
- If there is also giant cell arteritis, prevent blindness.

Weight and Energy

Achieve or maintain a healthy body weight.

Protein, Carbohydrate, and Fat

Promote a healthy diet rich in phytochemicals.

Vitamins and Minerals

Correct any micronutrient deficiencies.

Fluids

Prevent dehydration.

FOOD AND NUTRITION

- Use a balanced diet high in phytochemicals. Although no specific diet guarantees improvement, the Mediterranean and Dietary Approaches to Stop Hypertension diets are good plans to follow.
- A weight-reduction plan may be needed. Weight control is an effective tool for improving FM symptoms (Rossi et al, 2015).
- Increased intake of omega-3 fatty acids may help to reduce inflammation and relieve pain in some individuals. Increase intake of fatty fish, walnuts, and flaxseed.
- If there is nonceliac gluten sensitivity, eliminate gluten (Rossi et al, 2015).
- For patients who also have irritable bowel syndrome, try a diet low in fermentable oligo-, di-, monosaccharides, and polyols (see Section 7, page 587).

FOOD-DRUG-HERB INTERACTIONS

Common Drugs and Nutrition Implications

- Pregabalin (Lyrica) was the first drug approved by the US Food and Drug Administration to treat FM (Kodner, 2015). Monitor serum vitamin B12 levels.
- Dual serotonin and norepinephrine reuptake inhibitors such as duloxetine (Cymbalta) and milnacipran (Savella) may be prescribed. They have side effects such as nausea, dry mouth, constipation, headache, somnolence/dizziness, and insomnia.
- Amitriptyline or the muscle relaxant cyclobenzaprine may be prescribed to promote better sleep.
- Narcotics (opioids) and botulinum toxin are not recommended (Laskin, 2018).
- For PMR, a low-dose corticosteroid is given, usually 10 to 15 mg of prednisone (Deltasone, Orasone) per day. Side effects may include sleeplessness, weight gain, loss of nitrogen and calcium, cataracts, thinning of the skin, hyperglycemia, and easy bruising.



INTERVENTION

OBJECTIVES

General

- Encourage efforts to relieve pain: heat, stretching, posture training, ultrasound, massage, acupuncture, CBT, and varied exercises.

Supplements, Herbs, and Botanicals

- Review herbs and botanical supplements with a health care provider or physician before use.
- Magnesium and sulfur compounds such as *S*-adenosyl-L-methionine, dimethyl sulfoxide, taurine, glucosamine, and chondroitin sulfate may have clinical applications in the treatment of FM, but controlled trials are needed.

NUTRITION EDUCATION, COUNSELING, CARE MANAGEMENT

- Aerobic exercise may be beneficial for pain management.
- Encourage daily exercise for strengthening weak muscles. Exercise adherence may reduce the need for pain medications.

- Discuss weight management, as needed.
- Discuss the role of a balanced, nutrient-rich diet for good health.

Patient Education—Food Safety

- With home enteral nutrition, careful sanitation and handling techniques must be taught and followed.
- If home parenteral nutrition is required, teach sterile techniques.

NUTRITION CARE PROCESS MINI CASE STUDY

Inadequate Intake of Bioactive Substances

Assessment Data

38-year-old female recently diagnosed with fibromyalgia. She reports intense pain in her joints, which has made daily living activities (cooking, opening jars and containers, preparing food) difficult. She has eaten less over the past 3 days due to this. Diet history and 3-day food record shows intake of less than 2 servings of fruits and vegetables daily. She enjoys cooking but is not very familiar with spices and often uses butter in food preparation.

Nutrition Diagnoses (PES)

Inadequate intake of bioactive substances (phytochemicals) related to limited intake of fruits and vegetables as evidenced by diet history and intake records

Interventions

Food and nutrient delivery: Provide spices, fruits, vegetables, and juices. Provide omega-3 fatty acid supplementation.

Education: Discuss the role of antioxidants, spices, and phytochemicals in reducing inflammation and the possibility of lessening pain symptoms. Educate on the association between saturated fats (butter) and disease flare-ups. Educate on the Mediterranean diet and the importance of including anti-inflammatory fats (omega-3) in the diet to help manage symptoms.

Counseling: Provide menus, recipes, and cooking tips for including more phytochemicals from nuts, grains, fruits, and vegetables. Encourage behavioral change from <2 servings of fruits and vegetables daily to 2–5 servings daily. Encourage behavioral change from using butter to using olive oil as well as adding spices for the benefit of both flavor and anti-inflammatory effects.

Coordination of care: Collaborate with medical team for follow-up.

Monitoring and Evaluation

Monitoring: Quality of meals/snacks in 24 hours; use of omega-3 fatty acid supplement.

Evaluation: After 3 months: Food records now show higher intake of spices (turmeric, cumin, cocoa, and cinnamon), coffee, berries, apples, pomegranates, and vegetables such as broccoli and cabbage on a daily and weekly basis. She consumes at least 3 servings of fruits and vegetables daily. Patient reports improved confidence with identifying and incorporating foods with phytochemicals into her diet. Patient continues to consume a daily omega-3 fatty acid supplement. Reports improved symptoms and fewer flare-ups.

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For More Information

- American College of Rheumatology: Polymyalgia Rheumatica www.rheumatology.org/I-Am-A/Patient-Caregiver/Diseases-Conditions/Polymyalgia-Rheumatica
- American Fibromyalgia Syndrome Association www.afsafund.org

- Fibromyalgia Network www.fmnetnews.com
- Mayo Clinic: Myofascial Pain Syndrome www.mayoclinic.org/diseases-conditions/myofascial-pain-syndrome/symptoms-causes/syc-20375444
- Myositis Association www.myositis.org
- National Institute of Arthritis and Musculoskeletal and Skin Diseases: Fibromyalgia www.niams.nih.gov/hi/topics/fibromyalgia/fibrofs.htm
- National Institute of Arthritis and Musculoskeletal and Skin Diseases: Polymyalgia Rheumatica www.niams.nih.gov/Health_Info/Polymyalgia/default.asp

Gout



DEFINITIONS AND BACKGROUND

Gout is an inflammatory arthritis from the accumulation of excess uric acid. Although uric acid is the product of purine metabolism, most cases of gout have a genetic origin. *Tophi* form as deposits of monosodium urate crystals in the joints and tendons. About 70% of daily urate excretion is performed by the kidneys, so impaired renal excretion leads to hyperuricemia. See Box 11.4 and Figure 11.4.

Gout is the most common form of inflammatory arthritis among males between the ages of 30 and 50 years. There is also an increased incidence in postmenopausal patients, with polyarticular onset, hand involvement, and the development of tophi. Prevalence increases with age, metabolic syndrome, and hypertension. Treating hyperuricemia in patients with gout and chronic kidney disease may improve renal and cardiovascular outcomes (Foody et al, 2017).

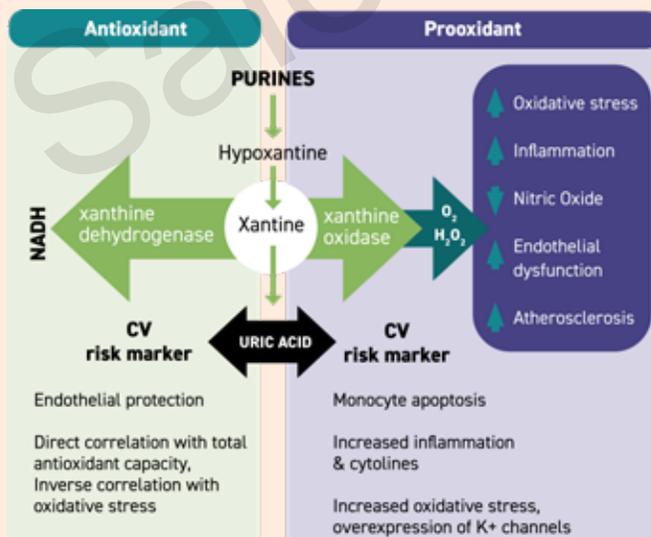
Acute attacks of gout may be triggered by surgery, sudden and severe illness, fasting, chemotherapy, or joint injury. Generally, gout first affects the big toe, the ankles, the knees, and the first metatarsal joint of the foot. The joint swells, and affected skin turns warm, red, purplish, and shiny. Severe pain occurs, more so at night. Gout progresses from asymptomatic hyperuricemia to acute gouty arthritis, with intervals between acute attacks, and finally to chronic tophaceous gout.

Patients with asymptomatic hyperuricemia should try changes in diet. Dairy products, fruits, vegetables, whole grains, nuts and legumes, coffee, and vitamin C supplements decrease the risk, whereas red meat, fructose-containing beverages, and alcohol increase the risk.

Permanent tophi may develop if the condition goes untreated. Although attacks of gout subside in a few days, repeated attacks can also cause permanent joint damage. Most patients with gout eventually require long-term treatment with medications to lower blood uric acid levels. Conventional drugs include allopurinol,

Hot Topic: Inflammation

Uric acid can function as either an antioxidant or a prooxidant (see image below). The buildup of monosodium urate crystals enhances pro-inflammatory cytokine interleukin-1 β and decreases the bioavailability of nitric oxide (Perez-Ruiz et al, 2015). Altering the gut microbiome can decrease this inflammatory state (Steves et al, 2016). Uric acid can shift from the protective antioxidant capacity to detrimental prooxidizing and proatherogenic effects according to concentration and the surrounding microenvironment.



Abbreviations: CV, cardiovascular; NADH, reduced nicotinamide adenine dinucleotide.

Image adapted under CC BY 4.0 from Reginato AM, Mount DB, Yang I, Choi HK. The genetics of hyperuricemia and gout. *Nat Rev Rheumatol.* 2012;8(10):610-621.

Box 11.4. Acquired Causes of Hyperuricemia

Cause	Description
Increased urate production	
Nutritional	Excessive intake of alcohol or fructose-sweetened foods
Hematological	Myeloproliferative and lymphoproliferative disorders, polycythemia
Drugs	Ethanol, cytotoxic drugs; vitamin B12 (treatment of pernicious anemia)
Miscellaneous	Obesity, psoriasis, hypertriglyceridemia
Decreased renal excretion of urate	
Drugs	Alcohol, cyclosporine (Sandimmune), thiazides, furosemide (Lasix) and other loop diuretics, ethambutol (Myambutol), pyrazinamide, aspirin (low-dose), levodopa (Larodopa), nicotinic acid (Nicolar)
Renal	Hypertension, polycystic kidney disease, chronic renal failure (any etiology)
Metabolic/endocrine	Dehydration, hypothyroidism, hyperparathyroidism, lactic acidosis, ketosis
Miscellaneous	Obesity, sarcoidosis, leukemia, toxemia of pregnancy

Sources:

- Mayo Clinic. High uric acid level. Accessed January 21, 2021. www.mayoclinic.org/symptoms/high-uric-acid-level/basics/causes/sym-20050607
- Harris M, Siegel LB, Alloway JA. Gout and hyperuricemia. *Am Fam Physician*. 1999;59(4):925-934.

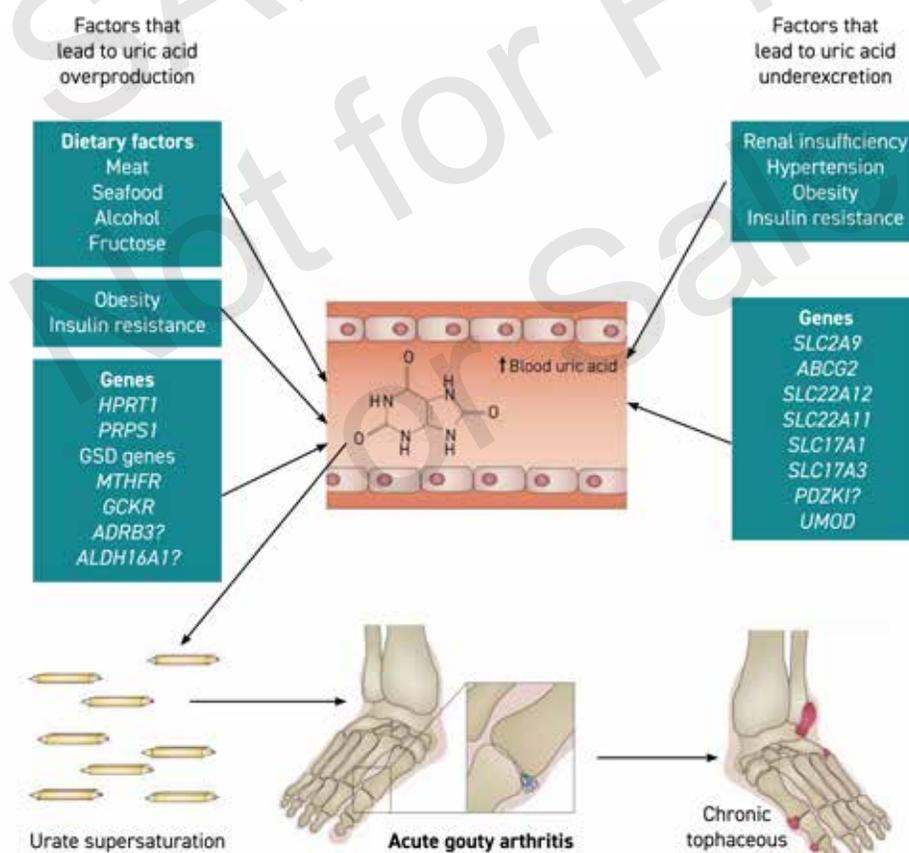


Figure 11.4 Pathophysiology of gout

Abbreviation: GSD, glycogen storage disease.

Adapted with permission from Reginato AM, Mount DB, Yang I, Choi HK. The genetics of hyperuricaemia and gout. *Nat Rev Rheumatol*. 2012;8(10):610-621.

febuxostat, and probenecid. The disease gout often results in substantial disability and frequent medical care.



ASSESSMENT, MONITORING, AND EVALUATION

See Appendix B for support information.

ANTHROPOMETRICS

- Height
- Weight
- BMI
- Obesity

BIOCHEMICAL

- Alb
- ALT
- AST
- Birefringent crystals in the synovial fluid
- BUN (increased)
- Ca⁺⁺
- Chol
- Creat
- CRP
- Gluc
- K⁺
- Mg⁺⁺
- Na⁺
- Trig (may be elevated)
- UA (increased)
- Vitamin D3

CLINICAL/HISTORY

- Arthritis
- Asymmetrical swelling within a joint on x-ray
- Swollen, painful big toe (podagra)
- Tophus, suspected or confirmed
- Urate crystals in urine

DIETARY FACTORS

- Alcohol use (amount, frequency)
- Dietary intake
- I&O

GENETIC MARKERS

- About 10% of people with hyperuricemia develop gout.
- Most of the relevant genes are involved in the renal urate-transport system: *SLC2A9*, *ABCG2*, and *SLC22A12* (Tu et al, 2016).



INTERVENTION

OBJECTIVES

General

- Reduce the excess urate burden by regular use of a medication that reduces serum urate levels.
- Maintain serum uric acid levels below 6 mg/dL.
- Reduce acute and chronic inflammation.
- Prevent complications such as renal disease, hypertension, and stroke.
- Alleviate comorbid conditions (chronic kidney disease, psoriasis, urolithiasis, diabetes, metabolic syndrome, and thyroid dysfunction) that are aggravated by hyperuricemia (Yu et al, 2018).

Weight and Energy

- Diets leading to weight loss through energy and carbohydrate reductions may be effective in lowering serum urate levels (Kolasinski, 2014).
- If patient is obese, promote gradual weight loss; avoid rapid weight loss.

Protein, Carbohydrate, and Fat

- Encourage lifestyle changes to reduce gout flare-ups.
- Limit use of alcohol, fructose-sweetened foods, meat, and seafood.
- Correct any existing dyslipidemia.

Vitamins and Minerals

Promote intake of fruits and vegetables, nuts, and whole grains. Phytochemicals can reduce additional flare-ups (Jhang et al, 2018).

Fluids

Increase fluid intake to excrete excess uric acid and prevent the formation of uric acid kidney stones. Avoid alcoholic beverages.

FOOD AND NUTRITION

- Encourage the consumption of dairy products.
- Use antioxidant-rich foods such as cherries, pomegranates, raspberries, and strawberries.
- If medicines are not effective, limit purines from beef, organ meats, seafood, pork, bacon, and ham (Hainer et al, 2014).
- Encourage a high intake of fluids, especially water, milk, and coffee.
- Exclude alcoholic beverages (especially beer), as well as fructose-sweetened and sugar-sweetened beverages.

FOOD-DRUG-HERB INTERACTIONS

Common Drugs and Nutrition Implications

- Uricosuric drugs, such as probenecid (Benemid) and sulfapyrazone (Anturane), block the renal absorption of urates. Anorexia, nausea, vomiting, and sore gums may result. Use plenty of fluids.
- Xanthine oxidase inhibitors, such as allopurinol (Aloprim) and febuxostat, are used to prevent recurrent gout by blocking uric acid formation. Extra fluids are needed. Mild gastrointestinal upset, taste changes, and diarrhea can occur; take after meals.
- Treatment with probenecid appears to be associated with a modestly decreased risk of cardiovascular events including myocardial infarction, stroke, and heart failure exacerbation compared with allopurinol (Kim et al, 2018).
- Patients receiving urate-lowering medications should be treated concurrently with nonsteroidal anti-inflammatory drugs, colchicine, or low-dose corticosteroids to prevent flare-ups (Hainer et al, 2014).
- Losartan, an angiotensin receptor blocker, increases urinary excretion of uric acid.
- Medications that can increase uric acid levels include low-dose aspirin and some transplantation medications (cyclosporine and tacrolimus). Thiazide diuretics do not affect urate-lowering medicines (Ranieri et al, 2018).

Supplements, Herbs, and Botanicals

- Review herbs and botanical supplements with a physician or other health care provider.
- Morin, from the osage orange, may have anti-inflammatory properties that may be useful in gout (Caselli et al, 2016).

NUTRITION EDUCATION, COUNSELING, CARE MANAGEMENT

- Cut down or eliminate fructose- and sugar-sweetened beverages, which increase the risk of gout (Bray, 2013).
- The inflammatory response may be suppressed by omega-3 fatty acids from fish oils as well as walnuts, flaxseed, and cherries. Use these foods often.
- Alcohol, beef, seafood, and pork may precipitate an attack. Otherwise, there is little need for a traditional “low-purine” diet.
- Weight loss may be helpful but avoid fasting. Instruct the patient to lose weight gradually.
- Discuss the importance of adequate fluid ingestion; intake of 8 cups of liquids daily, including water and milk.

Patient Education—Food Safety

If home enteral nutrition is needed, discuss the importance of sanitation and hand washing.

NUTRITION CARE PROCESS MINI CASE STUDY

Excessive Alcohol Intake

Assessment Data

52-year-old male with gout. His diet history is notable for 36 oz whiskey daily, 1 case of beer every weekend, skipping meals, drinking very little water, and 0–1 servings of fruits and vegetables daily. He reports having a poor appetite and oral intake <50% for the past 2 weeks. He arrives to the hospital with the following lab values: sodium 129 (low), potassium 2.9 (low), calcium 7.8 (low), phosphorus 1.8 (low), and elevated liver labs. Recent painful flare of gout with hyperuricemia.

Nutrition Diagnoses (PES)

Excessive alcohol intake related to undesirable food choices as evidenced by consuming 36 oz whiskey daily and 1 case of beer every weekend

Interventions

Food and nutrient delivery: Provide vitamin–mineral supplementation. Abstain from alcohol intake while in the hospital. Decrease alcohol intake at home to short-term goal of <6 oz daily and long-term goal of <4 servings weekly. Implement a healthful diet with at least 2 servings of fruits/vegetables daily and at least 8 cups of water daily.

Education: Discuss the role of alcohol, fluid intake, and medications in managing gout.

Counseling: Try motivational interviewing and goal setting with patient to implement recommended lifestyle modifications into daily plan. Provide counseling about adding fruits/vegetables, reducing alcohol intake, and choosing non-alcoholic beverage options to help meet fluid needs. Encourage behavioral change from 36 oz whiskey daily and 1 case of beer every weekend to short-term goal of <6 oz daily and long-term goal of <4 servings weekly.

Coordination of care: Collaborate with interdisciplinary team. Substance abuse counselor and other team members if alcohol rehabilitation is suggested. Physician to help manage electrolyte imbalances and provide vitamin–mineral supplements.

Monitoring and Evaluation

Monitoring: Quality of meals/snacks; multivitamin along with thiamin and folic acid supplementation; lab values; appetite and intake. No alcohol consumption since hospital admission.

Evaluation: After 3 months: Patient has cut down on intake of whiskey and now consumes only 2 oz with dinner a few days a week instead of daily. He reports a good appetite and he consumes 75%–100% of his meals. He consumes ~2 servings of vegetables/fruits and 6–10 cups of water daily. No recent gout flares noted.

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For More Information

- Arthritis Association: Gout www.arthritis.org/about-arthritis/types/gout
- Mayo Clinic: Gout www.mayoclinic.org/diseases-conditions/gout/symptoms-causes/syc-20372897
- MedlinePlus: Gout <https://medlineplus.gov/gout.html>
- MedicineNet: Gout in the Foot www.medicinenet.com/gout_gouty_arthritis/article.htm

Immobilization



DEFINITIONS AND BACKGROUND

Immobilization for extended periods of time can be nutritionally depleting. Falls and fractures can lead to immobilization, which may induce loss of both muscle mass and bone mass. Patients with orthopedic injuries may lose 15 to 20 lb (6.8 to 9.1 kg) from stress, immobilization, trauma, and bed rest.

Skeletal muscle is composed of multinuclear cells called myofibers (Fukada, 2018). Prolonged immobilization and nonuse of lower and upper limb muscles may cause fiber atrophy (see Figure 11.5).

Intramuscular differential atrophy occurs in most, but not all, of the muscles of the lower limb during prolonged bed rest (Miokovic et al, 2012). Muscle atrophy during disuse for longer than 10 days occurs primarily through declines in the rates of muscle protein synthesis (Wall et al, 2013). Older adults are particularly vulnerable. Successive short periods of muscle disuse, due to sickness or injury, accumulate throughout an individual's lifespan and contribute to the net muscle loss observed with aging (Wall et al, 2013).

Nitrogen depletion can be extensive. A significant nitrogen loss and high protein oxidation are related to extensive injury and elevated energy expenditure. Acid-base balance with metabolic acidosis can occur. In some cases, potassium bicarbonate is prescribed to counteract these effects.

Unloading of weight-bearing bones induced by immobilization has significant impacts on calcium and bone metabolism. *Hypercalcemia of immobilization* is a rare occurrence but involves nausea, vomiting, abdominal cramps, constipation, headache, lethargy, and bone loss. Prevention of osteoporosis and related fractures

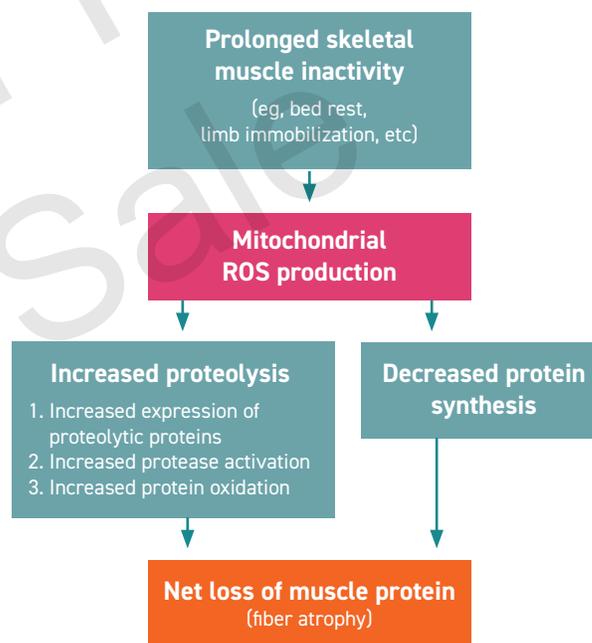


Figure 11.5 Steps leading from oxidative stress to muscle fiber atrophy

Abbreviation: ROS, reactive oxygen species.

Adapted under CC BY 4.0 Powers SK. Can antioxidants protect against disuse muscle atrophy? *Sports Med*. 2014;44 (Suppl 2):S155-S165.

includes calcium and vitamin D supplementation and risk-based screening. With careful attention to functional capacity enhancements, bone mass can be restored.

One final group at risk for the consequences of immobilization consists of individuals who are in intensive care units (ICUs) for a prolonged period. Prolonged immobility and bedrest lead to catabolism and muscle atrophy and are associated with critical illness neuromyopathy and weakness (Lipshutz et al, 2013). There is a need for physical therapy, to the extent possible, in order to avoid a long recovery. Resistance training induces myofiber hypertrophy and should be encouraged (Fukada, 2018).



ASSESSMENT, MONITORING, AND EVALUATION

See Appendix B for support information.

ANTHROPOMETRICS

- Height or arm length and knee height
- Weight
- BMI
- Weight changes
- TSF
- MAMC
- MAC

BIOCHEMICAL

- Alb, CRP (inflammation)
- ALP
- BUN, Creat
- Ca⁺⁺ (increased)
- H&H
- Mg⁺⁺
- N balance
- Na⁺, K⁺
- PTH
- RBC
- TTR
- Urinary Ca⁺⁺ (high)
- Vitamin D3

CLINICAL/HISTORY

- Blood clots
- Change in quality of life
- Contractures, stiff joints
- Decreased range of motion
- Depression
- DXA scan
- Pressure ulcers

DIETARY FACTORS

- Constipation
- Dietary intake

- I&O
- Indigestion, anorexia

GENETIC MARKERS

- Immobilization is usually from injury or another nongenetic cause.
- Immobility may be a side effect of diseases with a genetic origin, such as spina bifida.



INTERVENTION

OBJECTIVES

General

- Support moderate exercise, which can reduce the inflammatory milieu and the loss of muscle mass.
- Correct anorexia, indigestion, and constipation.
- Prevent venous thrombosis.
- Improve quality of life.

Weight and Energy

Meet energy requirements. If weight is excessive, design a plan for gradual loss.

Protein, Carbohydrate, and Fat

- Correct any negative nitrogen balance.
- Prevent pressure injury and infections.
- Prevent or correct anemias from insufficient protein or micronutrients.

Vitamins and Minerals

- Prevent deossification and osteoporosis of bones.
- Prevent hypercalcemia from low serum levels of albumin, which normally binds calcium.

Fluids

- Prevent kidney and bladder stones and urinary tract infections.
- Provide adequate fluid intake to aid excretion of wastes and to prevent constipation, impactions, and obstruction.

FOOD AND NUTRITION

- Diet should provide intake of high-biological-value proteins; up to 1.2 g of protein per kilogram of body weight may be needed to achieve nitrogen balance.
- Provide adequate energy from carbohydrates and fatty acids to spare protein. Include 1% to 2% of total energy as essential fatty acids.

- Include plenty of potassium, calcium, and magnesium with the Mediterranean and Dietary Approaches to Stop Hypertension diets.
- Provide a high fluid intake unless otherwise restricted by medical condition.
- Ensure an adequate intake of vitamin C and zinc to protect against skin breakdown.
- Provide adequate amounts of fiber to prevent constipation. Avoid overuse of fiber if there is an impaction.

FOOD-DRUG-HERB INTERACTIONS

Common Drugs and Nutrition Implications

- Medications may be used to treat underlying conditions; they may have side effects that contribute to nutrient losses.
- The patient should take pain medications as directed to maintain relief and allow greater mobility.
- Consider a bowel regime to prevent constipation, as well as adequate fiber.

Supplements, Herbs, and Botanicals

Review herbs and botanical supplements with a physician or health care provider before use.

NUTRITION EDUCATION, COUNSELING, CARE MANAGEMENT

- Explain that calcium and nutrient intakes will be monitored for patients being tube fed or receiving a liquid diet for extended periods of time.
- Teach the principles of a healthful diet and the inclusion of anti-inflammatory foods, such as fatty fish and resveratrol-rich foods.
- Explain the need for adequate fiber (25 to 30 g) and fluid (2 to 3 L/d) to prevent constipation, urinary tract infections, and so on.
- Early ambulation is the best treatment possible. In the ICU, it would be helpful to reduce heavy sedation and limit orders for bed rest (Lipshutz et al, 2013). Identify strengths and limitations, alternate rest periods with activity, and do range-of-motion exercises every day.
- Monitor and report to a physician any symptoms such as pain and fatigue upon movement, numbness in legs or arms, loss of motor strength, increased weakness, or loss of bowel or bladder control.

Patient Education—Food Safety

- If enteral nutrition is needed, teach the principles of sanitation and the importance of hand washing.
- With home parenteral nutrition, sterile techniques must be taught.

NUTRITION CARE PROCESS MINI CASE STUDY

Physical Inactivity

Assessment Data

43-year-old male. New paraplegia following motorcycle accident. He reports feeling depressed and anxious since his accident. His appetite and oral intakes were 75%–100% at home. However, since admission to the hospital, he has been drinking only 1–2 cups of fluid daily and consumes <25% of his meals. His intakes of protein and calcium are very low. He reports having a decreased appetite and a reduced desire to eat.

Nutrition Diagnoses (PES)

Physical inactivity related to non-ambulatory status as evidenced by inability to walk voluntarily after motorcycle accident

Interventions

Food and nutrient delivery: Offer food preferences to improve intake. Monitor calcium and protein intake. Provide multivitamin. Provide oral nutrition supplement until oral intakes (especially protein) improve.

Education: Discuss importance of physical therapy and nutrition in maintaining as much lean body mass as possible. Discuss importance of optimal intakes of protein and calcium to help

maintain integrity of bones and muscles. Educate on foods high in protein (meats, milk, fish, eggs, and peanut butter) and foods high in calcium (yogurt, milk, cheese, and leafy greens). Discuss increasing fluid intake to help prevent dehydration and constipation as well as provide support for physical therapy.

Counseling: Counsel about adding high-protein foods to help prevent loss of lean body mass and adding high-calcium foods to help maintain integrity of bones. Encourage behavioral change from 1–2 cups of fluid daily to at least 8 cups of fluid daily.

Coordination of care: Collaborate with interdisciplinary team (physician, nursing, physical therapy, occupational therapy, and pharmacist) to improve quality of life and recovery of independence.

Monitoring and Evaluation

Monitoring: Quality of meals/snacks; daily multivitamin use; appetite and intake; participation in physical therapy.

Evaluation: *After 3 months:* Patient reports improved appetite and desire to eat; oral intakes of at least 75% at every meal. He consumes 85%–100% of his protein at each meal. Staff note increased tolerance of physical therapy to maintain muscle mass, and an improved nitrogen balance.

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Wall BT, Dirks ML, van Loon LJ. Skeletal muscle atrophy during short-term disuse: implications for age-related sarcopenia. *Ageing Res Rev.* 2013;12(4):898-906.

For More Information

- Registered Nursing: NCLEX-RN Exam Guide: Mobility and Immobility
www.registerednursing.org/nclex/mobility-immobility

Lupus



DEFINITIONS AND BACKGROUND

Lupus is a multisystem autoimmune disorder that involves areas of inflammation of the joints, tendons, other connective tissues, and skin. Figure 11.6 shows the organs affected by lupus.

Systemic lupus erythematosus (SLE) is the most common form. SLE may present as isolated cutaneous lupus, undifferentiated connective tissue disease, mixed connective tissue disease, or drug-induced lupus (Frieri, 2013). Between 1 and 2 million people have lupus. It is especially common among Latino, Black, and Indigenous American females, with onset in the late adolescence to 30s. Environmental factors that can trigger the disease include antibiotics (especially sulfa and penicillin); other drugs; and exposure to phthalates in toys, plastics, and beauty products. Because lupus has symptoms that mimic other disorders, including celiac disease, careful diagnosis is important.

Dietary changes affect both the composition and function of the gut microbial communities, which can, in turn, alter the innate and adaptive immune system (Viera et al, 2014). Diet and gut dysbiosis promote the development of SLE (Mu et al, 2015), as described in Figure 11.7. Dendritic cells, regulatory T (Treg) cells, interleukin-6 (IL-6), interferon γ , IL-17, and IL-23 are the most determinant dysregulated mediators (Esmacili et al, 2017). Metabolites derived from bacteria could be used as potential therapies for nonintestinal autoimmune diseases (Opazo et al, 2018)

For most people, lupus is a mild disease affecting only a few organs; for some, it can be serious or even life-threatening. Infections can cause a lupus flare-up. Active lupus contributes to premature cardiovascular disease. About one-third of patients with lupus will also develop lupus nephritis, requiring medical and nutritional management.

A cure for lupus is not yet available, but various treatments allow a more normal life. Clinical trials involving immunosuppression, cell depletion, and antigen-specific immunomodulation are ongoing (Frieri, 2013). Alteration of gut dysbiosis with probiotics and prebiotics may also be beneficial.

Hot Topic: Inflammation

Vitamin D mediates immunity; its deficiency has been associated with an increased prevalence of systemic lupus erythematosus. In juvenile-onset systemic lupus erythematosus, vitamin D deficiency is common. Abnormal cytokines also play a role in the pathophysiology of systemic lupus erythematosus. Different subpopulations of macrophages contribute to various immune and nonimmune processes. Antiphospholipid antibody-mediated cytokines contribute to the inflammatory process (Willis et al, 2017).

Serum antinuclear antibody, anti-double-stranded DNA antibody, autoantibodies, and low complement levels are commonly found (Yu et al, 2014). Unfortunately, no single set of tests easily identifies systemic lupus erythematosus.

Active systemic lupus erythematosus is associated with evidence of increased endothelial damage and endothelial dysfunction, which improves with suppression of inflammation (Parker et al, 2014).



ASSESSMENT, MONITORING, AND EVALUATION

See Appendix B for support information.

ANTHROPOMETRICS

- Height
- Weight
- BMI

BIOCHEMICAL

- Alb, TTR
- BUN, Creat
- Ca⁺⁺, Mg⁺⁺
- Chol (increased)

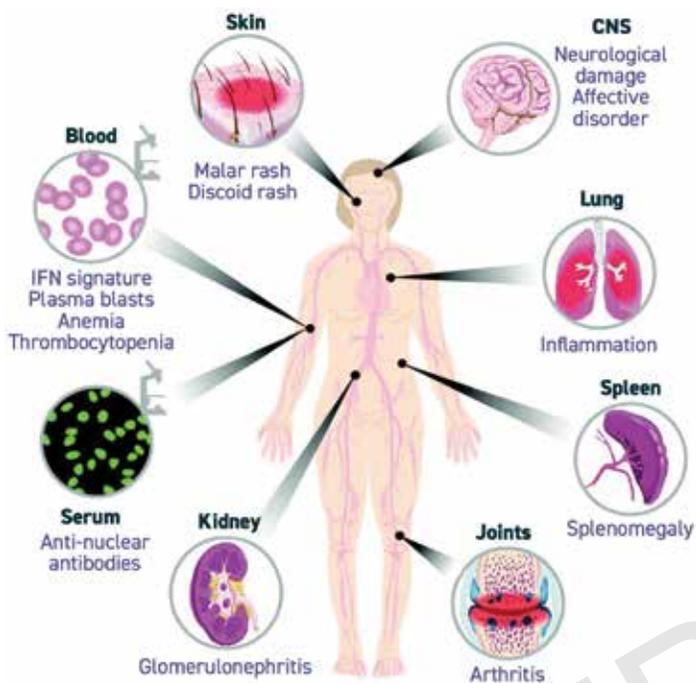


Figure 11.6 Organs affected by lupus

Abbreviations: CNS, central nervous system; IFN, interferon.

Reproduced under CC BY 4.0 from Crampton SP, Morawski PA, Bolland S. Linking susceptibility genes and pathogenesis mechanisms using mouse models of systemic lupus erythematosus. *Dis Models Mech.* 2014;7:1033-1046.

- Complement protein tests (component 3, component 4, total hemolytic complement measuring 50% or 100% cell lysis)
- CRP (elevated)
- Cu^{++} (increased)
- Erythrocyte sedimentation rate
- Gluc (increased)
- H&H, ferritin (decreased)
- Immunoglobulin E antibodies
- INR
- Lupus erythematosus cell test
- Low platelet count
- Na^+ , K^+
- Positive antinuclear antibody test (ANA)
- TP (decreased)
- TFN
- Urine specific gravity (decreased)
- Vitamin D3
- WBC (decreased)

CLINICAL/HISTORY

- Achy joints (arthralgia)
- BP
- Butterfly rash across cheeks and nose
- Dry eyes
- Easy bruising

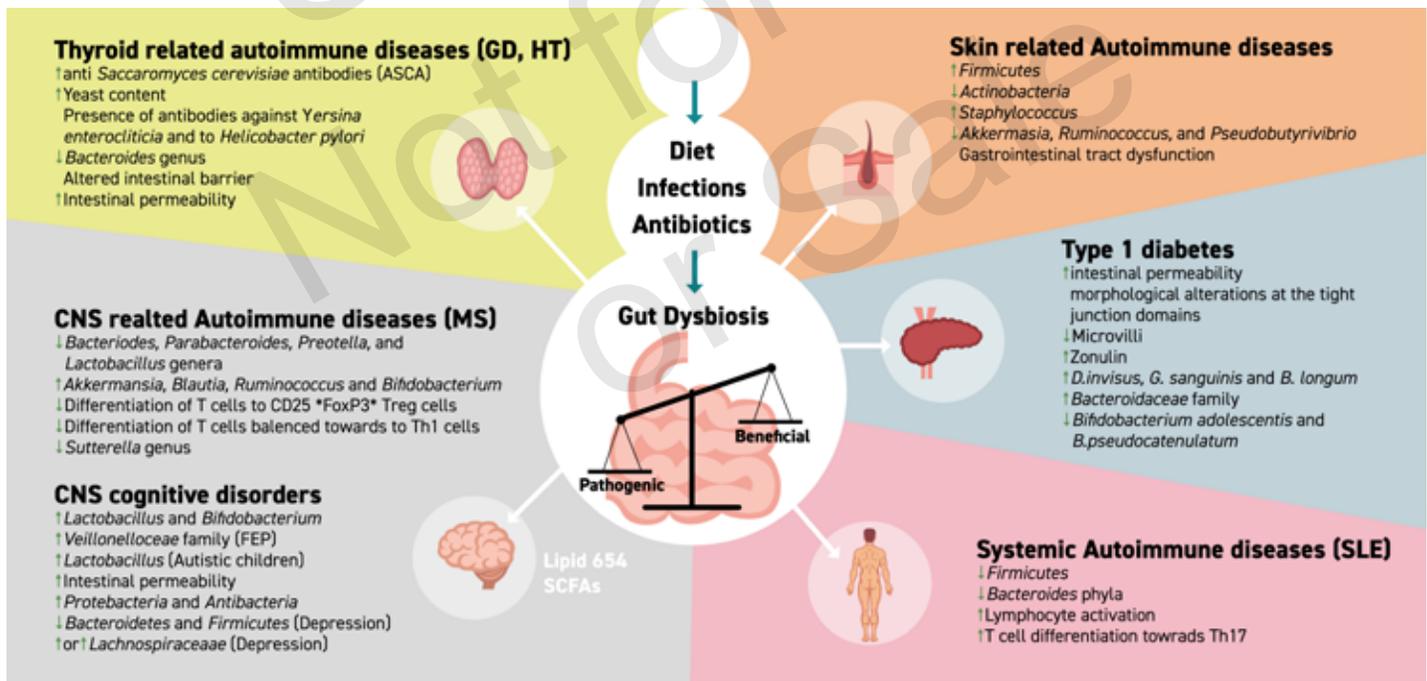


Figure 11.7 Influence of the gut microbiota in nonintestinal diseases

Gut dysbiosis induced by external factors such as diet, infections, and antibiotic overuse leads to an inflammatory response that influences the outcome of Graves disease (GD), Hashimoto thyroiditis (HT), multiple sclerosis (MS), systemic lupus erythematosus (SLE), type 1 diabetes mellitus, and psoriasis.

Abbreviations: CD25⁺, α -chain of the interleukin 2 receptor; CNS, central nervous system; FEP, fibroepithelial polyp; FoxP3⁺, forkhead box protein P3; SCFAs, short-chain fatty acids; Th1, type 1 helper T cell; Th17, type 17 helper T cell; Treg, regulatory T cells.

Adapted under CC BY 4.0 from Opazo MC, Ortega-Rocha EM, Coronado-Arrázola I, et al. Intestinal microbiota influences non-intestinal related autoimmune diseases. *Front Microbiol.* 2018;9:432.

- Fatigue, prolonged
- Fever (>100°F)
- Painless mouth or nose ulcers
- Pale or purple fingers from cold or stress (Raynaud phenomenon)
- Photosensitivity
- Pleurisy or pericarditis
- Protein or cellular casts in urine
- Seizures and cognitive dysfunction
- Skin rashes, red raised patches
- Swollen and painful joints (nonerosive arthritis)
- Swollen ankles
- Unusual hair loss

DIETARY FACTORS

- Dietary intake
- Food allergies or sensitivities
- I&O

GENETIC MARKERS

- Both genetic and epigenetic factors are involved in the development of SLE (Wu et al, 2016). Individuals with close family members who have lupus have a 10 times greater frequency of developing the disorder than the general population.
- Alleles in the *TTK2* gene have been associated with SLE.

INTERVENTION

OBJECTIVES

General

- Control disease manifestations and prevent irreversible organ damage.
- Manage cardiac effects, including accelerated atherosclerosis, premature coronary heart disease, and pericarditis.
- Prevent or manage urinary tract infections, shingles, respiratory infections, yeast infections, *Salmonella*, and herpes.

Weight and Energy

Help patient achieve or maintain a healthy body weight.

Protein, Carbohydrate, and Fat

- Provide a balance of macronutrients.
- Address hyperglycemia if present.

Vitamins and Minerals

- Counteract steroid therapy; replenish potassium and nutrient reserves.
- Correct nutrient deficiencies and weight loss. Patients with SLE are prone to develop vitamin D deficiency.

Fluids

Ensure an adequate fluid intake.

FOOD AND NUTRITION

- Suggest use of the Mediterranean diet; extra-virgin olive oil, with its anti-inflammatory factors, is especially beneficial (Crespo et al, 2018). This diet also includes nuts, fish and fish oils, fruits, vegetables, herbs and spices, and whole grains that are rich in phytochemicals and antioxidants. Refer to Box 11.2 for more information about the effects of some dietary factors on rheumatic disorders.
- Consider use of a multivitamin–mineral supplement. If vitamin C, vitamin B12, iron, and folate intakes are low and anemia is documented, discuss sources to achieve dietary reference intake levels.
- The patient's diet should be adequate in protein and energy. Extra calories will be needed when there is fever.
- When renal disease is present, adjust the diet according to laboratory values (blood urea nitrogen, creatinine, electrolytes). Mildly restrict sodium intake (if patient is salt-sensitive) and monitor for potassium and phosphorus changes.
- Modify diet, if needed, to reduce blood pressure or excess body weight.
- If gluten intolerance is present, provide a nutritious gluten-free eating plan (Dima et al, 2017).

FOOD-DRUG-HERB INTERACTIONS

Common Drugs and Nutrition Implications

- Belimumab (Benlysta) is a biologic drug developed specifically for SLE. Many other drugs are in clinical trials.
- High-dose steroid therapy may cause negative nitrogen balance, sodium retention, hyperglycemia, and potassium and calcium depletion. Long-term use can aggravate organ damage (Tarr et al, 2017). Side effects are many; see Figure 11.8.
- Immunosuppressive agents such as azathioprine (Imuran), cyclophosphamide (Cytoxan), and methotrexate are used to control the overactive immune system, but they have gastrointestinal side effects. Methotrexate (Rheumatrex) confers an advantage by lowering daily prednisone requirements. Fish oil supplements may also allow for the gradual reduction in the use of steroids.
- Hydroxychloroquine (HCQ) is an alkalinizing antimalarial drug that increases the pH in lysosomes (Ponticelli et al, 2017). Early treatment with HCQ may lead to fewer SLE flare-ups and less cumulative organ damage over time. Side effects are rare but may include skin rashes, anorexia, nausea, abdominal cramps, and diarrhea.

Supplements, Herbs, and Botanicals

- Herbs and botanical supplements should not be used without prior discussion with a health care provider or physician.
- There is evidence supporting the immunomodulatory ability of some probiotics, particularly *Lactobacillus* and *Bifidobacterium* strains (Esmaeili et al, 2017). Other probiotics should be evaluated as trials are completed.

NUTRITION EDUCATION, COUNSELING, CARE MANAGEMENT

- Ensure that the patient has an adequate intake of fluids during febrile periods.
- Discuss the use of naturally anti-inflammatory foods and ingredients (omega-3 fatty acids, green tea, resveratrol) that are readily available.
- Describe foods that are sources of sodium and potassium.
- Adequate rest is needed during disease flare-ups.
- Discuss how to manage an eating plan for elevated blood glucose; insulin may be needed and carbohydrate counting may be useful. Educate the patient about the signs and symptoms of hyperglycemia and when to contact the physician.
- Regular physician visits and laboratory tests are important for monitoring the management of lupus.
- Consider medical nutrition therapy strategies to prevent obesity, osteoporosis, and dyslipidemia.

Patient Education—Food Safety

- If home enteral nutrition is used, teach sanitation and safe handling.
- With use of home parenteral nutrition, teach sterile techniques.

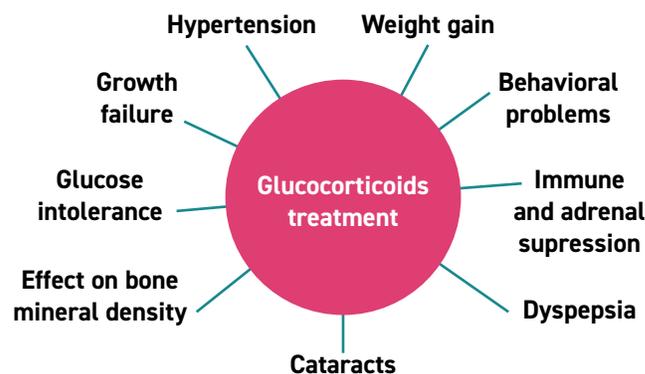


Figure 11.8 Effects of glucocorticoid therapy on the body

Adapted under CC BY 4.0 from Cruz Guzmán O, Chávez García AL, Rodríguez-Cruz M. Muscular dystrophies at different ages: metabolic and endocrine alterations. *Int J Endocrinol.* 2012;2012:485376.

NUTRITION CARE PROCESS MINI CASE STUDY

Drug-Nutrient Interaction

Assessment Data

37-year-old female with lupus who has been taking corticosteroids for several years. She arrives to the hospital with the following lab values: potassium 3.1 (low), calcium 7.3 (low), and vitamin D 12.7 (low). Her fasting blood glucose levels have also been elevated, and are being managed with insulin. The patient reports losing ~10 lb (4.5 kg), 7% of UBW,^a within the past 3 months. She also complains of swollen ankles and fluid retention. Upon physical examination, mild muscle losses are noted.

Nutrition Diagnoses (PES)

Drug-nutrient interaction related to prolonged use of corticosteroids as evidenced by low serum lab values (potassium, calcium, and vitamin D), elevated blood glucose levels, mild muscle loss, and sodium-fluid retention

Interventions

Food and nutrient delivery: Provide 2-gm sodium diet and encourage patient to choose options on the menu that are high in protein, calcium, and potassium. Provide high-protein oral nutrition supplement and a vitamin D supplement.

Education: Discuss interaction of nutrients (calcium, potassium, sodium, glucose, and protein) with corticosteroids while managing

lupus. Discuss increasing high-quality nutrients while taking steroid medications (protein, calcium, potassium) and decreasing sodium-rich foods. Educate on which foods are high in protein, calcium, potassium, and vitamin D. Discuss foods that are high/low in sodium. Provide recipes, handouts, and online resources.

Counseling: Use motivational interviewing and goal setting with patient to implement recommended lifestyle modifications. Address use of the DASH^b diet for enhancing nutritional quality of the diet. Counsel about adding foods high in calcium/potassium/vitamin D, reducing sodium intake, and adding high-protein foods to help prevent loss of lean body mass.

Coordination of care: Collaborate with interdisciplinary team to help manage electrolyte imbalances and provide vitamin-mineral supplements.

Monitoring and Evaluation

Monitoring: Appetite and intake; use of vitamin D supplementation; lab values.

Evaluation: *After 3 months:* Fluid retention and swollen ankles markedly improved. Per dietary recall, patient daily consumes <3,000 mg sodium and ~4,000 mg potassium, ~700 mg calcium, and 0.8–1.2 g/kg protein. She still takes a vitamin D supplement and a high-protein nutrition supplement daily. Regaining lean muscle mass and weight.

^aUBW = usual body weight ^bDASH = Dietary Approaches to Stop Hypertension



APPENDIX C

Culturally Sensitive and Inclusive Nutrition Care, Education, and Counseling

CONTENTS

Understanding Cultural Humility and Competence	1254
Practice-Based Cultural Humility and Competence	1254
Culturally Sensitive and Inclusive Nutrition Care and Counseling	1256
Nutrition Education and Counseling	1261

SAMPLE
Not for Print
or Sale

UNDERSTANDING CULTURAL HUMILITY AND COMPETENCE

Cultural humility and competence are essential for providing equitable nutrition and health education, counseling, and care. They support increased respect and mutual understanding with patients and clients and, ultimately, better health outcomes. To ensure that all people receive equitable, effective health education, counseling, and care, the Joint Commission (TJC) includes standards for meeting individual, cultural, and religious needs and preferences. Its recommendations address language, culture, health literacy, and other challenges to effective communication, with the goal of helping hospitals and their personnel meet the unique needs of each patient (TJC, 2010). For health care providers, many cultural elements influence beliefs and belief systems surrounding health, healing, wellness, illness, disease, and delivery of health services (National Institutes of Health, 2021).

National Standards for Culturally and Linguistically Appropriate Services in Health and Health Care established a blueprint for providing healthcare services that are respectful of and responsive to health and food beliefs and practices, and to clients' cultural and linguistic needs (US Department of Health and Human Services, 2020). Cultural humility education for healthcare professionals is recognized for its potential to reduce persistent disparities in healthcare quality and outcomes among some minority cultural and linguistic populations (Horvat et al, 2014).

Recognizing that cultural traditions impact food behavior and health risk, the *US Dietary Guidelines for Americans, 2020-2025* provides a framework, intended to be customized to individual needs and preferences, and to the foodways of the diverse cultures in the United States. The science that informs the Guidelines considered various segments of the US population, including populations from diverse racial and ethnic backgrounds, who are healthy or at risk of chronic disease and who have disproportionately and/or historically been affected by diet-related disparities (US Department of Agriculture and US Department of Health and Human Services, 2020). Definitions related to culture are outlined in Box C.1.

PRACTICE-BASED CULTURAL HUMILITY AND COMPETENCE

Developing cultural humility and competence in clinical nutrition practice is an ongoing process and extends far beyond knowledge of ethnic foods and practices. To work effectively in cross-cultural settings and encounters, dietetics practitioners must understand and respect the complexities of culture and recognize that individuals and families interpret healthy eating in complex and diverse ways that reflect their personal, social, and cultural experiences and environments (Bisoqni et al, 2012).

Self-Awareness of Culture

Equitable and effective nutrition guidance and care, health promotion, and disease prevention require a sensitivity and understanding, assessment, and respect for the culture, health beliefs and values, and food practices and preferences of the client. Dietetics practitioners first must have awareness of their own cultural background and biases and how this might influence their personal values, beliefs, and practices. See Figure C.1 for a self-assessment of cultural awareness. This process of self-reflection and discovery is key to cultural humility that helps build honest and trustworthy relationships.

The following tips can help dietetics practitioners prepare for culturally sensitive nutrition care and counseling:

- Recognize your own culture and its values, norms, and health-related beliefs and practices. Consider how they might affect your interactions, teaching, counseling, and care. Self-awareness and mindfulness fosters awareness of and sensitivity to the cultures of others. Avoid imposing your values.
- Put aside explicit (conscious) and implicit (unconscious) biases, assumptions, and stereotypes about ethnicity, race, gender, sexual orientation, gender identity, age, religious affiliation, and those who are disabled, of low income, or experiencing homelessness. Keep an open mind, and avoid jumping to conclusions based on appearance, attire, verbal accent, or demeanor.

Box C.1. Definitions Related to Culture for Dietetics Professionals

Culture is expressed through its visible attributes, such as language, attire, artistic expression, housing, and food. As well as its "hidden" shared attribute, often described as the combination of a body of knowledge, a body of belief, and a body of behavior, involving several elements that are often specific to ethnic, racial, religious, geographic, or social groups. This includes personal identification, language, thoughts, communications, actions, customs, beliefs, values, and institutions (National Institutes of Health, 2021). One's individual culture is a complex mixture of many influences and values (Yeager et al, 2013).

Cultural competence can be considered a set of congruent behaviors, attitudes, and policies that come together in a system, agency, or among professionals that enables effective interaction in cross-cultural situations (Centers for Disease Control and Prevention, 2020; Cross et al, 1989). Simply stated, cultural competence is the ability to interact effectively and respectfully with those of different cultural and socioeconomic backgrounds.

Culturally competent nutrition care is balanced and not perceived by the client as one-sided, with all knowledge held by the nutrition and healthcare team, and it does not insist that a client fit into the cultural values and norms of those on the healthcare team. It is built through relationships and trust and requires sensitivity, respect, and acceptance of traditional and personal beliefs, values, and practices.

Cultural humility is an ongoing process of reflection and lifelong inquiry, involving self-awareness of personal and cultural biases as well as awareness and sensitivity to significant cultural issues of others (Foronda et al, 2016). As a lifelong process, cultural humility recognizes the dynamic nature of culture with influences that change over time and vary with location (Yeager et al, 2013).

Equity differs in meaning from equality. While equality means providing each person or group with the same resources or opportunities, equity recognizes individual differences in circumstances and allocates resources and opportunities to reach an equal outcome, for example in health care (Milken Institute School of Public Health, 2020).

Food culture includes specific foods, cooking methods, food practices and behaviors, and the attitudes and beliefs related to food acquisition, handling, preparation, food patterns, and eating occasions.

Norms are learned behavior patterns, or a system of "rules," that are common within cultures and shaped by the values, attitudes, and beliefs of their members. In other words, norms are why individuals within a culture typically do what they do in given situations (Duyff, 2020).

Subcultures are commonly identified by attributes such as age, socioeconomic level, education, gender, gender identity, regionality, and for immigrants, degree of acculturation; subcultures, too, need to be recognized, understood, and respected. Subgroup identification may change as life circumstances evolve, for example with assimilation, age, education, or changes in income (Duyff, 2020).

Cultural humility and competence start with self-awareness. After each statement, indicate where you fit on the continuum.					
Awareness		Cultural Humility/Competence			
		Less	←————→		More
		Never	Sometimes/ Occasionally	Fairly Often/ Pretty Well	Always/ Very Well
Value diversity	I view human difference as positive and a cause for celebration.				
Know myself	I have a clear view of my own ethnic, racial, and cultural identity.				
Share my culture	I am aware that in order to learn more about others I need to understand and be prepared to share my own culture.				
Am aware of areas of discomfort	I am aware of my own discomfort when I encounter differences in race, religion, sexual orientation, language, and ethnicity.				
Check my assumptions	I am aware of the assumptions I hold about people of cultures different from my own.				
Challenge my stereotypes	I am aware of my stereotypes when they arise and have developed personal strategies for reducing the harm they cause.				
Reflect on how my culture informs my judgment	I am aware of how my cultural perspective influences my judgment about what are "normal," "appropriate," or "superior" behaviors, values, and communication styles.				
Accept ambiguity	I accept that in cross-cultural situations there can be uncertainty and that uncertainty can make me anxious. It can also mean that I do not respond quickly and take the time needed to get more information.				
Am curious	I take any opportunity to put myself in a place where I can learn about differences and create relationships.				
Aware of personal privilege or opportunities from my demographic or culture	If working with others who don't share a demographic of opportunity or privilege, I may be perceived as a person of power and maybe not as unbiased or as an ally.				

Figure C.1 Self-Assessment of Cultural Awareness

Adapted with permission from Central Vancouver Island Multicultural Society. Cultural competence self-assessment checklist. Accessed December 21, 2020. www.coloradoinitiative.org/wp-content/uploads/2015/10/cultural-competence-self-assessment-checklist.pdf

- Recognize that cultures and their norms are dynamic and often evolve with changing life experiences, education, socioeconomic circumstances, and for immigrants and refugees, their degree of acculturation and perhaps language proficiency within a new culture.
- Get to know the health risks, disease prevalence, disease patterns—and their social determinants—common within the populations you may serve. Become familiar with any common biological, physical, physiological, and psychological attributes that may impact health.
- Develop a broad cultural knowledge of your healthcare team: their norms, values, and lifestyle practices; religious and spirituality practices; ethnic and everyday food practices; beliefs, taboos, rituals, and attitudes (fears and hopes) about health care.
- Inform yourself of any integrative health practices, medicine, and herbal or botanical products that may be used within your client population. If these practices and products cause no harm, consider how to integrate them with the preventive or medicinal care you provide. Some cultures apply various herbs and practices as folk medicine.
- Partner with cultural informants who have extensive knowledge of and experience in the deeper aspects of the client's culture, perhaps by being part of that culture. Enlist cultural informants who work collaboratively in a respectful and reciprocal way. Dietitians in several Member Interest Groups of the Academy of Nutrition and Dietetics may be resources for some cultural, ethnic, religious, and racial groups, and cultures of gender and age.
- Become knowledgeable about food assistance programs in your community and other local services and community partners that serve families with various diverse backgrounds.