

Preface

Nutrition is one of the most important factors that impact health in all areas of the lifecycle. Pregnant women need adequate food and health care to deliver a healthy baby who has a good birth weight and a fighting chance for survival. In many regions of the world, the infant mortality rate is very high, meaning that many infants will not live to see their first birthday. Breastfeeding is the ideal method of feeding and nurturing infants, because breast milk contains many immunologic agents that protect the infant against bacteria, viruses, and parasites. Yet, less than 40 percent of infants worldwide are exclusively breastfed (no other food or drink, not even water) for the first four months of life. Children need adequate nutrition to develop and grow to their full potential.

Malnutrition, both undernutrition and overnutrition, is at an all time high, with close to one-third of the world's children suffering from it. The number of undernourished people in the world continues to increase because of little or no progress to reduce poverty. Thousands of children die daily from hunger and its effects, even in technologically advanced countries. Without adequate nutrition, a person's cognitive ability is diminished, which adversely affects their ability to get a good paying job and contribute to their local economy. Paradoxically, childhood and adult obesity in many parts of the developed world are also near epidemic proportions. There are 300 million obese people in the world. In the United States, about 34 percent of Americans are overweight and 30.5 percent are obese.

Life expectancy has increased in many countries and the population of older adults is growing at an unprecedented rate in the United States and other technologically advanced countries. In the United States the average life expectancy is 70, while globally, the average rose to 67 years in 1998, up from 61 in 1980. These countries are unsure of how they will provide adequate health care for this growing segment of the population. Cardiovascular disease (coronary heart disease, hypertension, stroke) and cancer are top killers in many countries and HIV/AIDS continue to ravage our societies, taking individuals in the productive years of their lives.

Arrangement of the Material

Nutrition and Well-Being A to Z is a two-volume set that provides timely information on the personal, cultural, and global issues that affect (or have an impact on) health and nutritional status. Users will find detailed coverage of topics covered in general nutrition, food science, and personal and

family courses. This encyclopedia explains fundamental concepts such as amino acids, cutting-edge ideas such as functional foods, social issues such as food insecurity, and political issues such as bioterrorism.

The set was also designed to meet consumer needs. Users will be able to spot a quack health-care provider, discriminate between reliable and unreliable health claims, as well as understand the role of government in keeping food safe. The set also profiles individuals who have made a social, historical, or scientific impact on health, nutrition, and food trends. Most entries are written from a global perspective, and dietary patterns from different regions of the world are discussed. Many professional health organizations are described.

The information in *Nutrition and Well-Being A to Z* is clearly presented and easy to find. Professionals in the field of nutrition, dietetics, food science, agriculture, medicine, health education, and public health wrote with the student in mind. Students and teachers can use the set to reinforce classroom topics on food, nutrition, and health, and to expand discussions on special or new topics. The extensive use of illustrations enhances the learning of the material. Entries are arranged alphabetically and an extensive cross-referencing system encourages the user to further explore other entries. All topics in a volume can be found in the index at the back of the book.

Acknowledgements and Thanks

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Delores C. S. James

Topical Outline

American Dietary Habits

African Americans, Diet of
Asian Americans, Diets of
Dietary Trends, American
Hispanics and Latinos, Diet of
Native Americans, Diet of
Pacific Islander Americans, Diet of
Regional Diets, American

Biographies

Battle Creek Sanitarium
Brillat-Savarin, Jean Anthelme
Funk, Casimir
Glisson, Francis
Goldberger, Joseph
Graham, Sylvester
Johnson, Howard
Kellogg, John Harvey
Krock, Ray
Mellanby, Edward
Pasteur, Louis
Pauling, Linus
Pemberton, John S.
Rosenstein, Nils Rosén von
Stark, William
Tulp, Nicholaas
White, Ellen G.
Wilson, Owen

Body Function and Processes

Digestion and Absorption
Immune System
Insulin
Metabolism

Dieting, Weight Management, Exercise, Eating Disorders

Addiction, Food

Anorexia Nervosa

Appetite
Binge Eating
Body Image
Bulimia Nervosa
Cravings
Diet
Dieting
Eating Disorders
Eating Disturbances
Eating Habits
Ergogenic Aids
Exercise
Exercise Addiction
Fad Diets
Female Athlete Triad
Grazing
Mood-Food Relationships
Pica
Satiety
Sports Nutrition
Weight Loss Diets
Weight Management
Yo-Yo Dieting

Diseases and Disorders

Arteriosclerosis
Atherosclerosis
Bezoars
Cancer
Cardiovascular Disease
Diabetes Mellitus
Heart Disease
HIV/AIDS
Hyperglycemia
Hypertension
Hypoglycemia
Obesity

Food Habits, Trends, and Alternative Choices

Alternative Medicines and Therapies
Fat Substitutes
Legumes
Macrobiotic Diet
Plant-Based Diets
Popular Culture, Food and Quackery
Soy
Vegan
Vegetarianism
Whole Foods Diet

Food Industry, Technology, and Food Safety

Additives and Preservatives
Artificial Sweeteners
Biotechnology
Commodity Foods
Convenience Foods
Fast Foods
Fat Substitutes
Food Safety
Fortification
Generally Recognized as Safe
Genetically Modified Foods
Green Revolution
Illnesses, Food-Borne
Irradiation
Marketing Strategies
Meat Analogs
Organic Foods
Organisms, Food-Borne
Pasteurization
Pesticides
Probiotics
Regulatory Agencies

Space Travel and Nutrition	Lipid Profile	Vitamins, Fat-Soluble
Sustainable Food Systems	Malnutrition	Vitamins, Water-Soluble
Health Programs and Organizations	Nutrient-Drug Interactions	Water
American Dietetic Association	Nutritional Assessment	
American Public Health Association	Nutrient Density	
American School Food Service Association	Nutritional Deficiency	Nutritional Deficiencies
American School Health Association	Oral Rehydration Therapy	Anemia
Comprehensive School Health Program	Overweight	Beriberi
Disaster Relief Organizations	Smoking	Goiter
Emergency Nutrition Network	Underweight	Kwashiorkor
Expanded Food and Nutrition Education Program (EFNEP)	Waist-to-Hip Ratio	Lactose Intolerance
Food Aid for Development and the World Food Programme		Marasmus
Food and Agriculture Organization (FAO)		Osteoporosis
Global Database on National Nutrition Policies and Programmes		Osteomalacia
Meals On Wheels		Osteopenia
National Academy of Sciences (NAS)		Pellagra
National Institutes of Health (NIH)		Rickets
Nongovernmental Organization (NGO)		Scurvy
Nutrition Programs in the Community		Xerophthalmia
Refugee Nutrition Information System (RNIS)		
School Food Service		Nutrition and the Life Cycle
Society for Nutrition Education		Adolescent Nutrition
United Nations Children's Fund (UNICEF)		Adult Nutrition
WIC Program		Aging and Nutrition
World Health Organization (WHO)		Baby Bottle Tooth Decay
		Beikost
		Breastfeeding
Health Risks and Health Assessment		Childhood Obesity
Alcohol and Health		College Students, Diets of
Allergies and Intolerances		Failure to Thrive
Anthropometric Measurement		Fetal Alcohol Syndrome
Body Fat Distribution		Growth Hormone
Body Mass Index		Inborn Errors of Metabolism
Caffeine		Infant Mortality Rate
Dehydration		Infant Nutrition
Diarrhea		Life Expectancy
Dietary Assessment		Low Birth Weight Infant
Fasting		Mastitis
Food Insecurity		Maternal Mortality Rate
Growth Charts		Menopause
Homelessness		Men's Nutritional Issues
Hunger		Phenylketonuria (PKU)
Infection		Pregnancy
Lead Poisoning		Premenstrual Syndrome
		Preschoolers and Toddlers, Diet of
		School-Aged Children, Diet of
		Small for Gestational Age
		Toxemia
		Women's Nutritional Issues
		Nutrition, Health, and Professional Issues
		Careers in Dietetic
		Cultural Competence
		Dietetics

Dietetic Technician, Registered
(DTR)
Dietitian
Health
Health Communication
Health Education
Health Promotion
Lay Health Advisor
Medical Nutrition Therapy
Nutrition

Nutrition Education
Nutritionist
Oral Health
Wellness
**Nutrition Standards,
Guidelines, Reports**
Dietary Guidelines
Dietary Reference Intakes
Dietary Supplements

Exchange System
Food Guide Pyramid
Food Labels
Health Claims
Healthy Eating Index
Healthy People 2010 Report
National Health and Nutrition
Examination Survey (NHANES)
Recommended Dietary Allowances
(RDA)

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For Your Reference

TABLE 1. SELECTED METRIC CONVERSIONS

WHEN YOU KNOW	MULTIPLY BY	TO FIND
Temperature		
Celsius ('C)	1.8 ('C) + 32	Fahrenheit ('F)
Celsius ('C)	'C + 273.15	Kelvin (K)
degree change (Celsius)	1.8	degree change (Fahrenheit)
Fahrenheit ('F)	[('F) - 32] / 1.8	Celsius ('C)
Fahrenheit ('F)	[('F - 32) / 1.8] + 273.15	Kelvin (K)
Kelvin (K)	K - 273.15	Celsius ('C)
Kelvin (K)	1.8(K - 273.15) + 32	Fahrenheit ('F)
WHEN YOU KNOW	MULTIPLY BY	TO FIND
Distance/Length		
centimeters	0.3937	inches
kilometers	0.6214	miles
meters	3.281	feet
meters	39.37	inches
meters	0.0006214	miles
microns	0.000001	meters
millimeters	0.03937	inches
WHEN YOU KNOW	MULTIPLY BY	TO FIND
Capacity/Volume		
cubic kilometers	0.2399	cubic miles
cubic meters	35.31	cubic feet
cubic meters	1.308	cubic yards
cubic meters	8.107×10^{-4}	acre-feet
liters	0.2642	gallons
liters	33.81	fluid ounces
WHEN YOU KNOW	MULTIPLY BY	TO FIND
Area		
hectares (10,000 square meters)	2.471	acres
hectares (10,000 square meters)	107,600	square feet
square meters	10.76	square feet
square kilometers	247.1	acres
square kilometers	0.3861	square miles
WHEN YOU KNOW	MULTIPLY BY	TO FIND
Weight/Mass		
kilograms	2.205	pounds
metric tons	2205	pounds
micrograms (μg)	10^{-6}	grams
milligrams (mg)	10^{-3}	grams
nanograms (ng)	10^{-9}	grams

Food Guide Pyramid

A Guide to Daily Food Choices

Fats, Oils, & Sweets
USE SPARINGLY

KEY

Fat (naturally occurring and added) Sugars (added)

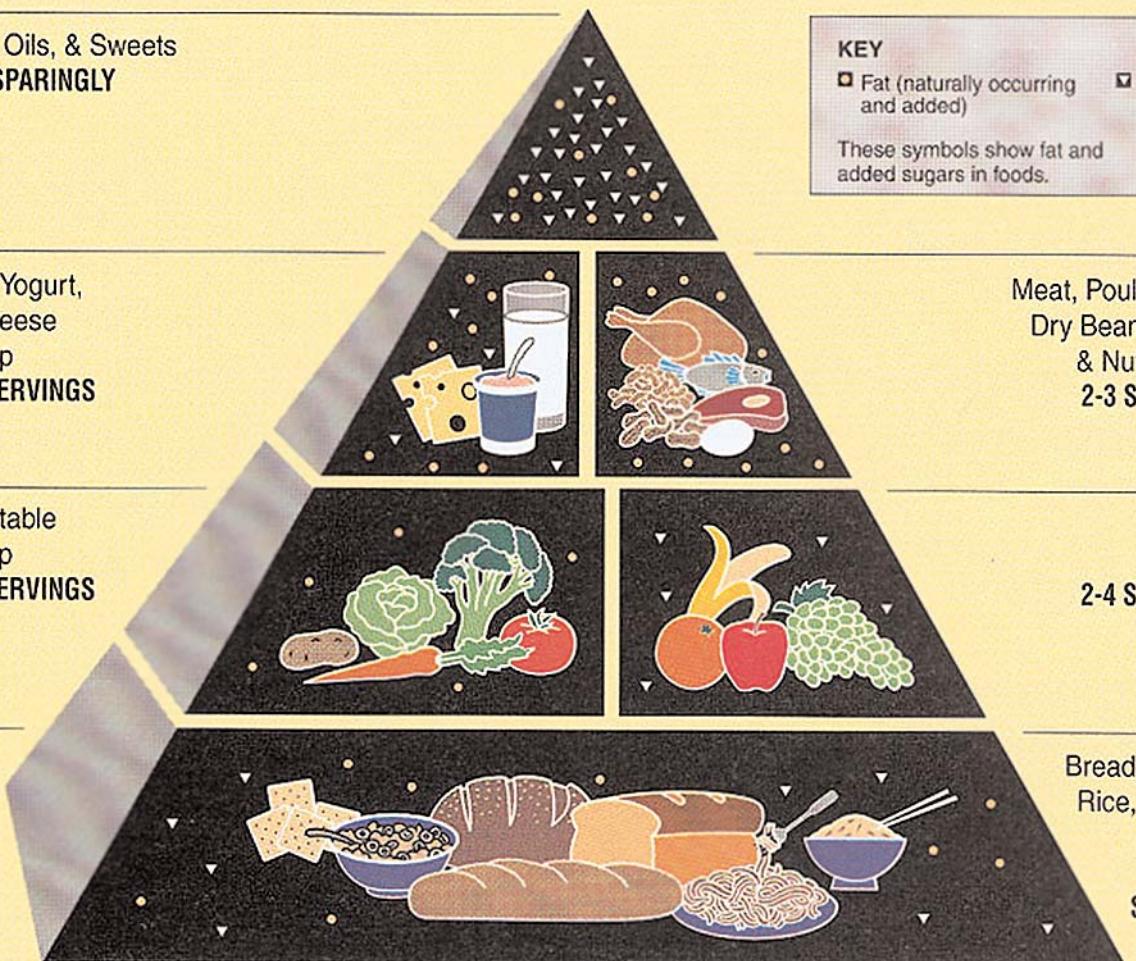
These symbols show fat and added sugars in foods.

Milk, Yogurt,
& Cheese
Group
2-3 SERVINGS

Meat, Poultry, Fish,
Dry Beans, Eggs,
& Nuts Group
2-3 SERVINGS

Vegetable
Group
3-5 SERVINGS

Fruit
Group
2-4 SERVINGS



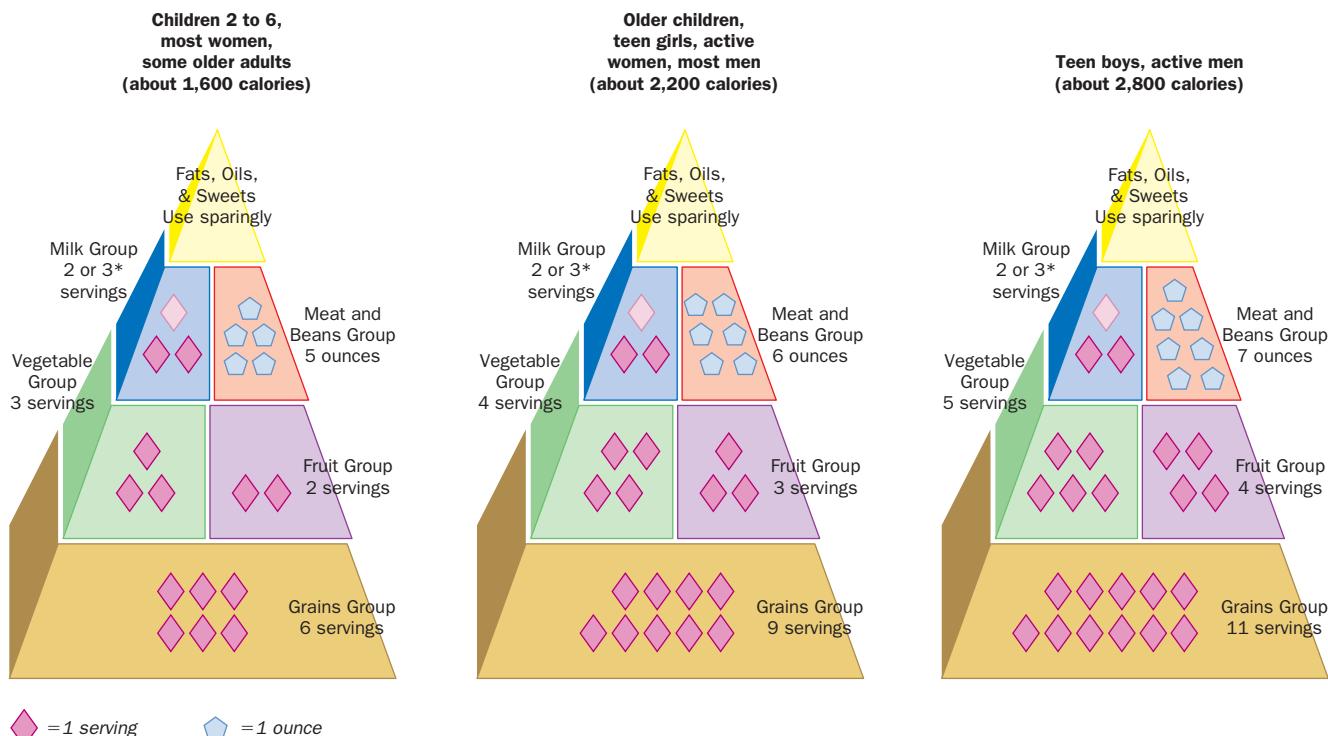
Source: U.S. Department of Agriculture/U.S. Department of Health and Human Services

VITAMINS IN FOODS

Vitamin A	liver, carrots, kale, red peppers, milk, spinach, eggs, butter
Vitamin B ₆	meat, whole grains, cabbage, peanuts, potatoes, soybeans, liver, fish, beans, milk
Vitamin B ₁₂	liver, fish, eggs, milk
Vitamin B ₉ (Folate)	tomatoes, spinach, beets, asparagus, potatoes, liver, wheat germ, soybeans, cabbage, whole grains, eggs, milk, meats
Vitamin C	tomatoes, potatoes, most fruits and vegetables
Vitamin D	milk, liver, fatty fish like herring, chicken skin, egg yolks
Vitamin E	most vegetable oils
Vitamin K	broccoli, turnip greens, lettuce, liver, cauliflower, spinach, cabbage, asparagus, Brussels sprouts
Thiamin	meats, whole grains, potatoes, fish, liver, legumes (like beans and peas)
Biotin	liver, soybeans, egg yolks, peanuts, cauliflower, carrots, oatmeal
Riboflavin	eggs, asparagus, liver, milk, fish, meat, whole grains
Pantothenic Acid	liver, fish, eggs, milk, whole grains, meats, legumes (like beans and peas)
Niacin	meats, whole grains, eggs, fish, milk, legumes (like beans and peas)

SOURCE: Adapted from "The Vitamins" by G. F. Coombs Jr.

RECOMMENDED PYRAMID SERVINGS FOR INDIVIDUALS



*Older children and teens 9 to 18 and adults over 50 need 3 servings from the Milk group. Others need 2 servings daily.

WHAT COUNTS AS A PYRAMID SERVING?

Grains Group

- 1 slice of bread
- About 1 cup of ready to eat cereal flakes
- $\frac{1}{2}$ cup of cooked cereal, rice, or pasta

Vegetable Group

- 1 cup of raw leafy vegetables
- $\frac{1}{2}$ cup of other vegetables—cooked or raw*
- $\frac{3}{4}$ cup of vegetable juice

Fruit Group

- 1 medium apple, banana, orange, pear
- $\frac{1}{2}$ cup of chopped, cooked or canned fruit
- $\frac{3}{4}$ cup of fruit juice

Milk Group

- 1 cup of milk or yogurt
- $1\frac{1}{2}$ ounces of natural cheese (such as Cheddar)
- 2 ounces of processed cheese (such as American)

Meat and Beans Group

The Pyramid recommends 2 to 3 servings for a total of 5 to 7 ounces. The following all count as 1 ounce equivalent:

- 1 ounce of cooked lean meat, poultry, or fish
- $\frac{1}{2}$ cup of cooked, dry beans*
- $\frac{1}{2}$ cup of tofu or $2\frac{1}{2}$ -ounce soyburger
- 1 egg
- 2 tablespoons of peanut butter
- $\frac{1}{3}$ cup of nuts

*Dry beans, peas, and lentils can be counted as servings in either the Meat and Beans group or the Vegetable group. As a vegetable, $\frac{1}{2}$ cup of cooked, dry beans counts as 1 serving. As a meat substitute, $\frac{1}{2}$ cup of cooked, dry beans counts as 1 ounce of meat.

SOURCE: Adapted from *Home and Garden Bulletin 267-3*. USDA.

BODY MASS INDEX TABLE

BMI	Normal						Overweight						Obese						Extreme Obesity																	
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Height (inches)	Body Weight (pounds)																																			
58	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167	172	177	181	186	191	196	201	205	210	215	220	224	229	234	239	244	248	253	258
59	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173	178	183	188	193	198	203	208	212	217	222	227	232	237	242	247	252	257	262	267
60	97	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179	184	189	194	199	204	209	215	220	225	230	235	240	245	250	255	261	266	271	276
61	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185	190	195	201	206	211	217	222	227	232	238	243	248	254	259	264	269	275	280	285
62	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191	196	202	207	213	218	224	229	235	240	246	251	256	262	267	273	278	284	289	295
63	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197	203	208	214	220	225	231	237	242	248	254	259	265	270	278	282	287	293	299	304
64	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204	209	215	221	227	232	238	244	250	256	262	267	273	279	285	291	296	302	308	314
65	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324
66	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216	223	229	235	241	247	253	260	266	272	278	284	291	297	303	309	315	322	328	334
67	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223	230	236	242	249	255	261	268	274	280	287	293	299	306	312	319	325	331	338	344
68	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230	236	243	249	256	262	269	276	282	289	295	302	308	315	322	328	335	341	348	354
69	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236	243	250	257	263	270	277	284	291	297	304	311	318	324	331	338	345	351	358	365
70	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243	250	257	264	271	278	285	282	299	306	313	320	327	334	341	348	355	362	369	376
71	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250	257	265	272	279	286	293	301	308	315	322	329	338	343	351	358	365	372	379	386
72	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258	265	272	279	287	294	302	309	316	324	331	338	346	353	361	368	375	383	390	397
73	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265	272	280	288	295	302	310	318	325	333	340	348	355	363	371	378	386	393	401	408
74	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272	280	287	295	303	311	319	326	334	342	350	358	365	373	381	389	396	404	412	420
75	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279	287	295	303	311	319	327	335	343	351	359	367	375	383	381	399	407	415	423	431
76	156	164	172	180	189	197	205	213	221	230	238	246	254	263	271	279	287	295	304	312	320	328	336	344	353	361	369	377	385	394	402	410	418	426	435	443

SOURCE: Adapted from *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report.*

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Contributors

Karen Ansel
Walnut Creek, California

Katherine Beals
Ball State University
Muncie, Indiana

Mindy Benedict
Ponte Vedra Beach, Florida

Frances Berg
Healthy Weight Network and University of North Dakota School of Medicine
Hellinger, North Dakota

Linda B. Bobroff
University of Florida
Gainesville, Florida

Leslie Bonci
University of Pittsburgh Medical Center
Pittsburgh, Pennsylvania

Susan T. Borra
International Food Information Council Foundation
Washington, DC

Karen Bryla
University of Kentucky
Lexington, Kentucky

Lori Keeling Buhi
Bryan-College Station Community Health Center
Bryan, Texas

Slande Celeste
University of Florida
Gainesville, Florida

Nilesh Chatterjee
Texas A&M University
College Station, Texas

Sara Chelland
Department of Nutrition, Food and Exercise Science
Tallahassee, Florida

Catherine Christie
University of North Florida
Jacksonville, Florida

Sonja Connor
Portland, Oregon

William Connor
Oregon Health Sciences University
Portland, Oregon

Marilyn Dahl
Preferred Nutrition Services
Jacksonville Beach, Florida

Raju Das
University of Dundee
Dundee, UK

Ruth DeBusk
Private Practice
Tallahassee, Florida

Sharon Doughten
Cuyahoga Community College
Cleveland, Ohio

Karen Drummond
Yardley, Pennsylvania

M. Cristina Flaminiano Garces
University of North Carolina at Chapel Hill

Beth Fontenot
McNeese State University
Lake Charles, Louisiana

John P. Foreyt
Baylor College of Medicine
Houston, Texas

Mohammed Forouzesh
California State University at Long Beach
Long Beach, California

Marion J. Franz
Nutrition Concepts by Franz, Inc.
Minneapolis, Minnesota

Marjorie Freedman
San Jose, California

Keri M. Gans
New York, New York

Chandak Ghosh
Harvard Medical School
Boston, Massachusetts

Gita C. Gidwani
Johns Hopkins University
Baltimore, Maryland

Emil Ginter
Institute of Preventive and Clinical Medicine
Bratislava, Slovak Republic

Diane Golzynski
California State University
Fresno, California

Leslene E. Gordon
Pasco County Health Department Nutrition Division
New Port Richey, Florida

Marcus Harding
International Medical Volunteers Association
Woodville, Massachusetts

Karen Hare
Nutrition Services, Inc.
Fort Collins, Colorado

Beth Hensleigh
Texas A&M University
College Station, Texas

Kirsten Herbes
University of Florida
Gainesville, Florida

Susan Himburg
Florida International University
Miami, Florida

Lenore S. Hodges
Florida Hospital
Orlando, Florida

Steve Hohman
Ohio University
Athens, Ohio

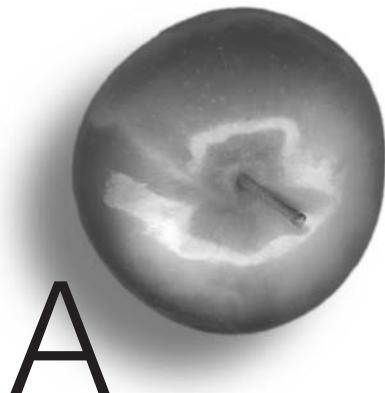
Elissa M. Howard-Barr
Coastal Carolina University
Conway, South Carolina

Delores C. S. James
University of Florida
Gainesville, Florida

Sunitha Jasti
University of North Carolina, Chapel Hill, North Carolina

Warren B. Karp
The Medical College of Georgia
Augusta, Georgia

Susan Kim <i>Williams College</i> Williamstown, Massachusetts	Laura Nelson <i>Texas A&M University</i> College Station, Texas	Kyle Shadix Art Institute of New York City
Seema Pania Kumar <i>Alexandria Primary Care Associates</i> Alexandria, Virginia	Virginia Noland <i>University of Florida</i> Gainesville, Florida	Jackie Shank <i>Southeast Nutrition Consultants</i> St. Augustine, Florida
M. Elizabeth Kunkel <i>Clemson University</i> Clemson, South Carolina	Neelima Pania <i>New York University Hospital</i> New York, New York	Heidi J. Silver <i>National Policy and Resource Center</i> <i>on Nutrition and Aging</i> Miami, Florida
Julie Lager <i>Texas A&M University</i> College Station, Texas	Mary Parke <i>Duval County Health Department,</i> <i>UIC and Nutrition Program</i> Jacksonville, Florida	Donna Staton <i>International Medical Volunteers</i> <i>Association</i>
Jens Levy <i>University of North Carolina</i> Chapel Hill, North Carolina	Isabel Parraga <i>Case Western Reserve University</i> Cleveland, Ohio	Tanya Sterling <i>Duval County Health Department</i> Jacksonville, Florida
Kheng Lim <i>University of Medicine and</i> <i>Dentistry of New Jersey</i> Camden, New Jersey	Gita Patel <i>Nutrition Consultant</i> Etna, New Hampshire	Milton Stokes New York, New York
Nadia Lugo <i>University of Florida</i> Gainesville, Florida	Nadine Pazder <i>Morton Plant Hospital</i> Clearwater, Florida	Lisa A. Sutherland <i>University of North Carolina</i> Chapel Hill, North Carolina
Teresa Lyles <i>University of Florida</i> Gainesville, Florida	Judy E. Perkin <i>University of North Florida</i> Jacksonville, Florida	Marie Boyle Struble <i>College of Saint Elizabeth</i> Morristown, New Jersey
Carole Mackey <i>Agency for Health Care</i> <i>Administration</i> St. Petersburg, Florida	Jeffrey Radecki <i>Robert Wood Johnson Medical</i> <i>School</i> Piscataway, New Jersey	D. Michelle Swords Gainesville, Florida
Amy N. Marlow New York, New York	Sheah Rarback <i>University of Miami School</i> <i>Medicine</i> Miami, Florida	Patricia Thomas San Antonio, Texas
Cindy Martin <i>Texas A&M University</i> College Station, Texas	Catherine Rasberry <i>Texas A&M University</i> College Station, Texas	Delores Truesdell <i>Florida State University</i> Tallahassee, Florida
Toni Martin <i>Duval County Health Department</i> Jacksonville, Florida	Barbara L. Rice <i>Enterprise Advisory Services, Inc.</i> Houston, Texas	Katherine Tucker <i>USDA/HNRCA at Tufts</i> <i>University</i> Boston, Massachusetts
Kiran Misra <i>Texas A&M University</i> College Station, Texas	Carlos Robles <i>University of the Virgin Islands</i>	Simin Vaghefi <i>University of North Florida</i> Jacksonville, Florida
Ranjita Misra <i>San Diego State University</i> San Diego, California	Judy Rodriguez <i>University of North Florida</i> Jacksonville, Florida	Pauline Vickery <i>Suwannee River Area Health</i> <i>Education Center</i>
Braxton D. Mitchell <i>University of Maryland</i> Baltimore, Maryland	Kim Schenck Colorado Springs, Colorado	Ruth Waibel <i>Ohio University</i> Athens, Ohio
Susan Mitchell <i>Practicalories, Inc.</i> Winter Park, Florida	Claire D. Schmelzer <i>Virginia Polytechnic Institute and</i> <i>State University</i> Blacksburg, Virginia	Daphne C. Watkins <i>Texas A&M University</i> College Station, Texas
Robert J. Moffatt <i>Florida State University</i> Tallahassee, Florida	<i>University of Kentucky</i> Lexington, Kentucky	Sally Weerts <i>University of North Florida</i> Jacksonville, Florida
Melissa Morris <i>University of Florida</i> Gainesville, Florida	Louise Schneider <i>Lorna Linda University</i> Lorna Linda, California	Paulette Weir Elmont, New York
Kweethai C. Neill <i>University of North Texas</i> Denton, Texas	Jessica Schulman <i>University of Florida</i> Gainesville, Florida	Katherine Will <i>Ohio University</i> Athens, Ohio
		Heidi Williams Gainesville, Florida



Addiction, Food

Food addiction is a nonmedical term that refers to a compulsion to eat specific foods, usually those that are high in sugar or starch. Although this term is used to describe intense cravings to seek out specific foods, these foods are not, in and of themselves, physically addictive in the way a drug might be. Instead, the need to pursue and consume these foods may be representative of a **psychological** disturbance, extreme **anxiety**, or emotional distress. SEE ALSO EATING DISORDERS; EATING DISTURBANCES.

Karen Ansel

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Additives and Preservatives

Additives are defined by the United States Food and Drug Administration (FDA) as “any substance, the intended use of which results or may reasonably be expected to result, directly or indirectly, in its becoming a component or otherwise affecting the characteristics of any food.” In other words, an additive is any substance that is added to food. Direct additives are those that are intentionally added to foods for a specific purpose. Indirect additives are those to which the food is exposed during processing, packaging, or storing. Preservatives are additives that inhibit the growth of **bacteria**, yeasts, and molds in foods.

Additives and preservatives have been used in foods for centuries. When meats are smoked to preserve them, compounds such as butylated hydroxyanisole (BHA) and butyl gallate are formed and provide both **antioxidant** and **bacteriostatic** effects. Salt has also been used as a preservative for centuries. Salt lowers the water activity of meats and other foods and inhibits bacterial growth. Excess water in foods can enhance the growth of bacteria, yeast, and fungi. Pickling, which involves the addition of acids such as vinegar, lowers the **pH** of foods to levels that retard bacterial growth. Some herbs and spices, such as curry, cinnamon, and chili pepper, also contain antioxidants and may provide **bactericidal** effects.

psychological: related to thoughts, feelings, and personal experiences

anxiety: nervousness

bacteria: single-celled organisms without nuclei, some of which are infectious

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

bacteriostatic: a state that prevents growth of bacteria

pH: level of acidity, with low numbers indicating high acidity

bactericidal: a substance that kills bacteria

leavening: yeast or other agents used for rising bread

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

microorganisms: bacteria and protists; single-celled organisms

oxygen: O₂, atmospheric gas required by all animals

nutrient: dietary substance necessary for health

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

enrichment: addition of vitamins and minerals to improve the nutritional content of a food

fortification: addition of vitamins and minerals to improve the nutritional content of a food

fortified: altered by addition of vitamins or minerals

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

niacin: one of the B vitamins, required for energy production in the cell

Uses of Additives and Preservatives in Foods

Additives and preservatives are used to maintain product consistency and quality, improve or maintain nutritional value, maintain palatability and wholesomeness, provide **leavening**, control pH, enhance flavor, or provide color. **Food additives** may be classified as:

1. *Antimicrobial agents*, which prevent spoilage of food by mold or **micro-organisms**. These include not only vinegar and salt, but also compounds such as calcium propionate and sorbic acid, which are used in products such as baked goods, salad dressings, cheeses, margarines, and pickled foods.
2. *Antioxidants*, which prevent rancidity in foods containing fats and damage to foods caused by **oxygen**. Examples of antioxidants include vitamin C, vitamin E, BHA, BHT (butylated hydroxytolene), and propyl gallate.
3. *Artificial colors*, which are intended to make food more appealing and to provide certain foods with a color that humans associate with a particular flavor (e.g., red for cherry, green for lime).
4. *Artificial flavors and flavor enhancers*, the largest class of additives, function to make food taste better, or to give them a specific taste. Examples are salt, sugar, and vanilla, which are used to complement the flavor of certain foods. Synthetic flavoring agents, such as benzaldehyde for cherry or almond flavor, may be used to simulate natural flavors. Flavor enhancers, such as monosodium glutamate (MSG) intensify the flavor of other compounds in a food.
5. *Bleaching agents*, such as peroxides, are used to whiten foods such as wheat flour and cheese.
6. *Chelating agents*, which are used to prevent discoloration, flavor changes, and rancidity that might occur during the processing of foods. Examples are citric acid, malic acid, and tartaric acid.
7. *Nutrient additives*, including **vitamins** and **minerals**, are added to foods during **enrichment** or **fortification**. For example, milk is **fortified** with **vitamin D**, and rice is enriched with thiamin, riboflavin, and **niacin**.
8. *Thickening and stabilizing agents*, which function to alter the texture of a food. Examples include the emulsifier lecithin, which, keeps oil and vinegar blended in salad dressings, and carrageen, which is used as a thickener in ice creams and low-calorie jellies.

Regulating Safety of Food Additives and Preservatives

Based on the 1958 Food Additives Amendment to the Federal Food, Drug, and Cosmetic (FD&C) Act of 1938, the FDA must approve the use of all additives. The manufacturer bears the responsibility of proving that the additive is safe for its intended use. The Food Additives Amendment excluded additives and preservatives deemed safe for consumption prior to 1958, such as salt, sugar, spices, vitamins, vinegar, and monosodium glutamate. These substances are considered “generally recognized as safe” (GRAS) and may be used in any food, though the FDA may remove additives from the GRAS list if safety concerns arise. The 1960 Color Additives Amendment to the FD&C Act required the FDA to approve synthetic coloring agents used in



The legendary longevity of some packaged foods such as Twinkies, is attributable in part to food additives that stabilize ingredients and prevent spoilage. Additives also enhance the nutrition, flavor, and consistency of foods. [Photograph by Orlin Wagner. AP/Wide World Photos. Reproduced by permission.]

foods, **drugs**, cosmetics, and certain medical devices. The Delaney Clause, which was included in both the Food Additives Amendment and Color Additives Amendment, prohibited approval of any additive that had been found to cause **cancer** in humans or animals. However, in 1996 the Delaney Clause was modified, and the commissioner of the FDA was charged with assessing the risk from consumption of additives that may cause cancer and making a determination as to the use of that additive.

The FDA continually monitors the safety of all food additives as new scientific evidence becomes available. For example, use of erythrosine (FD&C Red No. 3) in cosmetics and externally applied drugs was banned

drugs: substances whose administration causes a significant change in the body's function

cancer: uncontrolled cell growth

nitrite: NO_2^- , used for preservatives

amine: compound containing nitrogen linked to hydrogen

carcinogen: cancer-causing substance

fermentation: reaction performed by yeast or bacteria to make alcohol

asthma: respiratory disorder marked by wheezing, shortness of breath, and mucus production

toxicant: harmful substance

The Discovery of Canning

During the late eighteenth century the French army was suffering from scurvy, malnourishment, and outright starvation, and the French government offered a prize of 12,000 francs to anyone who could discover a way to preserve food for the troops. Nicholas Appert, a candymaker, brewer, and baker, reasoned that he should be able to preserve food in bottles, like wine. After fourteen years of experimentation, he finally discovered that if he put food in glass jars reinforced with wire, sealed them with wax, and applied heat, the food didn't spoil. Appert was presented with the 12,000-franc prize by Napoleon himself. However, the secret of preserved food soon leaked to the English, who proceeded to invent the can, and the armies that faced off at Waterloo were both fortified by preserved rations.

—Paula Kepos

in 1990 after it was implicated in the development of thyroid tumors in male rats. However, the cancer risk associated with FD&C Red No. 3 is about 1 in 100,000 over a seventy-year lifetime, and its use in some foods, such as candies and maraschino cherries, is still allowed. Tartrazine (FD&C Yellow No. 5) has been found to cause dermatological reactions ranging from itching to hives in a small population subgroup. Given the mild nature of the reaction, however, it still may be used in foods.

Nitrites are also a controversial additive. When used in combination with salt, nitrites serve as antimicrobials and add flavor and color to meats. However, nitrite salts can react with certain **amines** in food to produce nitrosamines, many of which are known **carcinogens**. Food manufacturers must show that nitrosamines will not form in harmful amounts, or will be prevented from forming, in their products. The flavoring enhancer MSG is another controversial food additive. MSG is made commercially from a natural **fermentation** process using starch and sugar. Despite anecdotal reports of MSG triggering headaches or exacerbating **asthma**, the Joint Expert Committee on Food Additives of the United Nations Food and Agriculture Organization, the World Health Organization, the European Community's Scientific Committee for Food, the American Medical Association, and the National Academy of Sciences have all affirmed the safety of MSG at normal consumption levels.

In the United States, food additives and preservatives play an important role in ensuring that the food supply remains the safest and most abundant in the world. A major task of the FDA is to regulate the use and approval of thousands of approved food additives, and to evaluate their safety. Despite consumer concern about use of food additives and preservatives, there is very little scientific evidence that they are harmful at the levels at which they are used.

In Europe, food additives and preservatives are evaluated by the European Commission's Scientific Committee on Food. Regulations in European Union countries are similar to those in the United States. The Food and Agricultural Organization (FAO) of the United Nations and the World Health Organization (WHO) Expert Committee on Food Additives work together to evaluate the safety of food additives, as well as contaminants, naturally occurring **toxicants**, and residues of veterinary drugs in foods. Acceptable Daily Intakes (ADIs) are established on the basis of toxicology and other information. SEE ALSO ARTIFICIAL SWEETENERS; FAT SUBSTITUTES.

M. Elizabeth Kunkel
Barbara H. D. Luccia

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Adolescent Nutrition

Adolescence is the transition period between childhood and adulthood, a time of life that begins at **puberty**. For girls, puberty typically occurs be-

puberty: time of onset of sexual maturity

tween ages 12 and 13, while for boys it occurs between ages 14 and 15. It is one of the fastest growth periods of a person's life. During this time, physical changes affect the body's nutritional needs, while changes in one's lifestyle may affect eating habits and food choices. Nutritional health during adolescence is important for supporting the growing body and for preventing future health problems.

Increased Nutritional Needs

The physical changes of adolescence have a direct influence on a person's nutritional needs. Teenagers need additional **calories**, **protein**, **calcium**, and **iron**.

Calories. Adolescents need additional calories to provide **energy** for growth and activity. Boys ages 11 to 18 need between 2,500 and 2,800 calories each day. Adolescent girls need approximately 2,200 calories each day. This is a significant increase from childhood requirements. To meet these calorie needs, teens should choose a variety of healthful foods, such as lean protein sources, low-fat dairy products, whole grains, fruits, and vegetables.

Protein. Protein is important for growth and maintenance of muscle. Adolescents need between 45 and 60 grams of protein each day. Most teens easily meet this requirement with their intake of beef, pork, chicken, eggs, and dairy products. Protein is also available from certain vegetable sources, including **tofu** and other soy foods, beans, and nuts.

Calcium. Adequate calcium intake is essential for development of strong and dense bones during the adolescent growth spurt. Inadequate calcium intake during adolescence and young adulthood puts individuals at risk for developing **osteoporosis** later in life. In order to get the required 1,200 milligrams of calcium, teens are encouraged to consume three to four servings of calcium-rich foods each day. Good sources include milk, yogurt, cheese, calcium-fortified juices, and calcium-fortified cereals.

Iron. As adolescents gain muscle mass, more iron is needed to help their new muscle cells obtain **oxygen** for energy. A deficiency of iron causes **anemia**, which leads to **fatigue**, confusion, and weakness. Adolescent boys need 12 milligrams of iron each day, while girls need 15 milligrams. Good sources of iron include beef, chicken, pork, **legumes** (including beans and peanuts), enriched or whole grains, and leafy green vegetables such as spinach, collards, and kale.

Eating and Snacking Patterns

Adolescents tend to eat differently than they did as children. With after-school activities and active social lives, teens are not always able to sit down for three meals a day. Busy schedules may lead to meal skipping, snacking throughout the day, and more eating away from home. Many teens skip breakfast, for example, but this meal is particularly important for getting enough energy to make it through the day, and it may even lead to better academic performance. When teens skip meals, they are more likely to grab fast food from a restaurant, vending machine, or convenience store. These foods are high in fat and sugar and tend to provide little nutritional value. In addition, eating too many fast foods can lead to weight gain and, in some cases, **diabetes** and **heart disease**.

calorie: unit of food energy

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

calcium: mineral essential for bones and teeth

iron: nutrient needed for red blood cell formation

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

tofu: soybean curd, similar in consistency to cottage cheese

osteoporosis: weakening of the bone structure

oxygen: O₂, atmospheric gas required by all animals

anemia: low level of red blood cells in the blood

fatigue: tiredness

legumes: beans, peas, and related plants

diabetes: inability to regulate level of sugar in the blood

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

Dietary decisions made in adolescence may have lasting health effects. For example, in the United States, more than 85 percent of teen girls and about 65 percent of teen boys do not include enough calcium in their diets. Such deficiency increases their chances of developing osteoporosis as adults.

[AP/Wide World Photos. Reproduced by permission.]



Eating meals and snacking away from home puts the responsibility for good food choices right in adolescents' hands. Snacks should be low in both fat and added sugar. Some healthful snack ideas include fresh fruit, sliced vegetables with low-fat dip, low-fat yogurt, low-fat string cheese, peanut butter and crackers, baked chips, granola bars, and graham crackers. Juices, fruit drinks, and sodas are usually very high in calories from natural or added sugar, so they should be consumed in moderation. The Food Guide Pyramid is an appropriate guide for adolescents' food choices, even when snacking.

Potential Nutrition-Related Problems

obesity: the condition of being overweight, according to established norms based on sex, age, and height

chronic: over a long period

Adolescents are at risk for **obesity**, obesity-related **chronic** diseases, and eating disorders.

Obesity, Diabetes, and Heart Disease. All over the world, adolescent obesity is on the rise. This has led to an increase in obesity-related diseases like diabetes and heart disease. Experts believe this rise in obesity is due to lack of physical activity and an increase in the amount of fast food and "junk food" available to adolescents. Staying active and eating foods that are low in fat and sugar promote a healthy weight for teens.

Eating Disorders. Adolescents tend to be very conscious of appearances and may feel pressure to be thin or to look a certain way. Fear of gaining weight may lead to overly restrictive eating habits. Some teens resort to self-induced vomiting or laxative use to control their weight. Both boys and girls are affected by eating disorders. Teens who suspect they have a problem with body image or eating habits should talk to a trusted adult.

High-Risk Groups

Certain groups of adolescents may be at risk for nutritional inadequacies.

Pregnant Teens. When a teenager becomes pregnant, she needs enough **nutrients** to support both her baby and her own continued growth and physical development. If her nutritional needs are not met, her baby may be born with low birth weight or other health problems. For the best outcome, pregnant teens need to seek prenatal care and nutrition advice early in their pregnancy.

Athletes. Adolescents involved in athletics may feel pressure to be at a particular weight or to perform at a certain level. Some young athletes may be tempted to adopt unhealthy behaviors such as crash dieting, taking supplements to improve performance, or eating unhealthy foods to fulfill their hearty appetites. A balanced nutritional outlook is important for good health and athletic performance.

Vegetarians. A vegetarian **diet** can be a very healthy option. However, adolescents who follow a vegetarian diet, whether for religious or personal reasons, need to carefully plan their intake to get the protein and **minerals** they need. Strict vegetarians (those who do not eat eggs or dairy products), also known as **vegans**, may need nutritional supplements to meet their needs for calcium, vitamin B₁₂, and iron.

Conclusion

Adolescence is a time of growing up both physically and socially. During these years, the nutrition choices people make will affect not only their current health, but their future health as well. SEE ALSO EATING DISORDERS; EATING DISTURBANCES; SCHOOL-AGED CHILDREN, DIET OF.

Amy N. Marlow

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Adult Nutrition

The science of **nutrition** is dedicated to learning about foods that the human body requires at different stages of life in order to meet the nutritional needs for proper growth, as well as to maintain health and prevent disease. A baby is born with a very high requirement for **energy** and **nutrient** intake per unit of body weight to provide for rapid growth. The rate of growth is the highest during the first year and declines slowly after the age of two, with a corresponding decrease in nutrient and energy requirements. During **puberty**, however, **nutritional requirements** increase sharply until this period of fast growth is completed. Adulthood begins at about the age of fourteen or fifteen for girls, and eighteen or nineteen for boys.

An adult individual needs to balance energy intake with his or her level of physical activity to avoid storing excess body **fat**. Dietary practices and food choices are related to **wellness** and affect health, fitness, weight

nutrient: dietary substance necessary for health

diet: the total daily food intake, or the types of foods eaten

mineral: an inorganic (non-carbon-containing) element, ion, or compound

vegan: person who consumes no animal products, including milk and honey

nutrition: the maintenance of health through proper eating, or the study of same

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

nutrient: dietary substance necessary for health

puberty: time of onset of sexual maturity

nutritional requirements: the set of substances needed in the diet to maintain health

fat: type of food molecule rich in carbon and hydrogen, with high energy content

wellness: related to health promotion

chronic: over a long period

osteoporosis: weakening of the bone structure

cardiovascular: related to the heart and circulatory system

cancer: uncontrolled cell growth

diabetes: inability to regulate level of sugar in the blood

physiological: related to the biochemical processes of the body

basal metabolic rate: rate of energy consumption by the body during a period of no activity

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

obesity: the condition of being overweight, according to established norms based on sex, age, and height

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fiber: indigestible plant material that aids digestion by providing bulk

diet: the total daily food intake, or the types of foods eaten

constipation: difficulty passing feces

hemorrhoids: swollen blood vessels in the rectum

diverticulosis: presence of abnormal small sacs in the lining of the intestine

appendicitis: inflammation of the appendix

management, and the prevention of **chronic** diseases such as **osteoporosis**, **cardiovascular** diseases, **cancer**, and **diabetes**.

For adults (ages eighteen to forty-five or fifty), weight management is a key factor in achieving health and wellness. In order to remain healthy, adults must be aware of changes in their energy needs, based on their level of physical activity, and balance their energy intake accordingly.

As teenagers reach adulthood, the basal energy needs for maintaining the body's **physiological** functions (**basal metabolic rate**, or BMR) stabilize, and so energy requirements also stabilize. BMR is defined as the energy required by the body to keep functioning. These functions include the pumping of blood by the heart, respiration, kidney function, and maintaining muscle tone and a constant body temperature, among others. BMR is directly related to the amount of lean body muscle mass, size, and gender. Physical activity, especially weight-training exercises, help increase and maintain lean body mass.

It is very important to reduce one's energy intake at the onset of adulthood, and to make sure that all of one's nutritional needs are met. This can be accomplished by making sure that an adequate amount of energy is consumed (this will vary by body weight, degree of physical fitness, and muscle vs. body fat), and that this amount of energy is adjusted to one's level of physical activity. Foods that are chosen to provide the energy must be highly nutritious, containing high amounts of essential nutrients such as **vitamins**, **minerals**, and **essential proteins**.

It is usually at this age that young adults start gaining body fat and reducing their physical activity, resulting in an accumulation of fat in the abdominal areas. This is an ever-increasing risk factor in the population of the United States, where **obesity** is not only a problem in adults, but also in children. It is believed that the high level of obesity in the United States is mostly due to bad dietary practices such as eating a high-fat, low-complex **carbohydrate** (low **fiber**) **diet**, including excessive amounts of meat. The indulgence in fast foods and a lack of regular physical activity are major factors. Obesity is a risk factor for other degenerative diseases, such as type II (adult onset) diabetes, diseases of heart and circulation, and certain cancers. Another nutritional problem related to eating such a diet is **constipation**, due to low-fiber diets. This may result in **hemorrhoids**, **diverticulosis**, **appendicitis**, and other more serious diseases of the lower intestine. Increasing the number of servings of fruits, vegetables, and whole grains in the diet will prevent these diseases. In the United States, the Dietary Guidelines for Americans (as summarized in the Food Guide Pyramid) provide practical guidelines for healthful eating.

At the onset of adulthood, energy requirements usually reach a plateau that will last until one's mid-forties, after which they begin to decline, primarily because activity levels and lean muscle mass (amount of muscle vs. body fat), which represents the BMR, decrease. It is believed that the changes in body composition and reduced lean muscle mass occur at a rate of about 5 percent per decade, and energy requirements decrease accordingly. However, these changes in body composition and decreased energy requirements can be prevented by maintaining regular physical activity, including resistance training, which helps maintain lean muscle mass and prevent deposition of excess body fat.



The basal metabolic rate—the number of calories a person's body uses while at rest—generally decreases with age. Good health requires adults to adapt their diets to the body's changing needs by eating low-fat and nutrient-rich foods. [Photograph by Michael Keller. Corbis. Reproduced by permission.]

By preventing normal age-related decline in lean muscle mass, one can prevent obesity and prolong one's physiological age. The result is that a person is less vulnerable to degenerative diseases, such as cardiovascular diseases, cancer, and diabetes, and can usually perform at a higher level than his or her chronological age would otherwise allow.

Older adults who are not physically active or who have poor nutritional practices will have a decline in BMR, a change in body composition, an increasing percentage of body fat, and a decrease in lean body muscle mass. In addition, they will show the signs of aging and will be more likely to develop degenerative diseases.

hypertension: high blood pressure

absorption: uptake by the digestive tract

calcium: mineral essential for bones and teeth

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

menopause: phase in a woman's life during which ovulation and menstruation ends

Many older adults need to take medications to control the advance of diabetes, **hypertension**, and cardiovascular disease. Medications can interfere with proper nutrition, however, as they affect appetite, the digestion and **absorption** of nutrients, and normal function of the digestive system.

As women age, they may develop osteoporosis if they have not built up strong bones by eating foods high in **calcium** and adequate **vitamin D**. Women start losing calcium from bones during and after the onset of **menopause** at the rate of 1 percent per year for about five years, after which the rate of calcium loss is reduced until about age seventy-five or eighty. Therefore, it is important for women to eat foods high in calcium up to the age of thirty-five. The recommended daily intake of calcium is 1,200 milligrams. This requirement can be met by consuming four servings of dairy products and two servings of green vegetables each day. It is well established that calcium from foods is much better absorbed than calcium from supplements. It is beneficial, therefore, to choose foods with a high calcium content, such as low-fat or skim dairy products. This regimen builds a bone density high enough so that, at menopause, losing approximately 5 percent of bone density in five years does not place a woman in the "fracture zone," where bones can break as a result of osteoporosis. SEE ALSO AGING AND NUTRITION; NUTRIENT-DRUG INTERACTIONS; OSTEOPOROSIS.

Simin B. Vaghefi

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African Americans, Diet of

The 2000 U.S. Census revealed that there were almost 35 million African Americans, or about 13 percent of the total U.S. population. This small percentage of the populace has had a significant influence on American cuisine, not only because African-American food is diverse and flavorful, but also because of its historical beginnings. Despite their cultural, political, economic, and racial struggles, African Americans have retained a strong sense of their culture, which is, in part, reflected in their food.

Origins of the African-American Diet: The Aftereffects of Slavery

The roots of the **diversity** of African-American cuisine may be traced back to 1619, when the first African slaves were sold in the New World. In a

diversity: the variety of cultural traditions within a larger culture

quest to build new cities in America, Europeans actively transported Africans and West Indians (people from the West Indies) to the new land. The West Indies (in the Caribbean Sea) was part of the slave route to America. Because the West Indians' skin color was similar to that of Africans, they were not treated any differently. As a result, some West Indian food traditions are similar to those of African Americans.

It is not surprising that African-American food has a distinctive culinary heritage with diverse flavors, as it includes traditions drawn from the African continent, the West Indies, and from North America. While the European nations were busy establishing new societies, they did not realize that the African and West Indian slaves who worked for them brought their own vibrant and rich culture—a culture that would withstand and adapt to the harsh centuries of slavery.

Food historian Karen Hess writes about the struggle of African Americans to maintain some of their original culture through food. "The only thing that Africans brought with them [from Africa] was their memories." Slave traders attempted to craft culturally sensitive rations for the Africans by including yams, rice, corn, plantains, coconuts, and scraps of meat in the slaves' provisions.

Southern slaves established their own cooking culture using foods that were similar to foods that were part of their African and West Indian heritages, and many popular foods in the African-American diet are directly associated with foods in Africa. For instance, the African yam is similar to the American sweet potato. White rice is also popular because it was a major part of the diet in West Africa. African Americans infuse plain rice dishes with their own savory ingredients (popular rice dishes include gumbo and "hoppin' John," a dish made with rice, black-eyed peas, and salt pork or bacon).

The Legacy of African-American Cuisine

Popular southern foods, such as the vegetable okra (brought to New Orleans by African slaves), are often attributed to the importation of goods from Africa, or by way of Africa, the West Indies, and the slave trade. Okra, which is the principal ingredient in the popular Creole stew referred to as gumbo, is believed to have spiritual and healthful properties. Rice and seafood (along with sausage or chicken), and file (a sassafras powder inspired by the Choctaw Indians) are also key ingredients in gumbo. Other common foods that are rooted in African-American culture include black-eyed peas, benne seeds (sesame), eggplant, sorghum (a grain that produces sweet syrup and different types of flour), watermelon, and peanuts.

Though southern food is typically known as "soul food," many African Americans contend that soul food consists of African-American recipes that have been passed down from generation to generation, just like other African-American **rituals**. The legacy of African and West Indian culture is imbued in many of the recipes and food traditions that remain popular today. The staple foods of African Americans, such as rice, have remained largely unchanged since the first Africans and West Indians set foot in the New World, and the southern United States, where the slave population was most dense, has developed a cooking culture that remains true to the African-American tradition. This cooking is aptly named *southern cooking*.



A major ingredient in cuisine of African origin, okra traveled to the eastern Mediterranean, Arabia, and India long before it came to the New World with African slaves. The thickening characteristic of its sticky substance is put to good use in the preparation of gumbos and stews. [Photograph by Robert J. Huffman/Field Mark Publications. Reproduced by permission.]

ritual: ceremony or frequently repeated behavior

the food, or *soul food*. Over the years, many have interpreted the term *soul food* based on current social issues facing the African-American population, such as the civil rights movement. Many civil rights advocates believe that using this word perpetuates a negative connection between African Americans and slavery. However, as Doris Witt notes in her book *Black Hunger* (1999), the “soul” of the food refers loosely to the food’s origins in Africa.

In his 1962 essay “Soul Food,” Amiri Baraka makes a clear distinction between southern cooking and soul food. To Baraka, soul food includes chitterlings (pronounced chitlins), pork chops, fried porgies, potlikker, turnips, watermelon, black-eyed peas, grits, hoppin’ John, hushpuppies, okra, and pancakes. Today, many of these foods are limited among African Americans to holidays and special occasions. Southern food, on the other hand, includes only fried chicken, sweet potato pie, collard greens, and barbecue, according to Baraka. The idea of what soul food is seems to differ greatly among African Americans.

General Dietary Influences

In 1992 it was reported that there is little difference between the type of foods eaten by whites and African Americans. There have, however, been large changes in the overall quality of the diet of African Americans since the 1960s. In 1965, African Americans were more than twice as likely as whites to eat a diet that met the recommended guidelines for **fat**, **fiber**, and fruit and vegetable intakes. By 1996, however, 28 percent of African Americans were reported to have a poor-quality diet, compared to 16 percent of whites, and 14 percent of other racial groups. The diet of African Americans is particularly poor for children two to ten years old, for older adults, and for those from a low socioeconomic background. Of all racial groups, African Americans have the most difficulty in eating diets that are low in fat and high in fruits, vegetables, and whole grains. This represents an immense change in diet quality. Some explanations for this include: (1) the greater market availability of packaged and **processed foods**; (2) the high cost of fresh fruit, vegetables, and lean cuts of meat; (3) the common practice of frying food; and (4) using fats in cooking.

Regional differences. Although there is little overall variability in diets between whites and African Americans, there are many notable regional influences. Many regionally influenced **cuisines** emerged from the interactions of Native American, European, Caribbean, and African cultures. After emancipation, many slaves left the south and spread the influence of soul food to other parts of the United States. Barbecue is one example of African-influenced cuisine that is still widely popular throughout the United States. The Africans who came to colonial South Carolina from the West Indies brought with them what is today considered signature southern cookery, known as *barbacoa*, or barbecue. The original barbecue recipe’s main ingredient was roasted pig, which was heavily seasoned in red pepper and vinegar. But because of regional differences in livestock availability, pork barbecue became popular in the eastern United States, while beef barbecue became popular in the west of the country.

Other Ethnic Influences. Cajun and Creole cooking originated from the French and Spanish but were transformed by the influence of African

cooks. African chefs brought with them specific skills in using various spices, and introduced okra and native American foodstuffs, such as crawfish, shrimp, oysters, crabs, and pecans, into both Cajun and Creole cuisine. Originally, Cajun meals were bland, and nearly all foods were boiled. Rice was used in Cajun dishes to stretch out meals to feed large families. Today, Cajun cooking tends to be spicier and more robust than Creole. Some popular Cajun dishes include pork-based sausages, jambalayas, gumbo, and coush-coush (a creamed corn dish). The symbol of Cajun cooking is, perhaps, the crawfish, but until the 1960s crawfish were used mainly as bait.

More recently, the immigration of people from the Caribbean and South America has influenced African-American cuisine in the south. New spices, ingredients, combinations, and cooking methods have produced popular dishes such as Jamaican jerk chicken, fried plantains, and bean dishes such as Puerto Rican *habichuelas* and Brazilian *feijoada*.

Holidays and Traditions. African-American meals are deeply rooted in traditions, holidays, and celebrations. For American slaves, after long hours working in the fields the evening meal was a time for families to gather, reflect, tell stories, and visit with loved ones and friends. Today, the Sunday meal after church continues to serve as a prime gathering time for friends and family.

Kwanzaa, which means “first fruits of the harvest,” is a holiday observed by more than 18 million people worldwide. Kwanzaa is an African-American celebration that focuses on the traditional African values of family, community responsibility, commerce, and self-improvement. The Kwanzaa Feast, or Karamu, is traditionally held on December 31. This symbolizes the celebration that brings the community together to exchange and to give thanks for their accomplishments during the year. A typical menu includes a black-eyed pea dish, greens, sweet potato pudding, cornbread, fruit cobbler or compote dessert, and many other special family dishes.

Folk beliefs and remedies. Folk beliefs and remedies have also been passed down through generations, and they can still be observed today. The majority of African-American beliefs surrounding food concern the medicinal uses of various foods. For example, yellow root tea is believed to cure illness and lower blood sugar. The bitter yellow root contains the antihistamine berberine and may cause mild low **blood pressure**. One of the most popular folk beliefs is that excess blood will travel to the head when one eats large amounts of pork, thereby causing **hypertension**. However, it is not the fresh pork that should be blamed for this rise in blood pressure, but the salt-cured pork products that are commonly eaten. Today, folk beliefs and remedies are most often held in high regard and practiced by the elder and more traditional members of the population.

Effects of Socioeconomic Status: Poverty and Health

Many of the foods commonly eaten by African Americans, such as greens, yellow vegetables, **legumes**, beans, and rice, are rich in **nutrients**. Because of cooking methods and the consumption of meats and baked goods, however, the diet is also typically high in fat and low in fiber, **calcium**, and

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

hypertension: high blood pressure

legumes: beans, peas, and related plants

nutrient: dietary substance necessary for health

calcium: mineral essential for bones and teeth

Diet-Related Disease by Race	Obesity (%)	Diabetes (%)	Hypertension (%)
African Americans			
Male	21.1	7.6	36.7
Female	37.4	11.2	36.6
Total	33.4	10.8	36.6
Whites			
Male	20.0	4.7	24.6
Female	22.4	5.4	20.5
Total	21.3	7.8	22.1
Hispanics			
Male	23.1	8.1	NA
Female	33.0	11.4	NA
Total	26.2	9.0	NA

SOURCE: Centers for Disease Control and Prevention, National Center for Health Statistics (2002).

obesity: the condition of being overweight, according to established norms based on sex, age, and height

type II diabetes: Inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

diabetes: inability to regulate level of sugar in the blood

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

prevalence: describing the number of cases in a population at any one time

potassium. In 1989, 9.3 million of the black population (30.1%) had incomes below the poverty level. Individuals who are economically disadvantaged may have no choice but to eat what is available at the lowest cost. In comparison to other races, African Americans experience high rates of **obesity**, hypertension, **type II diabetes**, and **heart disease**, which are all associated with an unhealthful diet.

Obesity and hypertension are major causes of heart disease, **diabetes**, kidney disease, and certain cancers. African Americans experience disproportionately high rates of obesity and hypertension, compared to whites.

High blood pressure and obesity have known links to poor diet and a lack of physical activity. In the United States, the **prevalence** of high blood pressure in African Americans is among the highest in the world. The alarming rates of increase of obesity and high blood pressure, along with the deaths from diabetes-related complications, heart disease, and kidney failure, have spurred government agencies to take a harder look at these problems. As a result, many U.S. agencies have created national initiatives to improve the diet quality and the overall health of African Americans.

Looking Forward to a Healthier Tomorrow

African-American food and its dietary evolution since the beginning of American slavery provide a complicated, yet extremely descriptive, picture of the effects of politics, society, and the economy on culture. The deep-rooted dietary habits and economic issues that continue to affect African Americans present great challenges regarding changing behaviors and lowering disease risk. In January 2000, the U.S. Department of Health and Human Services launched Healthy People 2010, a comprehensive, nationwide health promotion and disease prevention agenda. The overarching goal of this program is to increase quality and years of healthy life and eliminate health disparities between whites and minority populations, specifically African Americans. As national health initiatives and programs continue to improve and target African Americans and other populations in need, preventable diseases will be lowered, creating a healthier U.S. society. SEE ALSO **AFRICANS, DIETS OF; CARIBBEAN ISLANDERS, DIET OF; DIETARY TRENDS, AMERICAN.**

*M. Cristina F. Garces
Lisa A. Sutherland*

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Africans, Diets of

Africa, the second largest continent in the world, is rich in geographic and cultural **diversity**. It is a land populated by peoples with histories dating to ancient times and cultures shaped by innumerable tribes, languages, and traditions. Because it is the birthplace of *Homo sapiens* and the land of origin for much of the world's population, the culture of food and eating in the different regions of Africa is important to people throughout the world.

diversity: the variety of cultural traditions within a larger culture

Early History of Africa

The early history of man is the story of food in Africa. *Homo sapiens* evolved apart from other apes in Africa, and the adaptation of humans has been shaped by adaptations to **diet**. For example, some anthropologists believe

diet: the total daily food intake, or the types of foods eaten

that the selection pressure that led to bipedalism (walking on two legs) was an adaptation to changing environments that involved travel in search of tubers (rounded underground plant stems, such as potatoes). Africa's history includes some of humankind's earliest food production, with one of the most fertile centers located in Northern Africa, the Nile Valley. The Nile Valley historically was and continues to be a rich source of fish, animal, and plant food. In the drier African savannas, especially after the Sahara region became arid after 6000 B.C.E., nomad tribes raised cattle, goats, or sheep, which served as part of the tribes' food source. Crops that were less affected by extreme weather like cereals (such as wheat, barley, millet, and sorghum) and tubers (such as yams) slowly became popular throughout the continent and have remained important **staples** in the African diet today.

staples: essential foods in the diet

The African Climate and Terrain. The historic influences on the African diet began in ancient times and continue to the present day. Great geographic differences across the African continent caused much of the variety in the African diet. In addition, many tribes and peoples migrated or traded, bringing spices and foods from each other's culture into their own. However, though each region of Africa has its distinct **cuisines**, African food has its basic staples.

cuisine: types of food and traditions of preparation

The African Diet

legumes: beans, peas, and related plants

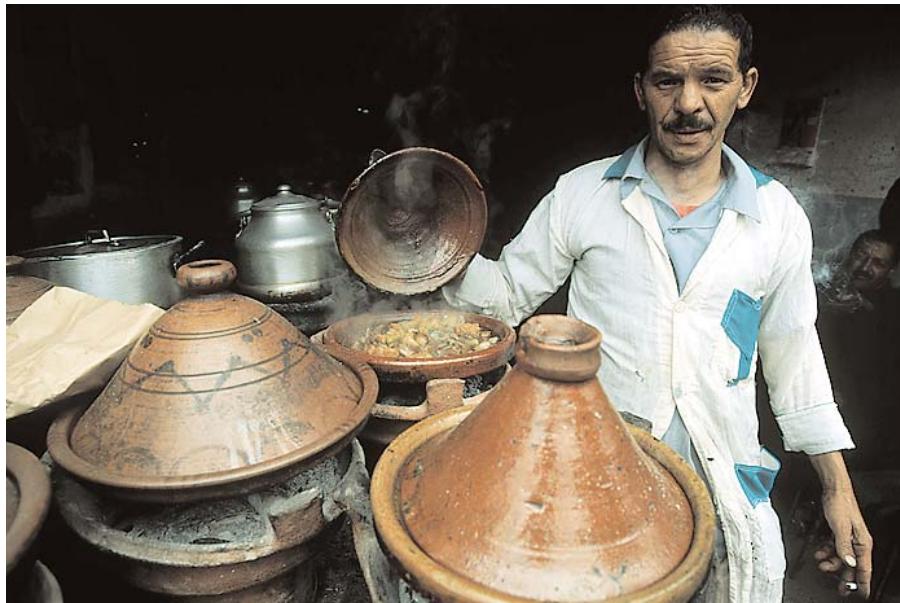
Throughout Africa, the main meal of the day is lunch, which usually consists of a mixture of vegetables, **legumes**, and sometimes meat. However, though different meats are considered staples in many areas, many Africans are not able to eat meat often, due to economic constraints. Beef, goat, and sheep (mutton) are quite expensive in Africa, so these foods are reserved for special days. However, fish is abundant in coastal regions and in many lakes.

The combination of various foods is called stew, soup, or sauce, depending on the region. This mixture is then served over a porridge or mash made from a root vegetable such as cassava or a grain such as rice, corn, millet, or teff. Regional differences are reflected in variations on this basic meal, primarily in the contents of the stew. The greatest variety of ingredients occurs in coastal areas and in the fertile highlands. Flavorings and spiciness have varied principally due to local histories of trade. In the traditional African diet, meat and fish are not the focus of a meal, but are instead used to enhance the stew that accompanies the mash or porridge. Meat is rarely eaten, though it is well-liked among carnivorous (meat-eating) Africans.

Traditional Cooking Methods. Traditional ways of cooking involve steaming food in leaf wrappers (banana or corn husks), boiling, frying in oil, grilling beside a fire, roasting in a fire, or baking in ashes. Africans normally cook outdoors or in a building separate from the living quarters. African kitchens commonly have a stew pot sitting on three stones arranged around a fire. In Africa, meals are normally eaten with the hands.

North Africa

The countries of North Africa that border the Mediterranean Sea are largely Muslim countries. As a result, their diet reflects Islamic traditions. The religion of Islam does not permit eating pork or any animal product that has



North African cuisine reflects the Islamic traditions of the region. Here, a man cooks with traditional Moroccan *tajines*, conical clay pots used for lamb stews and curries. [Photograph by Owen Franken. Corbis. Reproduced by permission.]

not been butchered in accordance with the traditions of the faith. Like other regions of Africa, much of the diet is based on grains. However, cooking with olive oil, onions, and garlic is more common in the countries of North Africa. Notable spices include cumin, caraway, clove, and cinnamon. Flat breads are a common staple and can accompany any meal, including breakfast, which is usually porridge prepared from millet or chickpea flour. *Couscous* (made from hard wheat and millet) is often the main dish at lunch, which is the primary meal. This may be accompanied by vegetable salads. Other main dishes include *tajine*, named for the conical clay pot in which a whole meal is prepared. Lamb is cooked in *tajines* as well as on kabobs (roasted on a skewer). Vegetables include okra, meloukhia (spinach-like greens), and radishes. Common fruits are oranges, lemons, pears, and mandrakes. Legumes such as broad beans (fava beans), lentils, yellow peas, and black-eyed peas are also important staples. Alcoholic drinks are forbidden by Islamic tradition. Mint tea and coffee are very popular beverages in this region.

West Africa

Within West Africa, there is considerable variation in the staple food. Rice is predominant from Mauritania to Liberia and across to the Sahel, a region that stretches across the continent between the Sahara and the southern savannas. Couscous is the prevalent dish in the Sahara. Along the coast from Côte d'Ivoire (Ivory Coast) to Nigeria and Cameroon, root crops, primarily varieties of yam and cassava, are common. Cassava, imported from Brazil by the Portuguese, is boiled and then pounded into a nearly pure starch. Yam is the chief crop in West Africa and is served in a variety of dishes, including *amala* (pounded yam) and *egwansi* (melon) sauce. Millet is also used for making porridge or beer.

Palm oil is the base of stew in the Gambia, southern, and eastern regions. In the Sahelian area, groundnut paste (peanut butter) is the main ingredient for stew. Other stews are based on okra (a vegetable native to the

Biotechnology and Africa

Many scientists believe that biotechnology is the most promising route to fighting and possibly eradicating chronic malnutrition among the 800 million people in the developing world who live in poverty. Researchers are working to develop improved versions of African staples, including a strain of sweet potato that is resistant to a virus that regularly devastates the crop, cassava that is resistant to the cassava mosaic virus, and corn that is resistant to the maize streak virus. Also under development is cotton that is less susceptible to insect infestation. However, genetically modified crops are controversial in some African countries. Zambia has banned donations of genetically modified food, and Zimbabwe has raised concerns about donations of corn from the United States that is not certified to be free of genetic modifications.

—Paula Kepos

rainforests of Africa), beans, sweet potato leaves, or cassava. Other vegetables are eggplant, cabbage, carrots, chilies, french beans, lettuce, okra, onions, and cherry tomatoes. All the stews in this territory tend to be heavily spiced, often with chilies.

West African Fruit. Plantain, a variety of banana, is abundant in the more tropical West Africa. Sweet plantains are normally fried, while hard plantains are boiled or pounded into *fufu*. Dates, bananas, guava, melons, passionfruit, figs, jackfruit, mangos, pineapples, cashews, and wild lemons and oranges are also found here.

Protein Sources. Meat sources of protein include cattle, sheep, chicken, and goat, though beef is normally reserved for holidays and special occasions. Fish is eaten in the coastal areas. Because of the Islamic influence, pork is localized to non-Muslim areas. In these regions, “bush meat” is widely eaten, including bush rat, a large herbivorous rodent, antelope, and monkey. Giant snails are also eaten in various parts of West Africa.

East Africa

Extensive trade and migrations with Arabic countries and South Asia has made East African culture unique, particularly on the coast. The main staples include potatoes, rice, *matake* (mashed plantains), and a maize meal that is cooked up into a thick porridge. Beans or a stew with meat, potatoes, or vegetables often accompany the porridge. Beef, goat, chicken, or sheep are the most common meats. Outside of Kenya and the horn of Africa, the stew is not as spicy, but the coastal area has spicy, coconut-based stews. This is quite unique in comparison to the central and southern parts of Africa.

Two herding tribes, the Maasai and Fulbe, have a notably different eating pattern. They do not eat very much meat, except for special occasions. Instead, they subsist on fresh and soured milk and butter as their staples. This is unusual because very few Africans consume milk or dairy products, primarily due to **lactose intolerance**.

The horn of Africa, which includes modern-day Somalia and Ethiopia, is characterized by its remarkably spicy food prepared with chilies and garlic. The staple grain, teff, has a considerably higher **iron** and **nutrient** content than other grain staples found in Africa. A common traditional food here is *injera*, a spongy flat bread that is eaten by tearing it, then using it to scoop up the meat or stew.

Southern Africa

lactose intolerance: inability to digest lactose, or milk sugar

iron: nutrient needed for red blood cell formation

nutrient: dietary substance necessary for health

temperate zone: region of the world between the tropics and the arctic or Antarctic

Outside of the **temperate zones**, in the southern part of the continent, a greater variety of fruits and vegetables are available. Fruits and vegetables in southern Africa include bananas, pineapples, pau-pau (papaya), mangoes, avocados, tomatoes, carrots, onions, potatoes, and cabbage. Nonetheless, the traditional meal in southern Africa is centered on a staple crop, usually rice or maize, served with a stew. The most common dish made from corn-meal is called *mealie meal*, or *pap* in South Africa. Also known as *nshima* or *nsima* further north, it is usually eaten with stew poured over it. The stew may include a few boiled vegetables, such as cabbage, spinach, or turnips, or on more special occasions, fish, beans, or chicken.

Nutrition and Disease

White South Africans (Dutch descendants called Afrikaaners), Europeans, and Asian Indians in Africa have diets similar to their countries of origin. In urban areas, however, the diet of (black) Africans is increasingly dependent on meat, much like the diet of some West African pastoral tribes, as well as on empty **calories** from prepackaged foods similar to those found in the West. The result is an unbalanced diet. In many parts of Africa, the traditional diets of indigenous peoples are often inadequate in essential **vitamins**, **minerals**, and protein, which can lead to a variety of diseases. **Micronutrient** deficiencies, particularly vitamin A, iodine, and iron deficiencies, which can result in vision impairment, goiter, and **anemia**, respectively, are prevalent throughout much of Africa, particularly in the arid areas where the soil is deficient either naturally or due to overuse.

Food Security

A far greater threat comes from increasingly insecure food sources (a lack of consistent and affordable food staples) arising from adverse weather (drought and floods) and war. During the late 1900s, **famine** became increasingly frequent in Africa. In addition, a new threat to the food supply emerged due to the worsening HIV/AIDS epidemic. As adults fall ill and die, agricultural production declines. Rural communities are the hardest hit, and women are particularly at risk given their unique physiologic needs tied to their roles as mothers, as well as their vulnerability due to lower economic and social status.

With its immense population, resources, and growing population, Africa is a continent that struggles to keep its people and cultures healthy. African history, the proliferation of foods and spices across the land, and the preservation of land that can still be farmed, will continue to be important. Weather, geography, politics, culture, and religion are forces that have caused strife within Africa for centuries, and will continue to do so. A land that was once pure and fertile can only be restored through land preservation and food availability. SEE ALSO AFRICAN AMERICANS, DIET OF; CARIBBEAN ISLANDERS, DIET OF.

Jens Levy
M. Cristina F. Garces

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calorie: unit of food energy

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

micronutrient: nutrient needed in very small quantities

anemia: low level of red blood cells in the blood

famine: extended period of food shortage

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Aging and Nutrition

Aging Americans will make up an unprecedented proportion of the population as the 78 million baby boomers reach age 50. The baby boomers, those born between 1946 and 1964, will first reach age 65 in 2011, transforming the 35 million people over age 65 in 2000 to an estimated 69 million by 2030. With improved health care, **socioeconomic status**, and health behaviors, people 85 and over are expected to be the fastest-growing group of elderly persons, tripling from 4 million in 2000 to about 14 million by 2040. Growth in the elderly population has led to two subgroups: the young-old (55 to 74 years) and the old-old (75 and older). Still, elderly people remain the most diverse segment of American society.

socioeconomic status: level of income and social class

diet: the total daily food intake, or the types of foods eaten

Dietary Reference Intakes: set of guidelines for nutrient intake

nutrient: dietary substance necessary for health

Recommended Dietary Allowances: nutrient intake recommended to promote health

calorie: unit of food energy

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

calcium: mineral essential for bones and teeth

A nutritious daily **diet** is one factor that can assist people who are 55 and older in maintaining optimal levels of health and preventing or delaying the onset of disease. The **Dietary Reference Intakes** (DRI) are the quantities of **nutrients** that form the basis for planning and assessing diets. The DRIs include the **Recommended Dietary Allowances** (RDA), the nutrient levels that meet the requirement for nearly all (97–98%) healthy people. Two sets of RDAs exist for elderly individuals, one for those 51 to 70 years of age, and one for those over 70 years of age.

According to the RDAs, elderly people have the same nutrient requirements as their younger counterparts, yet most need fewer **calories**. **Vitamins D** and **B₆**, and **calcium**, are exceptions and are needed in greater amounts for those 51 years old and older. Therefore, a nutrient-dense diet, with fewer calorie-laden foods, becomes more crucial at older ages of the life cycle. In general, women have nutrient requirements similar to men, though they require fewer calories. Therefore, elderly women must be especially careful to select nutrient-dense foods.

The best way to establish a nutrient-dense diet is to balance a variety of food choices (in moderation) that are adequate to meet nutritional and caloric needs. The Food Guide Pyramid (FGP) is helpful to guide food selection and daily serving totals. An FGP specifically for those over 70 years of age recommends 1,200–1,600 calories from whole-grain foods, a variety of colored fruits and vegetables, low-fat dairy products, lean meats, fish and poultry, and eight glasses of fluid daily. Food labels help put single servings of food into the FGP. Results of national dietary surveys have led some experts to recommend calcium supplements and a one-a-day type of multiple vitamin. Other health food supplements are not generally needed and can be very expensive for those on fixed incomes.

Nutrition Screening Initiative

Elderly individuals are at increased risk for problems that affect their nutritional status. The nationwide Nutrition Screening Initiative (NSI) categorizes these problems as those affecting functional, social, or financial status and access to food and drink. These problems can affect quality of life and the



Elderly people face unique nutritional challenges. Although age can diminish appetite and physical mobility, the body still requires as many nutrients as a younger adult's. [Photograph by Owen Franken. Corbis. Reproduced by permission.]

ability to perform activities of daily living, including eating. The **DETERMINE** checklist is the NSI tool used by physicians, registered dietitians, other health care providers and social service agencies to assess the impact of various dietary, medical, or physical and social problems:

Disease

Eating poorly

Tooth loss/mouth pain

Economic hardship

Reduced social contact

Multiple medications

Involuntary weight loss/gain

Needs assistance in self care

Elder years above age 80

DETERMINE: checklist used to identify nutritionally at-risk individuals

Recognizing the risk posed by these factors can result in interventions to improve the quality of life and the ability to perform activities of daily living.

Dietary Problems

Some elderly individuals encounter dietary problems, making them less able to select, purchase, prepare, eat, digest, absorb, and use food. An inability to consume an adequate daily diet places the elderly person at increased risk for medical, physical, and functional problems. Therefore, it is important to intervene to correct any dietary problems that may exist. Examples of dietary problems, and interventions to improve the problems, are described below.

Difficulty Chewing or Swallowing. Choose more fruit and vegetable juices, soft canned fruits, and creamed or mashed cooked vegetables; eggs, milk dishes (like creamed soups), cheese, and yogurt; and cooked cereals when chewing meat or fresh fruits and vegetables are difficult. Chop, stew, steam, or grate hard foods.

assisted-living: facility that provides aid in meal preparation, cleaning, and other activities to help maintain independent living

environment: surroundings

Congregate Dining: a support service that provides a meal at a central location on a specified day

chronic: over a long period

osteoporosis: weakening of the bone structure

arthritis: inflammation of the joints

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

diabetes: inability to regulate level of sugar in the blood

malnutrition: chronic lack of sufficient nutrients to maintain health

Difficulty Digesting. Choose more fruit and vegetable juices, soft canned fruits, and non-gas-forming vegetables rather than gas-producing vegetables like cabbage or broccoli. If digesting milk is a problem, use cultured dairy products like yogurt or add lactaid to milk. If milk continues to be problematic, consider a daily calcium supplement.

Difficulty Shopping. Shop by phone to find grocery stores that deliver in your area. Find volunteer or paid help in your area. Ask family or neighbors to help. See yellow pages under “Home Health Services” for assistance.

Difficulty Cooking. Use a microwave. Cook and freeze in batches. Relocate to a facility where others cook, such as a family member’s home or an **assisted-living** home **environment**.

Appetite Difficulties. Increase the flavor of food by adding spices and herbs, lemon juice, or meat sauces. Discuss medications with your physician, particularly if they are causing appetite or taste changes.

Financial Difficulty. Use coupons, unit pricing, and shopping lists. Plan and prepare ahead, freezing several meals at once. Buy more generic or store-brand foods and foods on sale. Find food assistance programs or sources for free and reduced-price meals, such as churches, Meals On Wheels, **Congregate Dining**, and Food Stamps. Buy more low-cost foods, such as dried beans and peas, rice, pasta, canned tuna, and peanut butter.

Social Problems

Loneliness. Invite a friend or neighbor over or have a standing date to eat out with friends or family. Buy smaller sizes to avoid the repetition of leftovers. Set the table attractively and play music softly. Participate in Congregate Dining in your area.

Living Alone. Research has shown a correlation between living alone and having lower quality diets. Men may be at greater risk because they are less experienced with planning, shopping, and preparing meals. Women may feel less motivated to prepare meals when there is no one to share them with. Ways to improve social interaction during meals and improve the experience of dining alone include: participating with others, such as at churches or Congregate Dining sites, eating by a window, using good china, eating in a park or on one’s porch, garnishing meals, and trying various frozen or prepared dinners.

When living alone challenges an elderly person’s health, he or she can investigate the continuum of care, including adult day care, in-home care, retirement communities, residential care or assisted living, intermediate care, and nursing homes or convalescent hospitals.

Medical, Physical, and Functional Problems

Many **chronic** medical conditions, such as **osteoporosis**, **arthritis**, **depression**, and **diabetes** have nutritional consequences. Loss of body water, lean body mass, and bone mass; decline of the immune response; over- and underweight; **malnutrition**; and declining taste, smell, and thirst are among the problems that affect physical strength, functional ability, and vitality. At times, specialized diets or medical nutrition therapy are needed; these are



Many elderly people live alone and may have less nutritious diets than those living with a partner. Programs such as Meals On Wheels can help prevent poor nutrition caused by loneliness. [Photo by Ken Hammond. © USDA Photography Center.]

best planned with a registered dietitian. In addition, medications can affect the **absorption** and use of nutrients. Lists of food and drug interactions are available from a pharmacist or from a registered dietitian who can coordinate advice about medications with specialized dietary information. SEE ALSO DIETARY REFERENCE INTAKES; MEALS ON WHEELS; MENOPAUSE; NUTRIENT-DRUG INTERACTIONS; OSTEOPOROSIS; RECOMMENDED DIETARY ALLOWANCES.

Sally Weerts

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Alcohol and Health

Alcohol is a central-nervous-system depressant that affects judgment, coordination, and inhibition. Mild alcohol intoxication causes a relaxed and carefree feeling, as well as the loss of inhibitions. After several drinks a person will exhibit impaired judgment, poor coordination, and slurred speech, while consumption of alcohol in large amounts can lead to coma and even death. Blood alcohol concentration (BAC) is a measurement of the amount of alcohol in a person's blood. Most states consider a person to be legally drunk at a BAC between .08 and .10. At a BAC level of .40 to .50, a person may go into a coma, while a BAC level of .60 to .70 will cause death.

Alcoholic beverages can be divided into three categories: beer, wine, and distilled spirits. Beer includes beer, ale, and malt liquor; wine includes wine,

absorption: uptake by the digestive tract

CALORIES IN ALCOHOLIC BEVERAGES AND MIXERS

Beverage	Number of Calories
Beer, 12 oz.	150
Martini, 3 oz.	145
Rum, 1 oz.	73
Sherry, 3 oz.	150
Wine, 5 oz.	100
Scotch, 1 oz.	73

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

calorie: unit of food energy

dependence: a condition in which attempts to stop use leads to withdrawal symptoms, including irritability and insomnia

tolerance: development of a need for increased amount of drug to obtain a given level of intoxication

champagne, wine coolers, and vermouth; and examples of distilled spirits are gin, rum, vodka, and whiskey. Alcohol provides no **vitamins** or **minerals**, only **calories**. Small amounts of alcohol are absorbed from the mouth, approximately 20 percent is absorbed in the stomach, and the remaining 80 percent is absorbed in the small intestine.

About 7 percent of Americans abuse alcohol or suffer from alcoholism. Alcoholism can be identified through four symptoms: (1) a craving or strong urge to drink alcohol, (2) not being able to stop drinking, (3) physical **dependence**, and (4) **tolerance**. Physical dependence occurs when an individual depends on the presence of alcohol to function normally. Tolerance occurs when the same amount of alcohol results in a lesser effect; therefore, more alcohol must be consumed in order to feel the same effect. Alcohol abuse differs from alcoholism in that it does not include a strong craving for alcohol, the loss of control over one's drinking, or physical dependence. Individuals may have a problem with alcohol abuse if they exhibit one or more of the following symptoms: work and money problems, drinking while driving, being arrested due to drinking, exhibiting violent or aggressive behaviors, or continuing to drink despite the problems that result from drinking.

Alcoholism

Although there is a debate among experts over whether alcoholism should be considered a disease, the National Institute on Alcohol Abuse and Alcoholism recognizes alcoholism as a disease. The risk for developing alcoholism is influenced by a person's **genes** and **lifestyle** behaviors. Alcoholism is a **chronic** disease that lasts for a lifetime. If diagnosed and treated early, however, alcoholism may be completely cured and severe complications prevented. Chronic alcohol abuse increases a person's risk for developing serious health problems, such as liver disease, **high blood pressure**, **heart disease**, **stroke**, **cancer** (especially cancer of the esophagus, mouth, and throat), and pancreatitis.

Approximately two million Americans suffer from liver damage caused by alcohol abuse. About 10 to 20 percent of heavy drinkers will develop cirrhosis of the liver, which is characterized by scarring of the liver and causes irreversible damage. If heavy drinkers do not stop drinking, cirrhosis can cause poor health and, ultimately, death. In addition to cirrhosis, heavy drinkers may suffer from chronic liver disease or alcoholic **hepatitis**.

Damage to the liver can lead to problems with blood sugar levels. When alcohol is present in the body, the liver works to **metabolize** it. Because the liver is busy metabolizing alcohol, it is often not able to adequately maintain blood sugar levels, which may result in **hypoglycemia** (low levels of blood sugar). Hypoglycemia is most likely to occur in individuals who have not maintained an adequate **diet**. When it occurs, the brain is not able to receive the **energy** it needs to function, and symptoms such as hunger, weakness, headache, tremor, and even coma (in severe cases) may occur.

Chronic alcohol abuse can lead to poor nutritional status. Chronic heavy drinkers do not eat adequate amounts of food because of the high caloric content of alcohol. This prevents them from getting the required vitamins and minerals to maintain health and well-being. Furthermore, when a person consumes large amounts of alcohol, it impedes or halts the digestion of food, as alcohol decreases the secretion of digestive **enzymes** from the pan-

gene: DNA sequence that codes for proteins, and thus controls inheritance

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

chronic: over a long period

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

cancer: uncontrolled cell growth

hepatitis: liver inflammation

metabolize: processing of a nutrient

hypoglycemia: low blood sugar level

diet: the total daily food intake, or the types of foods eaten

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

enzyme: protein responsible for carrying out reactions in a cell

College Binge Drinking

Alcohol abuse is considered the most significant public health problem facing college students in the United States. It is estimated that more than 500,000 injuries and 70,000 cases of sexual assault a year result from alcohol abuse among students, and more than 1,400 students die each year as a result of their injuries. Two out of every five students report an episode of binge drinking—which is usually defined as five or more drinks in a row—in any given two-week period. During the 1990s, as government and health organizations be-

gan to recognize the magnitude of the problem, the U.S. Surgeon General set a goal of reducing binge drinking by 50 percent by the year 2010, and colleges sharply increased alcohol education programs and penalties for excessive or underage drinking. Nevertheless, the rate of binge drinking on college campuses remained virtually unchanged between 1993 and 2001, the year of the last comprehensive study.

—Paula Kepos

creas. Alcohol also inhibits the **absorption** of **nutrients** into the blood. This decrease in digestion and absorption over a long period of time can lead to **malnutrition**.

High-Risk Groups

While alcohol abuse and alcoholism affect virtually every segment of the population, certain groups are at greater risk. Young adults between the ages of eighteen and twenty-nine have the highest **prevalence** of alcohol abuse, and persons who begin to drink at an early age, especially before the age of fourteen, have a greater risk for developing problems with alcohol. Persons with a family history of alcohol abuse or alcoholism are also more likely to experience alcohol-related problems. In the United States, American Indians and Alaska Natives (AI/ANs) have the highest rates of current and heavy drinking of all racial or ethnic groups. Deaths from chronic liver disease and cirrhosis are nearly four times greater among AI/ANs compared to the general U.S. population. They also have a higher prevalence of drunk driving compared to the general U.S. population.

The U.S. Department of Health and Human Services and the U.S. Department of Agriculture recommend that alcohol be consumed in moderation only. Moderation is considered two drinks per day for men and one drink per day for women (one drink is defined as twelve ounces of beer, five ounces of wine, or 1.5 ounces of a distilled spirit). Drinking alcohol is inappropriate for recovering alcoholics, persons under the age of twenty-one, persons taking medication, those who plan to drive, and women who are pregnant or plan to become pregnant.

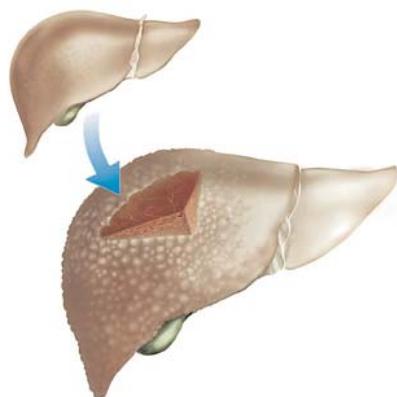
There is no known safe level of alcohol consumption during pregnancy, as it could injure the fetus. Alcohol consumption during pregnancy may result in fetal alcohol syndrome (FAS) or fetal alcohol effects (FAE). FAS is characterized by growth retardation, facial abnormalities, and central-nervous-system dysfunction. FAS is irreversible and will affect children their entire life. If a fetus's exposure to alcohol during pregnancy is not severe enough to cause FAS, it may result in fetal alcohol effects (FAE), alcohol-related developmental disabilities (ARDD), or alcohol-related neurodevelopmental disabilities (ARND).

absorption: uptake by the digestive tract

nutrient: dietary substance necessary for health

malnutrition: chronic lack of sufficient nutrients to maintain health

prevalence: describing the number of cases in a population at any one time



This illustration shows a healthy liver above, and a diseased liver below. Liver disease in alcoholics progresses from an enlargement of the liver to cirrhosis, which is characterized by liver scarring and is usually fatal unless alcohol consumption ceases. [Custom Medical Stock Photo, Inc. Reproduced by permission.]

In conclusion, knowing the effects of alcohol on the body and the consequences of alcohol abuse and misuse is very important. When consumed in large amounts or irresponsibly, alcohol can cause extensive damage to health and well-being, including liver damage, poor nutritional status, birth defects, and death. Therefore, if alcohol is consumed, it should be done so responsibly and in moderation only. SEE ALSO FETAL ALCOHOL SYNDROME; FRENCH PARADOX; MALNUTRITION; PREGNANCY.

Laura Nelson

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Allergies and Intolerances

allergy: immune system reaction against substances that are otherwise harmless

Food **allergies** affect approximately 3 percent of children and 1 percent of adults in the United States. It is estimated that an even larger percentage of the population experiences problems with food intolerance. Worldwide, adverse reactions to food constitute a significant public health issue.

Definitions

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

allergen: a substance that provokes an allergic reaction

lactose intolerance: inability to digest lactose, or milk sugar

enzyme: protein responsible for carrying out reactions in a cell

The term *adverse reaction* is used to describe health problems linked to food. Food allergy and food intolerance are two types of adverse food reactions (food-borne illnesses caused by bacterial, viral, or other forms of contamination are also adverse reactions). A food allergy is said to exist when the health problem is linked to a malfunction of the **immune system**. It is believed that this malfunctioning occurs when the body identifies a food **protein (allergen)** as a harmful substance. *Food intolerance* occurs when the underlying problem causing the adverse reaction is not related to a malfunction of the immune system. One example of a food intolerance is **lactose intolerance**, a condition affecting people who cannot digest milk due to a deficiency of the **enzyme** lactase, which breaks down milk sugar (lactose).



Food allergies can be triggered by almost any food. The most common food allergies are caused by wheat, nuts, fish, eggs, milk, and soy. Wheat, milk, and soy are also common causes of food intolerance. [Erik Freeland/Corbis. Reproduced by permission.]

Common Foods Associated with Food Allergy

Almost any food can cause an allergy, though the foods most commonly associated with an **allergic reaction** are those frequently consumed by a population. For example, an allergy to rice is common in Southeast Asia, while fish allergy is a problem in the Scandinavian countries, where fish is frequently consumed (even at breakfast). Age is also a factor influencing the types of foods to which a person might be allergic. In the United States, common foods to which adults are allergic include eggs, shrimp, lobster, peanuts, other nuts, and fish. U.S. children who have food allergies find their problems are most frequently linked to milk, soy, eggs, and peanuts. Infants may be allergic to cow's milk or soy formulas. Some food allergies may be outgrown, but allergies to peanuts, shrimp, and fish tend to last throughout life. In addition, some individuals are only allergic to one food, whereas some are allergic to several foods.

An allergic reaction can be triggered by a very small amount of a food. Persons with food allergies need to read food labels carefully and ask restaurant workers about food ingredients, and the food industry needs to ensure that **processed foods** are appropriately prepared so that people are not exposed to food allergens unknowingly. This may happen when improperly cleaned food equipment is used to prepare multiple types of food.

Food Allergy: Clinical Presentation and Diagnosis

Health problems associated with food allergies can involve the **gastrointestinal** system, the **respiratory system**, the skin, and the eyes. Persons with a food allergy may have difficulty breathing, or they may have problems with itching, rashes, swelling, **nausea**, or vomiting. A food allergy may also be a cause of **asthma**.

allergic reaction: immune system reaction against a substance that is otherwise harmless

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

gastrointestinal: related to the stomach and intestines

respiratory system: the lungs, throat, and muscles of respiration, or breathing

nausea: unpleasant sensation in the gut that precedes vomiting

asthma: respiratory disorder marked by wheezing, shortness of breath, and mucus production



Antihistamines can give some relief of minor allergic reactions, such as skin irritation. For more severe reactions, administering a dose of epinephrine may halt life-threatening anaphylactic shock.

[Erik Freeland/Corbis. Reproduced by permission.]

anaphylaxis: life-threatening allergic reaction, involving drop in blood pressure and swelling of soft tissues especially surrounding the airways

diet: the total daily food intake, or the types of foods eaten

prevalence: describing the number of cases in a population at any one time

anxiety: nervousness

elimination diet: diet in which particular foods are eliminated to observe the effect

glucose: a simple sugar; the most commonly used fuel in cells

The symptoms of food allergy vary widely from person to person. Food allergies can also cause a severe clinical reaction known as **anaphylaxis**, which can result in death. Anaphylaxis may be characterized by throat and lip swelling, shortness of breath, sweating, itching, and feeling very faint.

Diagnosis of a food allergy usually involves a careful examination of the patient's symptom history. Other causes of symptoms must be ruled out, and in some instances the suspected food or foods will be eliminated from the **diet** to see if symptoms stop. Blood tests or skin tests may also be performed. One test sometimes used to diagnose food allergy is the double-blind, placebo-controlled food challenge. This test involves giving a patient a capsule containing a suspected food allergen and a capsule without the allergen (the placebo) and seeing if either causes symptoms in a controlled clinical setting. The test is called *double-blind* because neither the patient nor the physician evaluating the symptoms is aware of which capsule contains the allergen at the time the testing occurs.

Common Foods Associated with Intolerance

Foods associated with intolerance include: preserved foods, foods containing monosodium glutamate (MSG, a flavor enhancer), and specific foods such as milk, pickled herring, soy sauce, chili peppers, and nutmeg. Intolerance to lactose is a major problem for many populations. In the United States, lactose intolerance is common among those of African and Asian descent. The Native American population also has a high **prevalence** of lactose intolerance.

For many food intolerances, including those listed above, specific chemicals or enzyme abnormalities have been identified as being associated with the intolerance. Lactose intolerance is associated with problems with the enzyme lactase. Chemicals associated with food intolerance include sulfite (in preserved foods), tyramine (in pickled herring and soy sauce), capsaicin (in chili peppers), and myristicin (in nutmeg).

Food Intolerance: Clinical Presentation and Diagnosis

Health problems caused by food intolerance vary depending upon the food and chemical involved. The amount of a food eaten may also play a role. Lactose intolerance is usually characterized by gastrointestinal problems such as bloating and diarrhea. Sulfite intolerance is typically characterized by difficulty in breathing. Those sensitive to MSG may experience a variety of symptoms, such as headache, numbness, and rapid heartbeat. Tyramine, found in pickled herring, soy sauce, red wine, and other foods, has been linked to migraine headache. Capsaicin can cause a “burning” pain in the mouth and other problems, such as nausea and vomiting. Myristicin has been associated with **anxiety**, chest pressure, hallucinations, fever, and skin redness.

Diagnostic techniques for food intolerances vary depending upon the specific intolerance suspected. Symptom history and **elimination diets** are tools that are used, and the double-blind, placebo-controlled food challenge may also be helpful. Diagnosis of lactose intolerance in adults may involve measuring the blood to see if lactose is being broken down and showing up as blood sugar (**glucose**), or by measuring the level of hydrogen in the breath, which is increased in persons who are lactose intolerant (lactose produces hydrogen gas in the colon).

Peanut Allergies

Peanut allergies, which are among the most widespread food allergies, affect more than 1.5 million people in the United States. Symptoms of an allergic reaction may include a flushed face, hives, difficulty breathing or swallowing, vomiting, dizziness, chills, and loss of consciousness. The reaction of an allergic person to peanuts can be rapid and dramatic, sometimes causing death within minutes. The incidence of peanut allergies among children doubled in the United States between 1997 and 2002, prompting some schools to consider banning peanuts and peanut products from

their premises. Proponents of a ban note that as little as half a peanut can be fatal in an allergic child, and that the risk of shared lunches or other accidental exposure is too great. Others argue that a peanut ban provides a false sense of security for children who inhabit a peanut-ridden world, and that educating students and school personnel about the problem, and preparing for the occasional incident, are more appropriate responses.

—Paula Kepos

Controversies Related to Food Allergies and Intolerances

Controversial issues in this area include the diagnosis of **brain allergy**, the diagnosis of **environmental illness** related to food allergy, and the diagnosis of **yeast allergy**. The connection of these problems to food allergies is not universally recognized. Some have also linked hyperactivity to food allergy or intolerance. Hyperactivity in children, in some instances, may be related to eating large amounts of **food additives**, but it is not accepted to be an allergic condition by the majority of the scientific community.

Other controversies relate to testing for food allergies. One controversial test is *cytotoxic* testing, which involves testing blood in the presence of the suspected food allergen to see if the blood cells are killed.

Treatment of Food Allergies and Intolerances

The major mode of treatment for food allergies and intolerances is for the person to avoid consuming the food or foods that seem to cause health problems. This involves a high degree of dietary awareness and careful food selection. When foods are eliminated from the diet, it is important to ensure the nutritional adequacy of the diet, and some individuals may need to take dietary supplements. There are some food intolerances, such as lactose intolerance, where individuals may be able to reduce the amount of the food consumed and not totally eliminate it from the diet. People with lactose intolerance do not have to completely eliminate milk products, though they must reduce their intake of lactose (milk sugar) to a manageable level. SEE ALSO ADDITIVES AND PRESERVATIVES.

Judy E. Perkin

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brain allergy: allergy whose symptoms affect brain function

environmental illness: illness due to substances in the environment

yeast allergy: allergy to yeasts used in baking or brewing

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

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Alternative Medicines and Therapies

chronic: over a long period

arthritis: inflammation of the joints

Alternatives to conventional medical care are increasingly popular in the United States, and their growing use by consumers represents a major trend in Western medicine. Alternative therapies appear to be used most frequently for medical conditions that are **chronic**, such as back pain, **arthritis**, sleep disorders, headache, and digestive problems. Surveys of U.S. consumers have shown that more people visit alternative practitioners each year than visit conventional primary-care physicians. Consumers do not necessarily reject conventional medicine, however. Many simply feel that alternative modalities offer complementary approaches that are more in line with their personal health philosophies.

Alternative Medicine, Complementary Medicine, and Integrative Medicine

The terms *alternative medicine* and *alternative therapies* refer to those medical practices that are not considered to be conventional medicine, as practiced in the United States. Other cultures, however, may use one or more of these approaches regularly, and, in fact, many have done so for thousands of years. Most people in the United States who use alternative medicine do so to complement conventional approaches. For example, in addition to using anti-inflammatory **drugs** to ease muscle pain, they may also use massage, **chiropractic**, and/or **osteopathic** manipulation. This practice of complementing conventional medicine with alternative approaches has given rise to the term *complementary medicine*. Presently, alternative medicine is most commonly referred to as *complementary and alternative medicine* (CAM). As conventional medical practitioners become familiar with alternative approaches, these approaches are being integrated into conventional medicine, which is giving rise to *integrative medicine*, in which a combination of therapies representing the best of conventional and alternative medicine is used.

drugs: substances whose administration causes a significant change in the body's function

chiropractic: manipulation of the spine and other bones for healing

osteopathic: related to the practice of osteopathy, which combines standard medical therapy with manipulation of the skeleton to correct problems

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

acupuncture: insertion of needles into the skin at special points to treat disease

nutrition: the maintenance of health through proper eating, or the study of same

meditation: stillness of thought, practiced to reduce tension and increase inner peace

ayurvedic: an Indian healing system

Types of CAM Modalities

The National Center for Complementary and Alternative Medicine divides the various CAM *modalities* into five categories: (1) alternative medical systems, (2) mind-body interventions, (3) biologically-based treatments, (4) manipulative and body-based methods, and (5) **energy** therapies. These modalities include a wide variety of approaches, from **acupuncture** to **nutrition** to **meditation** to chiropractic.

Alternative medical systems include medical practices that are traditional in other cultures, such as the **ayurvedic** medical system of India, Chinese traditional medicine, and traditional Native American and Hawaiian medicine.

COMPLEMENTARY AND ALTERNATIVE THERAPIES POPULAR IN THE UNITED STATES

CAM Category	Examples
Alternative medical systems	Acupuncture, Ayurveda, homeopathy, naturopathy, traditional medical systems, such as aboriginal, African, Middle Eastern, Native American, Chinese, Tibetan, Central and South American
Mind-body interventions	Art therapy, dance therapy, hypnosis, meditation, mental healing, music therapy, prayer
Biologically-based treatments	Special diets and nutrition therapy, such as macrobiotic diet; herbal (botanical) therapy, vitamin/mineral therapy, orthomolecular therapy
Manipulative and body-based methods	Chiropractic, massage therapy, osteopathic manipulation
Energy therapies	Biofield therapies, such as Qi gong, Reiki, and Therapeutic Touch; bioelectromagnetic therapies, which involve the unconventional use of electromagnetic fields, such as pulsed fields, magnetic fields, or alternating current or direct current fields

SOURCE: National Center for Complementary and Alternative Medicine

Mind-body interventions recognize the connection between the physical body and the spiritual self, and include practices such as meditation, prayer, and music therapy. Biologically-based modalities are primarily nutrition-related and vary from special diets such as the **macrobiotic diet** to the inclusion of dietary supplements in the diet. Body-based methods involve hands-on manipulation of the body, and include such modalities as massage and chiropractic. The energy therapies are based on the concept that the body has an energy field that can be manipulated to promote healing.

Included among the nutrition approaches that make up the biologically-based modalities is the use of dietary supplements. Dietary supplements may be **botanical (herbal)** supplements or nutritional supplements, which include **vitamins, minerals, antioxidants, enzymes, metabolites**, nonprescription **hormones**, glandular extracts, and various **amino acids, fatty acids**, and other **nutrients**.

The Dietary Supplement Health and Education Act of 1994

Dietary supplement usage in the United States has increased significantly since the passage in 1994 of the Dietary Supplement Health and Education Act (DSHEA, pronounced Dee-shay). This legislation defined *dietary supplements* as distinct from food and drugs, and it allowed them to be sold without a prescription. The passage of DSHEA provided consumers with the right to purchase dietary supplements that they felt would help them attain their personal health goals. At the same time, DSHEA transferred to consumers the responsibility for making informed choices about the supplements that they used. In contrast to prescription and **over-the-counter** drugs, where effectiveness and safety must be demonstrated prior to marketing of the drugs, premarket approval is not required of manufacturers of dietary supplements. As a result, there is a greater potential risk that dietary supplements may be ineffective, or even harmful, as compared with drugs.

The dietary supplements industry is not unregulated, it is just not regulated to the extent that U.S. consumers have come to expect for prescrip-

macrobiotic: related to a specific dietary regimen based on balancing of vital principles

diet: the total daily food intake, or the types of foods eaten

botanical: related to plants

herbal: related to plants

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

enzyme: protein responsible for carrying out reactions in a cell

metabolite: the product of metabolism, or nutrient processing within the cell

hormone: molecules produced by one set of cells that influence the function of another set of cells

amino acid: building block of proteins, necessary dietary nutrient

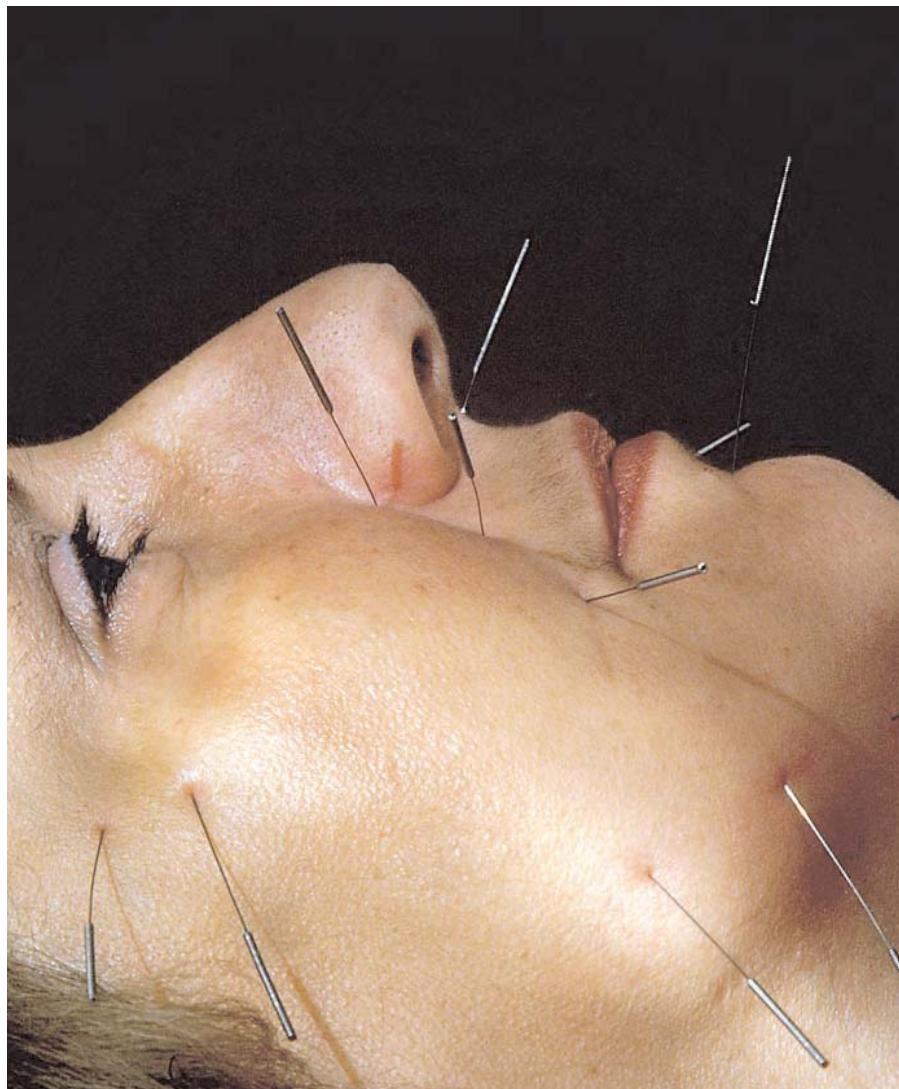
fatty acids: molecules rich in carbon and hydrogen; a component of fats

nutrient: dietary substance necessary for health

over-the-counter: available without a prescription

The rising popularity of alternative medicine has revived ancient techniques such as acupuncture. In the United States, the requirements for acupuncture licensure may vary from state to state.

[Photograph by Yoav Levy. Phototake NYC.
Reproduced by permission.]



tion drugs. Instead of the drug manufacturer and the physician working to insure that a drug meets the needs of the patient and that it is both safe and effective, consumers must provide these services for themselves with dietary supplements. It is, therefore, important to know the appropriate use of a dietary supplement, the dose at which it is effective, and whether it is likely to interfere with other medications or dietary supplements being taken. It is also important to know that the manufacturer adheres to high quality standards in the preparation of its products.

Supplement Facts Label

To help consumers make informed choices, dietary supplements now contain a supplement facts panel that clearly labels the product as a dietary supplement and gives information such as the amount of a standard dose, the number of recommended doses per day, the list of components (and how much of each is present in a standard dose), and, if the product is a botanical, the Latin name of the plant and the part of the plant used to prepare the product. This latter information is important because the components responsible for a certain health effect may be in one part of the plant but

not in other parts. For example, a consumer purchasing ginger to protect against seasickness would want a product prepared from the roots of the plant, where the active components are, and not the leaves.

In addition, DSHEA established standards for terms, such as **high potency** and antioxidant, and for the types of claims that could be made for a product. Claims that a dietary supplement may help to prevent or cure a disease cannot be made. Such claims are considered health claims and must be reviewed by the Food and Drug Administration for scientific accuracy prior to approval for use on a product label. Manufacturers may, however, use structure/function claims that state that a product can, for example, “help to promote healthy blood levels of **cholesterol**,” but they may not state that a product “helps to prevent **heart disease**.” All structure/function claims must be accompanied by the following disclaimer: “This statement has not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.”

high potency: a claim about vitamin or mineral content, defined as 100% or more of the Recommended Daily Intake

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

Selecting a CAM Modality

When selecting a CAM modality, it is important to have clearly defined health goals. In other words, what are you trying to accomplish, and is this modality an appropriate fit for you? If selecting a therapy, determine if the practitioner of the therapy being considered is a licensed health care practitioner. Licensure does not guarantee the modality will successfully meet one’s needs, but it does provide some assurance of training and competency on the part of the practitioner. This information can usually be obtained from the various state boards of medicine, which are responsible for licensing health care professionals.

Selecting quality dietary supplements can be a bit more challenging. Both the natural products industry and the Food and Drug Administration are working to develop uniform standards of quality for dietary supplements. Until these standards are in place, however, consumers must be proactive in determining for themselves what supplements are consistent with their health goals and what manufacturers offer quality products. It is important not to be fooled by **hype**. Be wary of supplements that sound too good to be true or that promise to cure a medical condition.

hype: advertising and brash claims

Quality natural ingredients and responsible product testing can add significantly to the cost of a dietary supplement. The cheapest supplement is not always the best buy, though a high price does not necessarily guarantee high quality. It is important to investigate the supplement manufacturer whose products are being considered. Manufacturer contact information appears on the supplement facts label. One should inquire whether the manufacturer uses Good Manufacturing Practices, how they ensure the purity of their ingredients, and whether they have their products tested by independent laboratories to verify that the label accurately reflects the product in the supplement container.

Alternative therapies are increasingly being used to complement conventional medicine. The consumer should be knowledgeable of the modality chosen, its intended purpose, and whether it is appropriate for that purpose. In the case of dietary supplements, consumers should educate themselves about the appropriate application for the supplement and the

dose that is known to be safe and effective. Although many reputable CAM practitioners and dietary supplement manufacturers exist, consumers should educate themselves about the hallmarks of a quality practitioner or dietary supplement. With CAM modalities in general, and dietary supplements in particular, it is helpful to identify health care professionals who are knowledgeable about CAM and who can provide help in using CAM effectively.

SEE ALSO DIETARY SUPPLEMENTS; MACROBIOTIC DIET.

Ruth M. DeBusk

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American Dietetic Association

nutrition: the maintenance of health through proper eating, or the study of same

The American Dietetic Association (ADA) was founded in 1917, and its stated mission is to "promote optimal **nutrition** and well-being for all people by advocating for its members" (ADA).

The majority of ADA members are registered dietitians (RDs) or dietetic technicians, registered (DTRs). Membership includes membership in a state dietetic association and an option to join an ADA dietetic practice group representing employment or dietetic interests. Through its annual Food and Nutrition Conference and Exhibition (FNCE), members, students, and interested professionals can network and receive continuing education credits. In addition to the FNCE, ADA provides various member services including promoting dietetic professionals to the public, advocating for the profession, and providing resources for career development.

The Association publishes and has available online the *Journal of the American Dietetic Association*, as well as an online newsletter, the *Courier*. SEE ALSO CAREERS IN DIETETICS; DIETITIAN; DIETETIC TECHNICIAN, REGISTERED.

Susan P. Himborg

American Public Health Association

The American Public Health Association (APHA) is an association of individuals and organizations working to improve the public's health and to achieve equity in health status for all. Founded in 1872, APHA is the oldest and largest organization of public health professionals in the world. APHA members represent over fifty occupations of public health, including physicians, nurses, health educators, community dietitians, social workers, environmentalists, epidemiologists, and others. Members advocate for policies and practices that assure a healthy global society, emphasize health promotion and disease prevention, and seek to protect environmental and community health by addressing issues such as pollution control, **chronic** and **infectious diseases**, and the availability of professional education in public health.

Marie Boyle Struble

chronic: over a long period

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

Internet Resource

American Public Health Association. <<http://www.apha.org>>

American School Food Service Association

The American School Food Service Association (ASFSA), founded in 1946, is dedicated to ensuring that "healthful meals and nutrition education are available to all children." Its stated mission is "to advance good nutrition for all children" (ASFSA).

The majority of ASFSA members are school food-service administrators, managers, educators, or personnel who advance the availability, quality, and acceptance of school nutrition programs as an integral part of education. Members can also join their state or local association, or pursue an option for professional certification. Through its annual national conference and state meetings, members, students, and interested professionals can network and receive continuing education credits. The association publishes *School Foodservice & Nutrition*. SEE ALSO SCHOOL FOOD SERVICE; SCHOOL-AGED CHILDREN, DIET OF.

Susan P. Himborg

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Internet Resource

American School Food Service Association. "About ASFSA." Available from <<http://www.asfsa.org/>>

American School Health Association

The American School Health Association (ASHA) was founded in 1927 by physicians who were members of the American Public Health Association. The main focus of the ASHA is to safeguard the health of school-age

environment: surroundings

children. Over the years it has evolved into a multidisciplinary organization of administrators, counselors, dentists, health educators, physical educators, school nurses, and school physicians that advocates high-quality school health instruction, health services, and a healthful school **environment**.

The association's stated mission "is to protect and promote the health of children and youth by supporting coordinated school health programs as a foundation for school success." As part of its mission, the ASHA publishes the *Journal of School Health*. SEE ALSO SCHOOL FOOD SERVICE; SCHOOL-AGED CHILDREN, DIET OF.

Susan P. Himburg

Internet Resource

American School Health Association. <<http://www.ashaweb.org/>>

Amino Acids

amino acid: building block of proteins, necessary dietary nutrient

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

oxygen: O₂, atmospheric gas required by all animals

diet: the total daily food intake, or the types of foods eaten

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

lipid: fats, waxes, and steroids; important components of cell membranes

molecule: combination of atoms that form stable particles

pH: level of acidity, with low numbers indicating high acidity

Amino acids are the building blocks of **protein**. The body has twenty different amino acids that act as these building blocks. Nonessential amino acids are those that the body can synthesize for itself, provided there is enough nitrogen, carbon, hydrogen, and **oxygen** available. Essential amino acids are those supplied by the **diet**, since the human body either cannot make them at all or cannot make them in sufficient quantity to meet its needs. Under normal conditions, eleven of the amino acids are nonessential and nine are essential.

Structure

All amino acids have a similar chemical structure—each contains an amino group (NH₂), an acid group (COOH), a hydrogen atom (H), and a distinctive side group that makes proteins more complex than either **carbohydrates** or **lipids**. All amino acids are attached to a central carbon atom (C).

The distinctive side group identifies each amino acid and gives it characteristics that attract it to, or repel it from, the surrounding fluids and other amino acids. Some amino acid side groups carry electrical charges that are attracted to water **molecules** (hydrophilic), while others are neutral and are repelled by water (hydrophobic). Side-group characteristics (shape, size, composition, electrical charge, and **pH**) work together to determine each protein's specific function.

TABLE OF ESSENTIAL AND NONESSENTIAL AMINO ACIDS

Essential amino acids	Nonessential amino acids
Histidine	Alanine
Isoleucine	Arginine
Leucine	Asparagine
Lysine	Aspartic acid
Methionine	Cysteine
Phenylalanine	Glutamic acid
Threonine	Glutamine
Tryptophan	Glycine
Valine	Proline
	Serine
	Tyrosine

The three-dimensional shape of proteins is derived from the sequence and properties of its amino acids and determines its function and interaction with other molecules. Each amino acid is linked to the next by a peptide bond, the name given to the link or attraction between the acid (COOH) end of one amino acid and the amino end (NH_2) of another. Proteins of various lengths are made when amino acids are linked together in this manner. A dipeptide is two amino acids joined by a peptide bond, while a tripeptide is three amino acids joined by peptide bonds.

The unique shapes of proteins enable them to perform their various tasks in the body. Heat, acid, or other conditions can disturb proteins, causing them to uncoil or lose their shape and impairing their ability to function. This is referred to as *denaturation*.

Functions of Proteins

Proteins act as **enzymes**, **hormones**, and **antibodies**. They maintain fluid balance and acid and base balance. They also transport substances such as oxygen, **vitamins**, and **minerals** to target cells throughout the body. Structural proteins, such as collagen and keratin, are responsible for the formation of bones, teeth, hair, and the outer layer of skin, and they help maintain the structure of blood vessels and other tissues. In contrast, motor proteins use **energy** and convert it into some form of mechanical work (e.g., dividing cells, contracting muscle).

Enzymes are proteins that facilitate chemical reactions without being changed in the process. The inactive form of an enzyme is called a proenzyme. Hormones (chemical messengers) are proteins that travel to one or more specific target tissues or organs, and many have important regulatory functions. **Insulin**, for example, plays a key role in regulating the amount of **glucose** in the blood. The body manufactures antibodies (giant protein molecules), which combat invading antigens. Antigens are usually foreign substances such as **bacteria** and **viruses** that have entered the body and could potentially be harmful. Immunoproteins, also called immunoglobulins or antibodies, defend the body from possible attack by these invaders by binding to the antigens and inactivating them.

Proteins help to maintain the body's fluid and **electrolyte** balance. This means that proteins ensure that the proper types and amounts of fluid and minerals are present in each of the body's three fluid compartments. These fluid compartments are *intracellular* (contained within cells), *extracellular* (existing outside the cell), and *intravascular* (in the blood). Without this balance, the body cannot function properly.

Proteins also help to maintain balance between acids and bases within body fluids. The lower a fluid's pH, the more acidic it is. Conversely, the higher the pH, the less acidic the fluid is. The body works hard to keep the pH of the blood near 7.4 (neutral). Proteins also act as carriers, transporting many important substances in the bloodstream for delivery throughout the body. For example, a *lipoprotein* transports **fat** and **cholesterol** in the blood.

Food Sources

Humans consume many foods that contain proteins or amino acids. One normally need not worry about getting enough protein or amino acids in



A diabetic child injects herself with insulin. Composed of 51 amino acids, insulin is a small protein used by the body to regulate glucose levels in the blood. [Custom Medical Stock Photo. Reproduced by Permission.]

enzyme: protein responsible for carrying out reactions in a cell

hormone: molecules produced by one set of cells that influence the function of another set of cells

antibody: immune system protein that protects against infection

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

insulin: hormone released by the pancreas to regulate level of sugar in the blood

glucose: a simple sugar; the most commonly used fuel in cells

bacteria: single-celled organisms without nuclei, some of which are infectious

virus: noncellular infectious agent that requires a host cell to reproduce

electrolyte: salt dissolved in fluid

fat: type of food molecule rich in carbon and hydrogen, with high energy content

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

legumes: beans, peas, and related plants

the typical American diet. Foods from animal sources are typically rich in essential amino acids. These include chicken, fish, eggs, dairy products, beef, and pork. With the increasing emphasis on vegetarian diets, plant sources of protein are gaining in popularity. Such sources include dried beans (black, kidney, northern, red, and white beans), peas, soy, nuts, and seeds. Although plant sources generally lack one or more of the essential amino acids, when combined with whole grains such as rice, or by eating nuts or seeds with **legumes**, all the amino acids can be obtained. SEE ALSO DIET; FATS; MAL-NUTRITION; NUTRIENTS; PLANT-BASED DIETS; PROTEIN.

Susan P. Himborg

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Anemia

anemia: low level of red blood cells in the blood

prevalence: describing the number of cases in a population at any one time

nutritional deficiency: lack of adequate nutrients in the diet

iron: nutrient needed for red blood cell formation

folate: one of the B vitamins, also called folic acid

chronic: over a long period

genetic: inherited or related to the genes

thalassemia: inherited blood disease due to defect in the hemoglobin protein

sideroblastosis: condition in which the blood contains an abnormally high number of sideroblasts, or red blood cells containing iron granules

absorption: uptake by the digestive tract

hemoglobin: the iron-containing molecule in red blood cells that carries oxygen

oxygen: O₂, atmospheric gas required by all animals

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

nervous system: the brain, spinal cord, and nerves that extend throughout the body

gastrointestinal: related to the stomach and intestines

Anemia affects more than 30 percent of the world's population, and it is one of the most important worldwide health problems. It has a significant **prevalence** in both developing and industrialized nations. Causes of anemia include **nutritional deficiencies**, particularly of **iron**, vitamin B₁₂, and **folate** (folic acid); excess blood loss from menstruation or **chronic** illness and infection; ingestion of toxic substances, such as lead, ethanol, and other compounds; and **genetic** abnormalities such as **thalassemia** and **sideroblastosis**.

Anemia is caused by a deficiency in the intake and **absorption** elements required to make red blood cells. The condition is defined as one in which the blood is deficient in red blood cells, in **hemoglobin**, or in total volume. This results in blood that is incapable of meeting the **oxygen** needs of the body's tissues. Anemia is characterized by changes in the size and color of red blood cells. Red blood cells, or erythrocytes, are primarily responsible for oxygen transport from the lungs to the body's many cells. Hemoglobin is an oxygen-carrying **protein** in the red blood cell that incorporates iron into its structure. Therefore, iron is an essential building block of blood erythrocytes. When red blood cells are larger than normal, the anemia is termed *macrocytic*, and when they are smaller than normal, it is called *microcytic*. Normal red cell color is termed *normochromic*, and if the red cells appear pale, the anemia is called *hypochromic*. When extensive lab testing is not available for diagnosis, the use of a portable colorimeter can be used to detect anemia.

Iron-Deficiency Anemia

Anemia in the developing world is most commonly caused by an iron deficiency, which affects up to 50 percent of the population in some countries. Iron deficiency not only impairs the production of red cells in the blood, but also affects general cell growth and proliferation in tissues like the **nervous system** and the **gastrointestinal** tract. Red cells in a patient with iron-deficiency anemia are both microcytic and hypochromic.

Sickle-cell anemia is a genetic disease that causes normal red blood cells (left) to become rigid and sickle-shaped (right). The misshapen cells can impede blood circulation, causing pain and possibly tissue damage. [Photograph by Stanley Flegler. Visuals Unlimited. Reproduced by permission.]

Image rights not available

Iron deficiency affects young children, adolescents, and women of reproductive age—three periods of rapid growth during which the body's iron needs are higher than normal. In children, iron requirements are highest between the ages of six and eighteen months, and can be ten times the requirement of a normal adult. Iron is commonly absorbed from both human milk and cow's milk, and, if consumed in good quantities, these sources can meet the body's iron needs. A deficiency can result from inadequate intake, or it can occur if milk remains the sole source of a child's **nutrition** after the age of four months, when iron needs exceed that provided by milk alone. Research in Chile has shown that 40 percent of children whose main source of nutrition was breast milk developed iron-deficiency anemia. Such children can appear tired and inattentive, and they can suffer from delayed motor development. Some children can even develop mild to moderate mental retardation as a result of iron-deficiency anemia. Recent research has shown that iron-deficiency anemia can also contribute to emotional development problems, with **malnourished** children acting more irritable and fussy.

nutrition: the maintenance of health through proper eating, or the study of same

malnourished: lack of adequate nutrients in the diet

TYPES AND CAUSES OF ANEMIA

Type	Lab values	Causes
Macrocytic, normochromic	MCV: > 100fl MCHC: 34	Vitamin B ₁₂ deficiency, folate deficiency, vitamin C deficiency, chemotherapy (megaloblastic marrow); aplastic anemia, hypothyroidism (normoblastic marrow)
Microcytic, hypochromic	MCV: < 80 MCHC: < 30	Iron deficiency, thalassemia, sideroblastic anemia, chronic lead poisoning, anemia of chronic illness
Normocytic, normochromic	MCV: 80–99fl MCHC: 34 +/− 2	Iron deficiency (early), chronic disease

MCV: mean corpuscular volume

MCHC: mean corpuscular hemoglobin concentration

fl: femtoliter (one quadrillionth of a liter)

parasitic: feeding off another organism

hookworm: parasitic nematode that attaches to the intestinal wall

malaria: disease caused by infection with Plasmodium, a single-celled protozoan, transmitted by mosquitoes

DNA: deoxyribonucleic acid; the molecule that makes up genes, and is therefore responsible for heredity

RNA: ribonucleic acid, used in cells to create proteins from genetic information

bone marrow: dividing cells within the long bones that make the blood

congenital: present from birth

kwashiorkor: severe malnutrition characterized by swollen belly, hair loss, and loss of skin pigment

marasmus: extreme malnutrition, characterized by loss of muscle and other tissue

neural: related to the nervous system

cardiovascular: related to the heart and circulatory system

cancer: uncontrolled cell growth

Pregnant women can have up to double the requirement of iron for a normal adult, with the majority of the mother's iron being transferred to her growing fetus. Adult diets in most of the developing world tend to be iron-poor, and a low dietary intake can result in iron deficiency. Deficiency can also occur as a result of poor iron absorption due to gastrointestinal pathology, blood loss due to normal menstruation, blood loss from **parasitic** infections such as **hookworm** and **malaria**, and blood loss from chronic diarrhea—all of which are common in developing countries.

Other Causes

The two other primary causes of nutritional anemia are deficiencies in vitamin B₁₂ and folic acid, both of which are necessary for the production of **DNA**, **RNA**, and protein. Without these necessary factors, red blood cells can develop abnormally, or even die prematurely in the **bone marrow** where they are made. This leads to what is known as *megaloblastic anemia*.

Folate deficiency is most often caused by poor intestinal absorption or low intake of folate-rich foods, such as human milk, cow's milk, fruits, green vegetables, and certain meats. It is also caused by **congenital** defects in intestinal absorption. Just as with iron, folic acid requirements are highest during periods of rapid growth, particularly infancy and pregnancy. Folate-deficient children present with common symptoms of anemia, as well as chronic diarrhea. Folate deficiency can also occur with **kwashiorkor** or **marasmus**. If it occurs during pregnancy, folate deficiency can lead to **neural tube** defects, spontaneous abortions, and prematurity.

Vitamin B₁₂, derived from a substance called *cobalamin*, is mainly found in meats and other animal products—humans cannot synthesize this vitamin on their own. A good amount of its absorption depends on the presence of a substance called *intrinsic factor* (see sidebar). It does not normally occur with kwashiorkor or marasmus. Both folate and vitamin B₁₂ deficiencies have also been linked to **cardiovascular** disease, mood disorders, and increased frequency of chromosomal breaks (which may contribute to the development of **cancer**).

Treatment

Each of the important causes of nutritional anemia can be eradicated through prevention and treatment. Many countries have begun this process by instituting food supplementation programs in which grains and cereals are

Pernicious Anemia

Pernicious anemia is a common cause of cobalamin/vitamin B₁₂ deficiency. It is primarily a disease of the elderly and caused by an abnormality in the immune system where the body creates antibodies to intrinsic factor (a substance that facilitates absorption of vitamin B₁₂) or to the cells in the stomach that secrete it. The lack of intrinsic factor B₁₂ leads to vitamin B₁₂ deficiency. It can also be caused by

physiologic or anatomic disturbances of the stomach that might prevent intrinsic factor secretion. In children, an atypical and rare form of pernicious anemia can be inherited. It is an autosomal recessive disorder that results in an inability to secrete intrinsic factor, and it presents with anorexia, weakness, a painful red tongue, and neurologic abnormalities.

fortified with iron, folate, or vitamin B₁₂. Given adequate resources, these deficiencies can also be ameliorated with direct oral supplements of absorbable iron, vitamin B₁₂, and folic acid. Injectable forms of iron are also available. It has been found that the supplementation of vitamin A to at-risk populations improves anemia more efficiently than iron supplementation alone.

Treatment plans must also focus on the causes of anemia and therefore must include sanitation, treatment of infections such as malaria and HIV, and, most important, treatment of intestinal **parasites**. Much work is needed to address general **malnutrition**—not only concerning these deficiencies, but also other commonly occurring ones (e.g., vitamin A, **zinc**, copper, **calcium**). Programs dedicated to decreasing the rates of infection and illness in developing countries—through health education, immunization, sanitation, and appropriate treatment—will also contribute to a lower **incidence** and prevalence of worldwide anemia. SEE ALSO KWASHIORKOR; MALNUTRITION; MARASmus; NUTRITIONAL DEFICIENCY; VITAMINS, WATER SOLUBLE.

Seema P. Kumar

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fortified: altered by addition of vitamins or minerals

parasite: organism that feeds off of other organisms

malnutrition: chronic lack of sufficient nutrients to maintain health

zinc: mineral necessary for many enzyme processes

calcium: mineral essential for bones and teeth

incidence: number of new cases reported each year

Anorexia Nervosa

Anorexia nervosa is an **eating disorder** characterized by an extreme reduction in food intake leading to potentially life-threatening weight loss. This syndrome is marked by an intense, irrational fear of weight gain or excess body fat, accompanied by a distorted perception of body weight and shape. The onset is usually in the middle to late teens and is rarely seen in females over age forty. Among women of menstruating age with this disorder, **amenorrhea** is common.

A clinical diagnosis of anorexia nervosa necessitates body weight less than 85 percent of average for weight and height. Subtypes of this disorder include the **binge** eating/purging type (bingeing and purging are present) or the restricting type (bingeing and purging are absent). SEE ALSO ADDICTION, FOOD; BODY IMAGE; BULIMIA NERVOSA; EATING DISORDERS; EATING DISTURBANCES.

Karen Ansel

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anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

amenorrhea: lack of menstruation

binge: uncontrolled indulgence

- American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition. Washington, DC: Author.
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Anthropometric Measurements

anthropometric: related to measurement of characteristics of the human body

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

The term **anthropometric** refers to comparative measurements of the body. Anthropometric measurements are used in nutritional assessments. Those that are used to assess growth and development in infants, children, and adolescents include length, height, weight, weight-for-length, and head circumference (length is used in infants and toddlers, rather than height, because they are unable to stand). Individual measurements are usually compared to reference standards on a growth chart.

Anthropometric measurements used for adults usually include height, weight, **body mass index** (BMI), waist-to-hip ratio, and percentage of body fat. These measures are then compared to reference standards to assess weight status and the risk for various diseases. Anthropometric measurements require precise measuring techniques to be valid. SEE ALSO BODY MASS INDEX; NUTRITIONAL ASSESSMENT; WAIST-TO-HIP RATIO.

Delores C. S. James

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

cancer: uncontrolled cell growth

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

free radical: highly reactive molecular fragment, which can damage cells

oxygen: O₂, atmospheric gas required by all animals

metabolism: the sum total of reactions in a cell or an organism

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

carotenoid: plant-derived molecules used as pigments

water-soluble: able to be dissolved in water

diet: the total daily food intake, or the types of foods eaten

Antioxidants

Americans spend several billion dollars a year on **antioxidants** in an effort to improve their health. Science has been looking at antioxidants and their role in everything from preventing **cancer** and **heart disease** to boosting the **immune system** and slowing the aging process. Antioxidants provide a layer of protection for the cells and tissues of the body, just as a thick coat of wax helps protect a car's finish. Specifically, antioxidants protect against free radical damage. What are **free radicals**?

People must breathe in **oxygen** to live. Continuously on the move in the blood stream and transported to every cell, oxygen is necessary for all essential bodily functions. However, a small amount of this oxygen gets loose and produces unstable by-products called free radicals. Body processes, such as **metabolism**, as well as environmental factors, including pollution and cigarette smoke, can produce free radicals. An overload of free radicals in the body causes damage to the cells, ultimately resulting in disease and accelerated aging.

Antioxidant-rich food may help prevent various cancers, heart disease, and diseases of aging. **Vitamins C and E**, **carotenoids** (including beta-carotene), and the mineral selenium are all powerful antioxidants found in food. Vitamin C, a **water-soluble** vitamin, is also known as ascorbic acid. Most of the vitamin C in the **diet** (90%) comes from fruits and vegetables. However, since vitamin C is water soluble, cooking can destroy the vitamin C in a food.



Cigarette smoke, including second-hand smoke, is a major source of free radicals. These volatile molecules can damage tissues and cause disease. [© 1993 Custom Medical Stock Photo, Inc. Reproduced by permission.]

Vitamin E, also known as alpha tocopherol, is a **fat**. Because vitamin E is found in oils, people who follow a low-fat diet may not get enough. Beta-carotene is a member of the carotenoid family. Found mainly in plants, carotenoids provide the vibrant red, yellow, green, and orange colors of fruits and vegetables, with carrots being a major contributor of beta-carotene. Typically, beta-carotene is a conditionally essential **nutrient**, but when one's intake of vitamin A is low, beta-carotene becomes an essential nutrient, meaning that it must be obtained from food and cannot be manufactured by the body.

Selenium is an essential **trace** mineral (*trace minerals* are needed only in small amounts). The amount of selenium found in food is directly related to the amount of selenium in the soil in which the food was grown. It is necessary for healthy immune function and is tied to **killer-cell** activity and **antibody** production. The many health benefits of the various antioxidants can be provided by a variety of food sources.

More and more **functional foods** contain combinations of various supplements. As popular as antioxidants are, an excess amount of them can be toxic. One reason to obtain antioxidants from food is that high doses may

fat: type of food molecule rich in carbon and hydrogen, with high energy content-soluble vitamin that is essential for human health

nutrient: dietary substance necessary for health

trace: very small amount

mineral: an inorganic (non-carbon-containing) element, ion, or compound

killer-cell: type of white blood cell that helps protect the body from infection

antibody: immune system protein that protects against infection

functional food: food whose health benefits are claimed to be higher than those traditionally assumed for similar types of foods

HEALTH BENEFITS OF ANTIOXIDANTS AND THEIR FOOD SOURCES		
Antioxidant	Health benefits	Food sources
Selenium	Helps maintain healthy hair and nails, enhances immunity, works with vitamin E to protect cells from damage. Reduces the risk of cancer, particularly lung, prostate, and colorectal.	Garlic, seeds, Brazil nuts, meat, eggs, poultry, seafood, whole grains. The amount in plant sources varies according to the content of the soil.
Beta-carotene	Keeps skin healthy, helps prevent night blindness and infections, promotes growth and bone development.	Red, yellow-orange, and leafy green vegetables and fruits, including carrots, apricots, cantaloupe, peppers, tomatoes, spinach, broccoli, sweet potatoes, and pumpkin.
Vitamin E	Acts as the protector of essential fats in cell membranes and red blood cells. Reduces risk of cancer, heart disease, and other age-associated diseases.	Peanut butter, nuts, seeds, vegetable oils and margarine, wheat germ, avocado, whole grains, salad dressings.
Vitamin C	Destroys free radicals inside and outside cells. Helps in the formation of connective tissue, the healing of wounds, and iron absorption, and also helps to prevent bruising and keep gums healthy. May reduce risk of cataracts, heart disease, and cancer.	Peppers, tomatoes, citrus fruits and juices, berries, broccoli, spinach, cabbage, potatoes, mango, papaya.

SOURCE: The American Dietetic Association And WebMD.

actually promote free radical production, also known as pro-oxidation, increasing the chance for health problems. Those who may benefit most from antioxidants include people dealing with a lot of **stress**, dieters limiting their **calories** to 1,200 per day or less, people on a low-fat diet, smokers, older adults, and people with a family history of heart disease or cancer. SEE ALSO **FUNCTIONAL FOODS**.

Susan Mitchell

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Appetite

Why do many people desire ice cream and pie or some other rich dessert after eating a huge Thanksgiving dinner? This desire is referred to as *appetite*, which is not the same as *hunger*. Appetite is a complicated phenomenon, linking biology with **environment**. It is a biopsychological system, meaning it is the result of both our biology (hunger) and psychology (desires and feelings).

environment: surroundings

Hunger, on the other hand, is purely **biological**. It is that nagging, irritating feeling that makes one think about food and the need to eat. It gets stronger the longer one goes without food, and it weakens after eating. Although the **physiological** reasons people feel hunger have not been clearly identified, the feeling of hunger rises and falls based on the activation of **neural** circuitry related to eating. There are many chemical agents in the human body that affect the sensation of hunger. Unfortunately for some people, eating behavior is not governed by hunger and satiety (feeling of fullness), but by a variety of other factors. For example, some people eat in response to their feelings of **anxiety**, **depression**, or **stress**. Eating temporarily helps lessen these feelings, and thus tends to become a coping response whenever they have these bad feelings.

Weight gain may occur if people eat for reasons other than hunger. One strategy to help people manage their weight is for them to learn to differentiate between appetite and hunger, to learn to “listen to their bodies,” and to eat only when they are hungry—and to stop when they are full. Hunger-control medications can help reduce the biological need to eat, but people still need to manage their psychological feelings about eating. SEE ALSO HUNGER; SATIETY; WEIGHT MANAGEMENT.

John P. Foreyt

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Arteriosclerosis

The term **arteriosclerosis** is used to describe several **cardiovascular** diseases, including those involving the blood vessels. In this instance, the **arteries** become hardened and blood vessels lose their “elastic” effect. Arteriosclerosis can begin in early childhood.

The primary risk factors for arteriosclerosis include hypertension (**high blood pressure**), **diabetes mellitus**, smoking, and **obesity**. All of these risk factors are preventable by exercising regularly, smoking cessation, eating at least five servings of fruits and vegetables daily, and through proper **stress** management.

Two types of arteriosclerosis include Monckeberg’s arteriosclerosis, which usually involves restricted movement of the lower extremities, and arteriolar sclerosis, which can lead to decreased vision and peripheral vascular disease. Signs and symptoms of arteriosclerosis include high blood pressure, multiple kidney infections, and poor circulation in the toes and fingers. SEE ALSO ATHEROSCLEROSIS; CARDIOVASCULAR DISEASES; HEART DISEASE.

Teresa A. Lyles

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biological: related to living organisms

physiological: related to the biochemical processes of the body

neural: related to the nervous system

anxiety: nervousness

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

stress: heightened state of nervousness or unease

cardiovascular: related to the heart and circulatory system

artery: blood vessel that carries blood away from the heart toward the body tissues

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

diabetes: inability to regulate level of sugar in the blood

obesity: the condition of being overweight, according to established norms based on sex, age, and height

stress: heightened state of nervousness or unease

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Artificial Sweeteners

caries: cavities in the teeth

glucose: a simple sugar; the most commonly used fuel in cells

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

metabolism: the sum total of reactions in a cell or an organism

insulin: hormone released by the pancreas to regulate level of sugar in the blood

sucrose: table sugar

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

amino acid: building block of proteins, necessary dietary nutrient

metabolic: related to processing of nutrients and building of necessary molecules within the cell

phenylketonuria: inherited disease marked by the inability to process the amino acid phenylalanine, causing mental retardation

Artificial sweeteners may assist in weight management, prevention of dental **caries**, and control of blood **glucose** for diabetics. It has also been suggested that low-calorie sweeteners may stimulate the appetite, but the bulk of evidence does not support this hypothesis. Conclusive research demonstrates that artificial sweeteners have no effect on **carbohydrate metabolism**, short- or long-term blood glucose control, or **insulin** secretion, and they are thus an excellent sugar alternative for diabetics. There have been a number of health concerns related with these products, though the Food and Drug Administration (FDA) approval process for artificial sweeteners involves a comprehensive analysis of scientific data to satisfy safety requirements. All "generally recognized as safe" (GRAS) sweeteners have undergone extensive safety testing and have been carefully reviewed by the FDA.

Five FDA-Approved (GRAS) Artificial Sweeteners

Acesulfame potassium (Acesulfame-K) was discovered in 1967 and approved for use in the United States in 1988. Its trade name is Sunette. Two hundred times sweeter than **sucrose**, this sweetener is stable when heated, making it suitable for cooking. However, when used in large amounts it has a bitter aftertaste. It is not broken down by the body, and it does not provide any calories. Over ninety scientific studies have been conducted by the FDA, and the World Health Organization's Joint Expert Committee on **Food Additives** (JECFA) has also endorsed Acesulfame K's safety.

Aspartame was discovered in 1969 and approved for use in the United States in 1981. Its trade name is NutraSweet. Also two hundred times sweeter than sugar, aspartame is not suitable in applications that require high temperatures, as it loses its sweetness when heated. It contains four calories per gram, but, because of its intense sweetness, the amount of **energy** derived from it is negligible. It is synthesized from aspartic acid and phenylalanine, two essential **amino acids**. Persons with the rare hereditary **metabolic** disorder **phenylketonuria** (PKU), an inborn error of metabolism, must control their intake of phenylalanine from all sources, including aspartame, and therefore all U.S. products containing aspartame are labeled "This product contains phenylalanine." Because it is impossible to know if an unborn child has PKU, it is recommended that pregnant women not use aspartame. The FDA states that aspartame is the most thoroughly tested food additive ever submitted to the agency.

Neotame was discovered in 1990 and was approved for use in the United States in 2002. Eight thousand times sweeter than sugar, this analog of aspartame can be used in both cooking and baking applications. Although neotame is a derivative of aspartame, it is not metabolized to phenylalanine, and



A few popular alternatives to table sugar include sucralose, aspartame, and saccharin. Despite controversy over potential health risks related to their consumption, each of these products has undergone a decade or more of scientific testing and is generally recognized as safe. [Octane Photographic. Reproduced by permission.]

no special PKU labeling is required. The FDA reviewed more than 113 human and animal studies before ruling on neotame.

Saccharin was discovered in 1879 and approved for use in the United States in 1879. Its trade name is Sweet'n Low. Three hundred to five hundred times sweeter than table sugar, saccharin provides no energy, as it is not metabolized by human beings. It has a bitter and somewhat metallic aftertaste. The largest population study to date, involving nine thousand individuals, showed that saccharin does not increase the risk of **cancer**, and on December 15, 2000, the U.S. Congress passed legislation to remove the warning label that had been required on foods and beverages containing saccharin since 1977 (warning labels were required because of findings that saccharin caused bladder tumors in mice when they were given high doses of the sweetener). Saccharin is approved in more than one hundred countries around the world and has been reviewed and determined safe by the Joint Expert Committee on Food Additives of the World Health Organization and the Scientific Committee for Food of the European Union.

Sucralose was discovered in 1976 and approved for use in the United States in 1988. Its trade name is Splenda. Six hundred times sweeter than sugar, sucralose is not absorbed from the digestive tract, so it adds no calories to consumed food. It is made from rearranged sugar **molecules** that substitute three **atoms** of chlorine for three hydroxyl groups on the sugar molecule. Sucralose has been tested in more than one hundred studies.

Sugar Alcohols (GRAS)

Sugar alcohols are not technically artificial sweeteners. Examples include sorbitol, xylitol, lactitol, mannitol, isomalt, and maltitol, which are used to sweeten “sugar-free” foods such as candy, cookies, and chewing gum. The alcohols have fewer calories than sugar, do not promote tooth decay, and do not cause a sudden increase in blood glucose because the bloodstream does not easily absorb them. They may cause, however, effects similar to a laxative if consumed in excess. Products containing large amounts of sugar alcohols must be labeled with the warning: “Excess consumption may have a laxative effect.”

cancer: uncontrolled cell growth

molecule: combination of atoms that form stable particles

atoms: fundamental particles of matter

Artificial Sweeteners Pending FDA Approval

Alitame is two thousand times sweeter than sugar. An FDA petition was filed in 1986. Like neotame, alitame is a derivative of aspartame. It is approved for use in a variety of food and beverage products in Australia, New Zealand, Mexico, Colombia, Indonesia, and the People's Republic of China.

Cyclamate was discovered in 1937, banned in 1969, and a petition for approval was refiled in 1982. After being banned by the FDA in 1969, due to findings that high doses cause bladder tumors in mice, cyclamate has been approved for use in more than fifty countries. The sweetener is a derivative of cyclohexylsulfamic acid and is thirty times sweeter than sucrose. In May 2003, the European Union reduced the recommended average daily intake of this sweetener in soft drinks, juice, and milk-based drinks, based on evidence that the conversion rate of cyclamate in the body is higher than previously thought.

Stevioside (stevia) is obtained from the leaves of a South American shrub. Though it can impart a sweet taste to foods, it cannot be sold as a sweetener because the FDA considers it an unapproved food additive. Stevioside is a high-intensity low-calorie sweetener three hundred times sweeter than sucrose. It is approved in Japan, South Korea, Brazil, Paraguay, and Argentina. However, the World Health Organization (WHO) has determined that the data is insufficient to label it as a sweetener.

Artificial sweeteners taste sweet like sugar without the added calories. They do not promote tooth decay, and they are an acceptable alternative for people with **diabetes** or those wishing to decrease their use of sucrose. Artificial sweeteners, and their metabolic by-products and components, are not considered harmful to human beings at the levels normally used. When used in the context of a healthful **diet**, artificial sweeteners are generally safe for consumption. SEE ALSO GENERALLY RECOGNIZED AS SAFE; INBORN ERRORS OF METABOLISM; PHENYLKETONURIA.

Kyle Shadix

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Asian Americans, Diets of

Asian Americans represent a large and rapidly growing segment of the U.S. population. According to the U.S. Census Bureau, there were 11.9 million Asian Americans residing in the United States (4.2 percent of the total population) in the year 2000. Chinese Americans were the leading Asian group



(not including Taiwanese Americans), followed by Filipinos (2.4 million) and Asian Indians (1.9 million). A U.S. Census estimate predicts a tripling of this population by 2050.

Asian Americans are exceedingly diverse, coming from nearly fifty countries and ethnic groups, each with distinct cultures, traditions, and histories, and they speak over 100 languages and dialects. Asian Americans have immigrated to the United States from different parts of Asia, including India, Pakistan, Bangladesh, Sri Lanka, the Philippines, China, Hong Kong, Cambodia, Vietnam, Laos, Thailand, Korea, and Japan. They are categorized by the Census Bureau under the broad classification of “Asian and Pacific Islanders in the United States.” In 2000, Asian-born residents accounted for 26 percent (7.2 million) of the nation’s total foreign-born population, with approximately half (about 45%) of them living in three metropolitan areas: Los Angeles, New York, and San Francisco.

Food Habits

Two key elements draw the diverse cultures of the Asian region together: (1) the composition of meals, with an emphasis on vegetables and rice, with relatively little meat; and (2) cooking techniques. Eating is a vital part of the social matrix, and Asian-American cuisine includes a wide variety of meals, snacks, and desserts for social occasions. Asian food preparation techniques include stir-frying, barbecuing, deep-frying, boiling, and steaming. All in-

Asian-American diets are based on rice and rice products, with less emphasis on the regular consumption of meat and dairy products, which differs from traditional American fare. [AP/Wide World Photos. Reproduced by permission.]

MERITS AND WEAKNESSES OF TRADITIONAL ASIAN DIETS

	Staple foods	Merits of diet	Weaknesses of diet	Common diseases
Cambodian	Rice Fish Tea	Low in fat Low in sugar	People often unable to obtain necessary food	Tuberculosis Polio
Chinese	Rice Vegetables Green Tea	Reduces risk for heart disease and certain cancers	Iodine deficiency Iron deficiency	Anemia
Filipino	Rice Vegetables Seafood Fruit	Reduces risk for heart disease and cancers	Protein deficiency Iron deficiency	Anemia Diarrhea Respiratory infections
Hmong	Rice Vegetables Meat Fish	Low in fat Low in sugar	Lack of fruit Calcium deficiency	
Asian Indian	Cereals Rice Vegetables	Low in fat Low in sugar	Protein deficiency Iron deficiency Vitamin A deficiency	Respiratory infections Intestinal infections Anemia Protein-energy malnutrition Diabetes
Laotian	Rice Vegetables Fish	Low in fat Low in sugar	Vitamin A deficiency Iron deficiency	Goiter Anemia
Vietnamese	Rice Fish Fruit	Low in fat Low in sugar	Iron deficiency	Anemia

nutrient: dietary substance necessary for health

diet: the total daily food intake, or the types of foods eaten

diversity: the variety of cultural traditions within a larger culture

socioeconomic status: level of income and social class

lactose intolerance: inability to digest lactose, or milk sugar

tofu: soybean curd, similar in consistency to cottage cheese

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

calcium: mineral essential for bones and teeth

redients are carefully prepared (chopped, sliced, etc.) prior to starting the cooking process. The **nutrient** composition of the traditional Asian **diet** is very similar to the Mediterranean diet in that both are largely plant-based diets and meat is consumed only a few times a month (and often in very small amounts).

There exists great **diversity** in language, **socioeconomic status**, religion, age, education, social class, location, length of time in the United States, and country of origin among Asian Americans. Hence, caution needs to be taken not to generalize or imply that food habits are similar for all individuals of this group. For example, Chinese meals consist mainly of four food groups: grains, vegetables, fruit, and meat. Because of **lactose intolerance**, most Chinese do not consume large amounts of dairy products, substituting soymilk and **tofu** as sources of **protein** and **calcium**. Some Asian food, such as Thai food, is generally spicy, hot, and high in sodium. Hot peppers are used daily. The Japanese are very concerned about the visual appeal of food and the “separateness” of the foods and tastes. Garlic and hot pepper, commonly used among Asian Americans, are not common ingredients in the Japanese cuisine. Korean Americans eat kimchi with each meal. Kimchi is cabbage marinated in salt water, layered with peppers and spices in crockery, and left to ferment for a few days. South Asians (people from India, Pakistan, Bangladesh, and Sri Lanka) use spices (e.g., ginger, garlic, fenugreek, cumin, etc.) and condiments in their cuisine.

Most Asian Americans like to use fresh food in their cooking. Unlike the fast food society of the United States, they select live seafood, fresh meats, and seasonal fruits and vegetables from the local market to ensure freshness. Food preparation is meticulous, and consumption is ceremonious and deliberate. Most Asians living in America adhere to a traditional Asian

diet interspersed with American foods, particularly breads and cereals. Dairy products are not consumed in large quantities, except for ice cream. Calcium is consumed through tofu and small fish (bones eaten). Fish, pork, and poultry are the main sources of protein. Significant amounts of nuts and dried beans are also eaten. Vegetables and fruits make up a large part of food intake. Rice is the mainstay of the diet and is commonly eaten at every meal.

The traditional Asian diet has received a lot of attention because many **chronic** diseases, such as **heart disease**, **diabetes**, and certain cancers, are not as common in Asia as in the United States and other Western nations. Researchers believe that the Asian plant-based diet provides protection against these chronic diseases. The diet is also believed to contribute to the long life spans commonly seen in Asia. To offer a healthful alternative to the 1992 U.S. Food Guide Pyramid, which lumped some animal and plant foods together in a single group, researchers developed an Asian Diet Pyramid, which emphasizes a wide base of rice, rice products, noodles, breads and grains, preferably whole grain and minimally **processed foods**, topped by another large band of fruits, vegetables, **legumes**, nuts, and seeds. Daily physical exercise, a small amount of vegetable oil, and a moderate consumption of plant-based beverages—including tea (especially black and green), sake, beer, and wine—are also recommended daily. Small daily servings of low-fat dairy products or fish are optional; sweets, eggs, and poultry are recommended no more than weekly; and red meat is recommended no more than monthly.

The Asian Diet Pyramid reflects the traditional, plant-based rural diets of Asia. Although there is an image of Asian Americans as a “model minority” who have overcome their “ethnic handicap” and are socioeconomically well off (Chen and Hawks), certain illnesses predominate in this group. For example, there is a particularly high rate of liver **cancer** among Asian Americans, while lung cancer is their leading cause of death. Vietnamese-American women’s cervical cancer rate is five times that of Caucasian women. Asian Americans have among the highest rates of **tuberculosis** and **hepatitis B** in the United States. Asian Indian immigrants in the United States have an unusually high rate of coronary **artery** disease, and **parasitic** infections are particularly widespread among Southeast Asian refugees.

Studies indicate that the food habits of Asians become increasingly Westernized after they move to the United States or other Western countries (see Karim, Bloch, Falciglia, and Murthy). There is a general shift from vegetarianism to nonvegetarianism, and ethnic foods are consumed along with traditional ingredients found in American supermarkets. Consequently, diets of immigrants living in the United States have changed from being low in fat and rich in **fiber** to being high in **saturated fat** and animal protein and low in fiber. There is also an increased tendency to consume fast foods and **convenience foods**. These dietary changes, along with **sedentary** and stressful lifestyles, may increase their risk for chronic disease. SEE ALSO ASIANS, DIET OF.

Ranjita Misra

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chronic: over a long period

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

diabetes: inability to regulate level of sugar in the blood

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

legumes: beans, peas, and related plants

cancer: uncontrolled cell growth

tuberculosis: bacterial infection, usually of the lungs, caused by *Mycobacterium tuberculosis*

hepatitis: liver inflammation

artery: blood vessel that carries blood away from the heart toward the body tissues

parasitic: feeding off another organism

fiber: indigestible plant material that aids digestion by providing bulk

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

convenience food: food that requires very little preparation for eating

sedentary: not active

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Asians, Diet of

With forty-seven countries, innumerable tribes, and thousands of distinct languages, Asia is home to more ethnic groups than any other part of the world. In addition, the geography and climate of Asia are as diverse as its nations and peoples. From the lush rice paddies of the Philippines to the crowded Tokyo metropolis to the rainforests of Indonesia, there is a staggering variety of fruit, food, and spices in this extraordinary part of the world. Asia can be divided into three regions: East Asia (including China, Taiwan, Japan, and Korea); Southeast Asia (including Malaysia, Singapore, and the Philippines); and South Asia (including India and Sri Lanka).

The Thread that Binds Asia: Rice

Though each Asian country and region has its distinct flavors and cooking styles, almost all share one food in common—rice. But rice is not eaten in the same manner in each country. As a staple food central to survival, especially during times of **famine**, rice has acquired an almost sacred status in Asian society, and it is served in many ways. It is cooked as a significant part of each meal of the day, incorporated as a main ingredient in confections such as candy and cakes, fermented to make wine (Japanese sake) or beer, or sometimes given as an offering to the gods to ensure a good harvest. Rice is a potent culinary and spiritual staple in Asia.

Asian Fruit

The fruits of Asia are unlike those of any other part of the world. The tropical climate of South and Southeast Asia, and the mild climate of East Asia, create a hospitable environment for many different fruits to grow. Fruit is a significant part of the Asian **diet** and is usually eaten as a dessert with lunch or dinner. In East Asia, oranges, quince, dates, pears, strawberries, cherries, watermelon, peaches, and grapefruit are eaten widely. In South and Southeast Asia, there are unique fruits such as sweet mangoes (originally

famine: extended period of food shortage

diet: the total daily food intake, or the types of foods eaten

from India), which are eaten individually or made into ice cream or other confections, and green mangoes, which are used widely in Vietnam, the Philippines, and India, where they are made into chutneys or curries (which are used as a broth, stew, or dry seasoning).

Coconuts are popular in Southeast Asian cuisine. Coconut milk is used for curries in Thailand, Malaysia, Indonesia, South India, Myanmar, and the Philippines. It is also a delicious beverage, and is often drunk straight from the coconut with a straw. Coconut meat is added to desserts and salads. Other tropical fruits found in Asia include guava, papaya, pawpaw, starfruit (carambola), mangosteen, sour sop, jackfruit, longan, rambutan, durian, pineapple, and lychee.

Other Common Ingredients Used across Asia

Nuts are popular in Asia, eaten plain as snacks or mashed into porridge and sauces. In Malaysia and Indonesia, satays (peanut-based sauces) flavor chicken and beef dishes. The Chinese bake almond cookies and make rice cream with almonds or hazelnuts. Steamed cakes with almonds or macadamias are also common, and rice puddings with fruit, raisins, almonds, walnuts, or hazelnuts are popular desserts in India. Both East and Southeast Asia boast stir-fry dishes with peanuts, while India flavors its rice with lemon and peanuts.

Image rights not available

A healthy serving of rice is the centerpiece of this modern Japanese bento box. Though they differ in many ways, most Asian cultures share a dependence on rice. [Courtesy of Corinne Trang. Reproduced by permission.]

East Asian Food

China. Different regions of China have distinct tastes in food. Shanghainese cooking is known for its spicy chili flavoring and trademark red-colored meats. The Cantonese and Chaozhao regions are known for cooked meats and vegetables; and in the Beijing, Mandarin, and Shandong regions steamed bread and noodles are used as **staples** instead of rice. The most prized food staples in China are rice and wheat, though yams, taros, and potatoes are eaten when rice and wheat are not available. Chinese vegetables are mostly imported from Central Asia, including cucumbers, coriander, peas, sesame, onions, grapes and pomegranates, tomatoes, maize, sweet potatoes, peanuts, mushrooms, and daikon (radish). Preserved foods are popular, including pickled foods, fermented vegetables, and smoked and salted meats. Other well-known seasonings that are used include salted black beans (douchi), sweet and salty sauce, garlic, oyster sauce, soy sauce, black fungus, chilies, hoisin sauce, ginger, sesame seeds, and sesame oil.

staples: essential foods in the diet

The Chinese cook most of their food by mincing the ingredients and sautéing them in a deep pan called a wok. Little **fat** is used to season the meals, but plenty of fresh flavorings are added, such as ginger, chilies, soy sauces, scallions, oyster sauce, and fagara (Szechuan pepper). In the cities, most people cook over a gas stovetop, while in the country they use a brick stove to cook several dishes at once, including the rice. Tea is the most common beverage, though sodas are also popular.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

Japan. Sushi (slices of raw fish on rice), teriyaki meats, and tempura (batter-fried vegetables or shrimp) are not the only foods in the Japanese diet. Salted vegetables are part of everyday diets, as are soybean products such as **tofu**, soy sauce, miso (a soybean paste), and dashi (a stock whose base is dried fish and kelp). Meat and seafood are popular in Japanese cooking, and broths

tofu: soybean curd, similar in consistency to cottage cheese

are also common. Ingredients for stock include dried sea tangle, dried bonito (a type of tuna), and brown mushrooms. Spices like pepper, wasabi (horse-radish), cloves, ginger, sesame, and garlic give special flavor to the food.

Japan centers its dishes on rice, with all other dishes thought of as side dishes. When rice stocks are low, millet or sweet potatoes are used. Different types of noodles are found in Japanese cuisine: soba (a buckwheat noodle) is popular in the west, and udon (a flour noodle) is popular in the east. Japanese rice wine (mirin or sake) is served both cold and warm. Green tea is especially popular.

Korea. Korea's cuisine is a blend of Chinese and Japanese, though with its own distinctive flavor. The Korean national dish is *bulgogi*, or "fire beef"—beef strips marinated in soy sauce, sesame oil, garlic, and chili. The mainstay of Korean food is kimchi (or gimchi), a side dish of pickled grated vegetables infused with ginger, garlic, and chili. Seafood is a major staple in Korea, in addition to pork, hens, deer, and wild boar. Popular vegetables include turnips, lotus roots, taro, leeks, lettuce, bamboo shoots, ferns, and mushrooms. Popular spices and nuts include pine nuts, hazelnuts, and ginseng, and chili peppers are used liberally.

Noodles are usually made of wheat, buckwheat, soya, rice, or beans. Rice-cake soup, dumpling soup, five-grain rice, rice gruel, and sweet rice beverages are all popular. Green tea, scorched rice tea, **herbal** teas, and coffee are popular drinks. Other well-liked drinks are made from barley, corn rice, sesame seeds, ginseng, ginger, cinnamon, and citron.

Southeast Asia

Southeast Asia is located in the monsoon belt, where heavy rains fall for several months a year. Most Southeast Asian countries use plenty of spice and coconut in their dishes, except for Vietnam.

Vietnam. Vietnamese cuisine does not include large amounts of meat and fish; instead, rice is supplemented with vegetables and eggs. Similar to Chinese cooking, Vietnamese cooking uses little fat or oil for frying. Instead of using soy sauce for seasoning, *nuocmam* (fish sauce) is used as the main flavoring in almost every dish. *Pho* is a type of soup in which noodles, beef, chicken, or pork are added, and the soup is then garnished with basil, bean sprouts, and other seasonings. Fruits are an integral part of each meal—bananas, mangoes, papayas, oranges, coconuts, and pineapple are all popular. Vietnamese coffee is made with condensed milk to make the drink extra sweet and delicious. Hot green tea is very popular as well.

The Philippines. Philippine culture is a fusion of Malay origin and Spanish, Japanese, Chinese, Islamic, and American influence. In the Philippines, four meals a day are served: breakfast, lunch, *merienda* (snack), and dinner. *Pancit*, or noodles, is considered a *merienda* dish and is served with a sponge-cake called *puto* and a glutinous ricecake called *cuchinta*. Lunch is the heaviest meal and consists of rice, a vegetable, a meat, and sometimes fish as well. Vegetables include *kangkung* (a local spinach), broccoli, Chinese broccoli, bitter melon, mung bean, beansprouts, eggplant, and okra. However, vegetables are not considered as important to the diet as in East Asia. Meat is a major part of the diet, with pork being one of the more popular meats.

herbal: related to or made from herbs

Beef and chicken are eaten often, and water buffalo are eaten in the provinces. The primary foods in the Philippines are rice, corn, coconuts, sugarcane, bananas, coffee, mangoes, and pineapples.

Malaysia and Singapore. These two countries have Indian, Muslim, and Chinese heritages that are reflected in their spicy **cuisines**. Authentic Malay food is difficult to find, though a wide selection of Chinese, Indian, Indonesian, and occasionally Western food is almost always available. *Nonya* is a Malaysian dish that has Chinese ingredients with local spices. Satays (meat kebabs in spicy peanut sauce) are a Malaysian creation, and fiery curries, Chinese noodles, fried tofu in peanut sauce, tamarind fish curry, curry prawns, and curried meat in coconut marinade are typical dishes. *Laksa* is a creamy curry with either seafood or chicken simmered in coconut milk. Popular desserts include *endol* (sugar syrup, coconut milk, and green noodles) and *is kacang* (beans and jellies topped with shaved ice, syrups, and condensed milk).

cuisine: types of food and traditions of preparation

South Asia

India's influence can be seen in Pakistan, Sri Lanka, Afghanistan, and even Bali (Indonesia). Sri Lankan cuisine is a snapshot of Indian food. Its fiery curry dishes with rice, and hoppers (fried pancake) served with yogurt and honey, are reminiscent of India. Meat and seafood are popular staples, as is tea.

India is the only country in this region that uses milk and dairy products in its diet, mostly in the form of yogurt and cheese. Indian seasonings include turmeric, tamarind, saffron, cumin, coriander, cardamom, mustard, ginger, celery seed, aniseed, fenugreek, curry leaf, and coconut milk. Cashews, pistachios, and almonds are also often found in meat dishes, as well as in the variety of breads that are baked, fried, or roasted to accompany the meals. Indian meals are served with chutney, a spicy relish, or *raita*, a chilled yogurt to soothe the spiciness of the dish.

In the north of India, meat dishes are more common and are usually made with goat, sheep, or chicken. The meals emphasize breads, grain, and spices. Southern meals focus on rice, vegetables, and chilies. Vegetables include onions, yams, potatoes, tomatoes, pumpkin, banana flowers, cucumbers, radishes, and lotus roots. The sacred status of the cow in the agrarian society has disallowed beef to be eaten by those who practice Hinduism. The **protein** in these diets comes primarily from **legumes** or dairy products.

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

legumes: beans, peas, and related plants

Food Security in Asia

Food is not always readily available across Asia because of a complex web of social and political factors. Weather also plays a heavy role in food security, which is the idea that everyone has access to food at a reasonable cost. If a typhoon causes devastating flooding or severe droughts destroy crops, people suffer because there will be no food to harvest. Droughts can also destroy food supplies and deplete drinking water supplies.

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

Micronutrient Deficiency

Micronutrients are essential **vitamins** and **minerals** that the body does not naturally produce. A certain amount of these vitamins and minerals are

nutritional deficiency: lack of adequate nutrients in the diet

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

cataract: clouding of the lens of the eye

hormone: molecules produced by one set of cells that influence the function of another set of cells

hemoglobin: the iron-containing molecule in red blood cells that carries oxygen

calcium: mineral essential for bones and teeth

cardiovascular: related to the heart and circulatory system

diabetes: inability to regulate level of sugar in the blood

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

obesity: the condition of being overweight, according to established norms based on sex, age, and height

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

required for human development, but in areas of famine or insufficient food, populations are at high risk of micronutrient deficiencies. In areas of famine, or where insufficient varieties of foods are available, certain populations (such as pregnant women, infants, and growing children) are often at high risk for **nutritional deficiencies**.

Vitamin A. Vitamin A is necessary to develop a strong **immune system** and proper eyesight. Vitamin A deficiency (VAD) not only causes blindness and visual impairment (e.g., **cataract**), but also growth retardation and susceptibility to infections. When VAD is not detected early, it may make a child more prone to illness and even death. In Asia alone, it is estimated that 125 million children under five years of age are currently at risk, and 1.3 million are reported to be vitamin A deficient.

Iodine Deficiency Disorder (IDD). Iodine is essential for pregnant women, infants, and young children because it regulates the production of **hormones** necessary for children's development. Providing the recommended daily amount of iodine to mothers and children helps prevent brain damage, stunted growth, and goiters (ball-shaped tumors on the neck) in children. Some children with IDD are unable to move normally, speak, or hear. Asia has an estimated 200 million people at risk of IDDs.

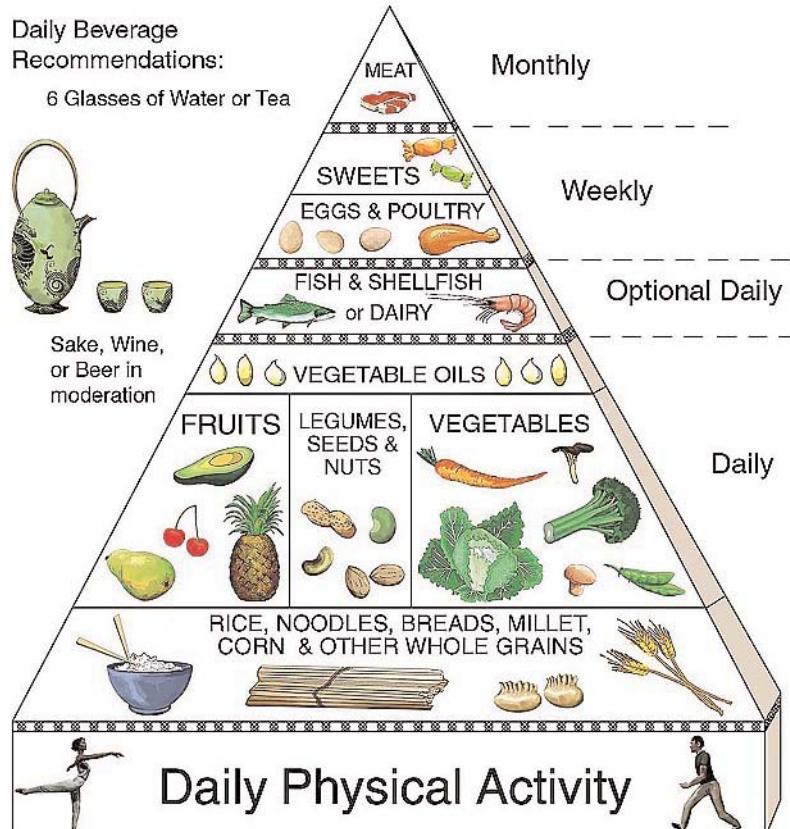
Iron Deficiency and Anemia. Iron deficiency is the most common micronutrient deficiency in the world. The consequences of iron deficiency include impaired cognitive development. Iron deficiency is the most common cause of anemia (low levels of red blood cells or **hemoglobin**) in Asia, with over 600 million people affected. Young children, adolescent girls, and women are the most severely affected. Southeast Asia has the largest proportion of anemia—about 600 million are at risk for iron deficiency in this region.

Lactose Intolerance. Historically, milk and dairy products have not been used in East and Southeast Asia. As a result, the hereditary ability to digest lactose is most common in Asia and parts of Africa. Milk and dairy products are a major source of **calcium**, and people who avoid them because of lactose intolerance may compromise their nutritional status and bone strength. Low-lactose milk products have been developed to reduce the symptoms of lactose intolerance (diarrhea, abdominal bloating and gas, and stomach cramps).

The Nutritional Transition and Its Health Effects

With people living longer, and with low birth weight at an all-time low, Asian health should be improving. But with increased Westernization of the Asian diet, elevated tobacco use (generally among Asian men), and lifestyle changes (such as decreased physical activity), there has been a marked rise in **cardiovascular** disease (CVD), **diabetes** mellitus, hypertension (**high blood pressure**), and certain cancers. **Obesity** is also a growing health problem in Asia, and is strongly associated with hypertension (along with **body mass index** and age). Despite the low obesity levels in the Asia Pacific region, rates of obesity-related diseases such as diabetes and CVD are on the rise. High blood pressure is also a growing problem in Asia. In India, Indonesia, and Thailand alone, nearly 10 to 15 percent of adults have high

The Traditional Healthy Asian Diet Pyramid



The plant-based Asian diet, with its heavy reliance on rice, is reflected in the Asian food pyramid. The Asian diet does not include much meat or dairy and is low in total fat. [2000 Oldways Preservation & Exchange Trust. Reproduced by permission.]

blood pressure. Hypertension is dangerous because it increases a person's risk of developing CVD or having a **stroke**.

Changes in the dietary intake patterns of Asian countries have been called the nutritional transition, meaning a shift away from the traditional Asian diets to a more varied diet higher in sugars, fats, and **processed foods**. This new eating trend includes fewer **carbohydrates** and **fiber** and is higher in fat and meat. Together with a shift towards physical inactivity, obesity among the Asian population has risen. The nutritional and health effects of these new foods contribute to higher mortality rates due to CVD in many Asian countries.

Conclusion

Asian food and the diets of Asians are often believed to be the model of healthful eating. Rice and fruit figure prominently in each country's typical meal. However, as diets have diversified, **chronic** diseases, such as **heart disease**,

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fiber: indigestible plant material which aids digestion by providing bulk

chronic: over a long period

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

nutrition: the maintenance of health through proper eating, or the study of same

have begun to affect Asians in a new and different way. Further, as weather patterns change over time and natural disasters occur, Asia, a largely agricultural society, is not always guaranteed a good crop. Asian food and **nutrition** is deeply rooted in the availability of food in each country. International organizations such as the United Nations Food and Agricultural Organization and Oxfam International continue to work on programs that ensure that continents like Asia will not suffer food shortages in the future. SEE ALSO ASIAN AMERICANS, DIETS OF; DIETARY TRENDS, INTERNATIONAL.

M. Cristina F. Garces

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Atherosclerosis

Macrovascular disease, or **atherosclerosis**, is the cause of more than half of all mortality in developed countries and the leading cause of death in the United States. It is a progressive disease of the large- and medium-sized **arteries**. The name is derived from the Greek *athero* meaning "gruel" or "paste" and *sclerosis* meaning "hardening." Thus, atherosclerosis is the hardening of the arteries due to the accumulation of this paste (commonly called plaque).

Any vessel in the body may be affected; however, the aorta, coronary, carotid, and iliac arteries are most frequently affected. When the coronary arteries are involved, it results in coronary artery disease (CAD). Hardening of the arteries is due to the build up of plaque and mineral deposits. As a result, the supply of blood to the heart is reduced, which can lead to chest pain or a myocardial infarction (**heart attack**). Hardening of the arteries causes an increase in resistance to blood flow and, therefore, an increase in **blood pressure**.

Everyone gets atherosclerosis. It is said that if every person lived to be 100 years old, each would eventually die of atherosclerosis. The process begins early in life. Therefore, physicians should obtain risk-factor profiles and a family history for children. Surgical procedures such as **angioplasty** and cardiac bypass may restore **cardiovascular** function. However, prevention is the key. Smoking, high blood **cholesterol**, **high blood pressure**, a high-fat **diet**, and lack of physical activity are the most serious risk factors for atherosclerosis and other cardiovascular diseases. Controlling one of these risk factors can help control the others. For example, regular exercise can help control cholesterol, blood pressure, weight, and **stress** levels. Smoking is the most preventable risk factor. For some, a low-dose aspirin taken daily is recommended for adults over age forty to thin the blood.

For optimal health, health professionals recommend a change to a healthful diet and lifestyle for those at risk, including daily physical activity; smoking cessation; a low-fat, low-cholesterol diet; reducing sodium intake; and managing stress. SEE ALSO **ARTERIOSCLEROSIS**; **CARDIOVASCULAR DISEASES**.

Delores C. S. James

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Baby Bottle Tooth Decay

Baby bottle tooth decay occurs in young children when their teeth or gums are exposed to infant formula, milk, juice, or other sweet drinks for long

atherosclerosis: build-up of deposits within the blood vessels

artery: blood vessel that carries blood away from the heart toward the body tissues

heart attack: loss of blood supply to part of the heart, resulting in death of heart muscle

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

angioplasty: reopening of clogged blood vessels

cardiovascular: related to the heart and circulatory system

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

diet: the total daily food intake, or the types of foods eaten

stress: heightened state of nervousness or unease

B

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

bacteria: single-celled organisms without nuclei, some of which are infectious

plaque: material forming deposits on the surface of the teeth, which may promote bacterial growth and decay

caries: cavities in the teeth

periods of time. This often happens when infants or toddlers fall asleep while sucking on a bottle. Breastfed infants are usually not at risk, unless they feed for extended periods. The **carbohydrates** in the drink (lactose in milk, or fructose in fruit drinks) mix with the normal **bacteria** in the mouth. This bacteria is found in the **plaque** on teeth and gums. When plaque mixes with carbohydrates, acids are formed that dissolve tooth enamel, causing tooth decay and dental **caries**. To prevent baby bottle tooth decay, a child should not be put in bed with a bottle; and the bottle should be taken away as soon as mealtime is over. Further, only formula or water should be put in a bottle; juices and sweet drinks should be offered in a cup. SEE ALSO INFANT NUTRITION; ORAL HEALTH.

Heidi J. Silver

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Battle Creek Sanitarium, Early Health Spa

The Western Health Reform Institute, which opened in 1866, was originally a residence belonging to Benjamin Graves, a judge of the Michigan Superior Court. Set on eight acres of land, this farm house gave no hint of what it was to become, but already there were ideas and propositions for the building that would lead to a worldwide reputation.

Upon its opening, in 1866, the Western Health Reform Institute was heralded far and wide through the Seventh-day Adventist journal *Review and Herald*. Dr. H. S. Lay, the first physician in charge, and James and Ellen White, early founders of the Seventh-day Adventist Church, were instrumental in founding this health institution. Taking in visitors and teaching simple principles, such as advocating the use of "Graham" bread and counseling eight hours of sleep at night, the institution struggled to live up to its grand name until 1876, when John Harvey Kellogg became medical director. In 1877, Kellogg changed the name to Battle Creek Sanitarium.

Ellen Gould White had come to Battle Creek, Michigan, in 1855 with her family. White was an advocate of healthful living, and she and her husband encouraged young John Harvey Kellogg to study medicine and eventually return to Battle Creek as medical director and surgeon.

The sanitarium, in its heyday during the 1880s, was the most famous health institution in the country, a reputation it held until World War II. The sanitarium was also instrumental in spawning the health food industry and lent strong support to the concept of vegetarianism.

Cereals put Battle Creek on the map. In November 1855, there were 3,000 inhabitants in all of Battle Creek, yet there were soon over forty cereal man-



In the late nineteenth and early twentieth centuries, the Battle Creek Sanitarium was an incubator for nutritional health movements, including vegetarianism and temperance. Early sanitarium members developed such dietary innovations as breakfast cereal and graham crackers.

[AP/Wide World Photos. Reproduced by permission.]

ufacturers in the city, and **entrepreneurs** and famous personalities would soon find their way to Battle Creek. Both Kellogg's brother Will and C. W. Post were to find great success and spawn businesses worth millions of dollars—all from the humble principles found in eating cereal breakfasts and promoting health foods for their **protein**, their **calories**, their **minerals** and **vitamins**, and, most of all, their bran. Famous personalities that visited the Battle Creek Sanitarium included J. C. Penney in 1929 and Professor Ivan Pavlov of Leningrad, Russia, who, at the age of eighty, visited in the summer of 1929.

The Great Depression interrupted the growth and expansion of this successful enterprise. On February 18, 1902, a fire burned two main buildings to the ground, and Kellogg immediately began an ambitious rebuilding project. He said at the time that "buildings may burn, but principles survive." The expansion cost \$4 million and was done in 1928. But by 1930, with a capacity for 1,400, there were only 300 patients in residence. In 1930, at the age of seventy-eight, Kellogg retired to Florida to start another sanitarium, which ran at full capacity (100 beds) for the remaining thirteen years of his life.

The Battle Creek Sanitarium represented a haven to those who made pilgrimages to its abundant facilities. It afforded indoor exercise facilities, a steam-heated environment, and all the amenities of a first-class hotel, including Edison electric lights and polite attendants. In 1927, its golden anniversary year, the Battle Creek Sanitarium treated more than 7,000 patients. It eventually became the Percy Jones Army Hospital, which treated casualties of World War II and the Korean War. SEE ALSO KELLOGG, JOHN HARVEY; WHITE, ELLEN G.

Louise E. Schneider

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entrepreneur: founder of a new business

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

calorie: unit of food energy

mineral: an inorganic (non-carbon-containing) element, ion or compound

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

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Beikost

The German word *beikost* translates as “foods other than milk or formula.” It refers to the first strained foods that are given to a young infant as a supplement to breast milk or formula. Beikost is introduced between four and six months of age, when an infant develops the appropriate oral motor skills and can indicate disinterest by leaning back and turning away. The first foods introduced vary by country, but are generally soft mashed foods that are easily digested. If solid foods are added before four months, there is a risk of overfeeding or negative physical reactions such as diarrhea. SEE ALSO INFANT NUTRITION.

Sheah Rarback

Beriberi

water-soluble: able to be dissolved in water

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

legumes: beans, peas, and related plants

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

clinical: related to hospitals, clinics, and patient care

nervous system: the brain, spinal cord, and nerves that extend throughout the body

Thiamin, or vitamin B₁, is a **water-soluble** vitamin that plays a role in **energy** production (through the synthesis of adenosine triphosphate [ATP]) and nerve conduction. (ATP is the major source of energy that the human body utilizes to do work.) Thiamin is found in abundance in foods such as lean pork, **legumes**, and yeast. In contrast, polished (white) rice, white flour, refined sugars, fats, and oils are foods lacking this vitamin. People at risk for thiamin deficiency include those who consume large quantities of alcohol and those who live in impoverished conditions, for such people are deficient in substantial amounts of **vitamins** and **minerals**.

Beriberi is a **clinical** manifestation of thiamin deficiency. Symptoms include **nervous system** abnormalities (e.g., leg cramps, muscle weakness), limb swelling, elevated pulse, and heart failure. Wernicke-Korsakoff syndrome is a related condition (with symptoms such as a jerky gait, disorientation, and impaired short-term memory) that occurs among alcoholics. SEE ALSO NUTRITIONAL DEFICIENCY; VITAMINS, WATER-SOLUBLE.

Kheng Lim

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Beta-Carotene

carotenoid: plant-derived molecules used as pigments

Beta-carotene is the most active of the deeply colored pigments called **carotenoids**. After consumption, beta-carotene converts to retinol, a read-

ily usable form of vitamin A. Beta-carotene's beneficial effects include protecting the skin from sunlight damage, fighting early **cancer** cells, boosting immunity, and preventing **cataract** formation. It also stops the creation of **free radicals** (oxidants), which are DNA-damaging molecular fragments in the body.

Food sources of beta-carotene include carrots, spinach, kale, and broccoli, as well as animal sources such as liver, whole eggs, and whole milk. Since beta-carotene is fat-soluble, most fat-free milk has been **fortified** with vitamin A to replace what is lost when the fat is removed.

Vitamin A is stored in the body, and an excess amount can lead to **acute** symptoms, such as vomiting and muscle weakness, as well as **chronic** problems such as liver abnormalities, birth defects, and **osteoporosis**. In addition, beta-carotene supplements have been found in some studies to actually increase the risk of cancer in smokers. (Excess beta-carotene is not stored in the body, however.) Because of these dangers, the Institute of Medicine recommends that beta-carotene supplements are not to be used by the general public. The institute does advocate the use of such supplements for populations with inadequate vitamin A intake. SEE ALSO **ANTIOXIDANTS; CAROTENOIDS; VITAMINS, FAT-SOLUBLE**.

Chandak Ghosh

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Bezoars

Bezoars are balls of undigested materials, **insoluble fiber**, and undissolved medicines that resist the action of digestive **enzymes** in the stomach. Bezoars are the result of a lack of stomach hydrochloric acid secretion, without which medicine like sulfa **drugs**, **iron**, and antacid tablets may not dissolve. They may also be caused by poor stomach emptying.

Bezoars in humans cause the feeling of fullness, pain, **nausea**, and vomiting, and they reduce or prevent stomach emptying. Treatment may include avoidance of fibrous foods such as apples, berries, Brussels sprouts, beans, and sauerkraut, as well as changes in any medication being taken. Bezoars may also form in animals' stomachs. In ancient Persian medicine, bezoars were used as an antidote to poison. SEE ALSO **CRAVINGS; PICA**.

Simin B. Vaghefi

cancer: uncontrolled cell growth

cataract: clouding of the lens of the eye

free radical: highly reactive molecular fragment, which can damage cells

fortified: altered by addition of vitamins or minerals

acute: rapid-onset and short-lived

chronic: over a long period

osteoporosis: weakening of the bone structure

Binge Eating

Binge eating disorder (BED), also known as compulsive overeating, has been designated as a psychiatric disorder requiring further study by the

insoluble: not able to be dissolved in

fiber: indigestible plant material that aids digestion by providing bulk

enzyme: protein responsible for carrying out reactions in a cell

drugs: substances whose administration causes a significant change in the body's function

iron: nutrient needed for red blood cell formation

nausea: unpleasant sensation in the gut that precedes vomiting

binge: uncontrolled indulgence

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

calorie: unit of food energy

overweight: weight above the accepted norm based on height, sex, and age

obese: above accepted standards of weight for sex, height, and age

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

diabetes: inability to regulate level of sugar in the blood

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

American Psychiatric Association. Like bulimics, individuals suffering from binge eating disorder indulge in regular episodes of gorging, but unlike bulimics, they do not purge afterward. Binges are accompanied by a similar sense of guilt, embarrassment, and loss of self-control seen among bulimics. Because of the tremendous number of **calories** consumed, many people with BED are **overweight or obese**, and as a result they are more prone to complications such as **high blood pressure, diabetes, high cholesterol, and heart disease.**

A clinical diagnosis of BED requires bingeing at least two times a week for a period of six months or longer. **SEE ALSO ADDICTION, FOOD; BULIMIA NERVOSA; EATING DISORDERS; EATING DISTURBANCES; Yo-Yo DIETING.**

Karen Ansel

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Bioavailability

A nutrient's **bioavailability** is the proportion of the nutrient that, when ingested, actually gets absorbed by the body. The remaining amount cannot be metabolized and is removed as waste. The ability to absorb nutrients varies by gender, disease state, and physiologic condition (e.g., pregnancy, aging). The bioavailability of a nutrient can also increase or decrease if other substances are present. For example, **calcium** and magnesium lose much of their effectiveness if taken with fatty foods. The **intestines** themselves may also regulate the amount of a mineral that enters the bloodstream. For these reasons, taking high-potency vitamin supplements does not guarantee that all of the included nutrients will enter one's system. **SEE ALSO NUTRIENTS.**

Chandak Ghosh

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Biotechnology

The term *biotechnology* refers to the use of scientific techniques, including **genetic engineering**, to improve or modify plants, animals, and **microorganisms**. In its most basic forms, biotechnology has been in use for millennia. For example, Middle Easterners who domesticated and bred deer, antelope, and sheep as early as 18,000 B.C.E.; Egyptians who made wine in

4000 B.C.E.; and Louis Pasteur, who developed **pasteurization** in 1861, all used biotechnology. In recent years, however, food biotechnology has become synonymous with the terms *genetically engineered foods* and *genetically modified organism* (GMO).

Traditional biotechnology uses techniques such as **crossbreeding**, **fermentation**, and **enzymatic** treatments to produce desired changes in plants, animals, and foods. Crossbreeding plants or animals involves the selective passage of desirable **genes** from one generation to another. *Microbial* fermentation is used in making wine and other alcoholic beverages, yogurt, and many cheeses and breads. Using **enzymes** as **food additives** is another traditional form of biotechnology. For example, papain, an enzyme obtained from papaya fruit, is used to tenderize meat and clarify beverages.

Genetic Engineering

The **DNA** contained in genes determines inherited characteristics. Modifying DNA to remove, add, or alter genetic information is called genetic modification or genetic engineering. In the early 1980s, scientists developed recombinant DNA techniques that allowed them to extract DNA from one species and insert it into another. Refinements in these techniques have allowed identification of specific genes within DNA—and the transfer of that particular gene sequence of DNA into another species. For example, the genes responsible for producing **insulin** in humans have been isolated and inserted into **bacteria**. The insulin that is then produced by these bacteria, which is identical to human insulin, is then isolated and given to people who have **diabetes**. Similarly, the genes that produce chymosin, an enzyme that is involved in cheese manufacturing, have also been inserted into bacteria. Now, instead of having to extract chymosin from the stomachs of cows, it is made by bacteria. This type of application of genetic engineering has not been very controversial. However, applications involving the use of plants have been more controversial.

Among the first commercial applications of genetically engineered foods was a tomato in which the gene that produces the enzyme responsible for softening was turned off. The tomato could then be allowed to ripen on the vine without getting too soft to be packed and shipped. As of 2002, over forty food crops had been modified using recombinant DNA technology, including pesticide-resistant soybeans, virus-resistant squash, frost-resistant strawberries, corn and potatoes containing a natural pesticide, and rice containing beta-carotene. Consumer negativity toward biotechnology is increasing, not only in the United States, but also in the United Kingdom, Japan, Germany, and France, despite increased consumer knowledge of biotechnology. The principle objections to biotechnology and foods produced using genetic modification are: concern about possible harm to human health (such as allergic responses to a “foreign gene”), possible negative impact to the environment, a general unease about the “unnatural” status of biotechnology, and religious concerns about modification.

Biotechnology in Animals

The most controversial applications of biotechnology involve the use of animals and the transfer of genes from animals to plants. The first animal-based application of biotechnology was the approval of the use of bacterially

pasteurization: heating to destroy bacteria and other microorganisms, after Louis Pasteur

crossbreeding: breeding between two different varieties of an organism

fermentation: reaction performed by yeast or bacteria to make alcohol

enzymatic: related to use of enzymes, proteins that cause chemical reactions to occur

gene: DNA sequence that codes for proteins, and thus controls inheritance

enzyme: protein responsible for carrying out reactions in a cell

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

DNA: deoxyribonucleic acid; the molecule that makes up genes, and is therefore responsible for heredity

insulin: hormone released by the pancreas to regulate level of sugar in the blood

bacteria: single-celled organisms without nuclei, some of which are infectious

diabetes: inability to regulate level of sugar in the blood

Scientists inserted daffodil genes and other genetic material into ordinary rice to make this *golden rice*. The result is a strain of rice that provides vitamin A, a nutrient missing from the diets of many people who depend on rice as a food staple. [AP/Wide World Photos. Reproduced by permission.]



hormone: molecules produced by one set of cells that influence the function of another set of cells

cloning: creation of an exact genetic copy of an organism

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

allergen: a substance that provokes an allergic reaction

allergy: immune system reaction against substances that are otherwise harmless

produced bovine somatotropin (bST) in dairy cows. Bovine somatotropin, a naturally occurring **hormone**, increases milk production. This application has not been commercially successful, however, primarily because of its expense. The **cloning** of animals is another potential application of biotechnology. Most experts believe that animal applications of biotechnology will occur slowly because of the social and ethical concerns of consumers.

Concerns about Food Production

Some concerns about the use of biotechnology for food production include possible allergic reactions to the transferred **protein**. For example, if a gene from Brazil nuts that produces an **allergen** were transferred to soybeans, an individual who is allergic to Brazil nuts might now also be allergic to soybeans. As a result, companies in the United States that develop genetically engineered foods must demonstrate to the U.S. Food and Drug Administration (FDA) that they did not transfer proteins that could result in food **allergies**. When, in fact, a company attempted to transfer a gene from Brazil nuts to soybeans, the company's tests revealed that they had transferred a gene for an allergen, and work on the project was halted. In 2000 a brand

Biotechnology and Global Health

The World Health Organization estimates that more than 8 million lives could be saved by 2010 by combating infectious diseases and malnutrition through developments in biotechnology. A study conducted by the Joint Centre for Bioethics at the University of Toronto identified biotechnologies with the greatest potential to improve global health, including the following:

- Hand-held devices to test for infectious diseases including HIV and malaria. Researchers in Latin America have already made breakthroughs with such devices in combating dengue fever.
- Genetically engineered vaccines that are cheaper, safer, and more effective in fighting HIV/AIDS, malaria, tuberculosis, cholera,

hepatitis, and other ailments. Edible vaccines could be incorporated into potatoes and other foods.

- Drug delivery alternatives to needle injections, such as inhalable or powdered drugs.
- Genetically modified bacteria and plants to clean up contaminated air, water, and soil.
- Vaccines and microbicides to help prevent sexually transmitted diseases in women.
- Computerized tools to mine genetic data for indications of how to prevent and cure diseases.
- Genetically modified foods with greater nutritional value.

—Paula Kepos

of taco shells was discovered to contain a variety of genetically engineered corn that had been approved by the FDA for use in animal feed, but not for human consumption. Although several antibiotic groups used this situation as an example of potential allergenicity stemming from the use of biotechnology, in this case the protein produced by the genetically modified gene was not an allergen. This incident also demonstrated the difficulties in keeping track of a genetically modified food that looks identical to the unmodified food. Other concerns about the use of recombinant DNA technology include potential losses of **biodiversity** and negative impacts on other aspects of the environment.

biodiversity: richness of species within an area

Safety and Labeling

In the United States, the FDA has ruled that foods produced through biotechnology require the same approval process as all other food, and that there is no inherent health risk in the use of biotechnology to develop plant food products. Therefore, no label is required simply to identify foods as products of biotechnology. Manufacturers bear the burden of proof for the safety of the food. To assist them with this, the FDA developed a decision-tree approach that allows food processors to anticipate safety concerns and know when to consult the FDA for guidance. The decision tree focuses on **toxicants** that are characteristic of each species involved; the potential for transferring food allergens from one food source to another; the concentration and **bioavailability** of **nutrients** in the food; and the safety and nutritional value of newly introduced proteins.

toxicant: harmful substance

bioavailability: availability to living organisms, based on chemical form

nutrient: dietary substance necessary for health

Labeling of genetically modified foods has sparked additional debate. Labels are required on food produced through biotechnology to inform consumers of any potential health or safety risk. For example, a label is required if a potential allergen is introduced into a food product. A label is also required if a food is transformed so that its nutrient content no longer

resembles the original food. For example, so-called golden rice has been genetically engineered to have a higher concentration of beta-carotene than regular rice, and thus it must be included on the label. In response to consumer demands, regulators in England have instituted mandatory labeling laws for all packaged foods and menus containing genetically modified ingredients. Similar but less restrictive laws have been instituted in Japan. In Canada, the policy on labeling has remained similar to that of the United States.

Some consumer advocates maintain that not requiring a label on all genetically modified foods violates consumers' right to make informed food choices, and many producers of certain foods, such as foods containing soy protein, now include the term "non-GMO" on the label to indicate that the product does not contain genetically modified ingredients.

The application of recombinant DNA technology to foods, commonly called biotechnology, may be viewed as an extension of traditional cross-breeding and fermentation techniques. The technology enables scientists to transfer genetic material from one species to another, and may produce food crops and animals that are different than those obtained using traditional techniques. The FDA has established procedures for approval of food products manufactured using recombinant DNA technology that require food producers to demonstrate the safety of their products. The American Dietetic Association, the American Medical Association, and the World Health Organization have each adopted statements that techniques of biotechnology may have the potential to improve the food supply. These organizations and others acknowledge that long-term health and environmental impacts of the technology are not known, and they encourage continual monitoring of potential impacts. SEE ALSO ADDITIVES AND PRESERVATIVES; FOOD SAFETY; GENETICALLY MODIFIED FOODS.

M. Elizabeth Kunkel
Barbara H. D. Luccia

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adipose tissue: tissue containing fat deposits

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

diabetes: inability to regulate level of sugar in the blood

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

triglyceride: a type of fat

obesity: the condition of being overweight, according to established norms based on sex, age, and height

Body Fat Distribution

Adipose tissue accumulation is referred to as body fat distribution. For individuals with *android* (apple-shaped) distribution, fat is centered around the abdominal area. This leads to an increased risk for coronary artery disease, **stroke**, **diabetes**, and high **cholesterol** and **triglyceride** levels. It is also an indicator for **obesity**. *Gynoid* (pear-shaped) distribution is associated with body fat that accumulates around the hip and thigh region.

Specific body fat distribution is often determined by measuring the waist-to-hip ratio, which is the circumference of the waist divided by the circumference of the hips. Android fat distribution is defined as a ratio

greater than 1.0 for men and 0.8 for women. SEE ALSO ANTHROPOMETRIC MEASUREMENTS; BODY IMAGE; OBESITY; WAIST-TO-HIP RATIO; WEIGHT MANAGEMENT.

Diane L. Golzynski

Body Image

The term *body image* refers to the view that a person has of his or her own body size and proportion. Body-image distortion occurs when a person's view of their body is significantly different from reality.

Many factors impact the perception of one's body image, including the mass media, peer groups, ethnic groups, and family values. There is no such thing as an "ideal" or "perfect" body, and different cultures have different standards and norms for appropriate body size and shape. Even within a particular culture, societal standards shift periodically. For example, in the United States, the value of being thin has been the predominant stereotype for women since the model Twiggy arrived on the scene in the 1960s. The average fashion model (at the beginning of the twenty-first century) is almost six feet tall and weighs 130 pounds, whereas the average American woman is five feet, four inches tall and weighs 140 pounds. This disparity in height and weight may lead to problems with self-esteem when a woman finds herself not meeting the cultural ideal of body size and shape. The interesting factor is that women tend to feel **overweight**, not "under height" when comparing themselves to fashion models.

Another example of body-image distortion can be seen among the contestants in the Miss America Beauty Pageant, the Miss Universe Pageant, and the Miss World Pageant. No winner of these pageants has ever been "overweight," and the winners have gotten progressively thinner over the years. Magazines and other media convey the image that being thin equates to being happy and successful, while cases of weight discrimination have been identified and argued in the courts. Fortunately, more emphasis is now being placed on health at any size, and on women becoming more muscular and fit, rather than simply thin. With increases in **obesity** statistics, however, some people may feel even more pressure to lose weight due to body-image distortion.

There are normal and predictable periods in life when body-image distortion occurs. One of these is **puberty**, when rapid changes in body size, body shape, and secondary sex characteristics take place. During this time, females tend to gain fat in the breasts, hips, buttocks, and thighs, developing a more pear-shaped body. Adolescent females may view their bodies as being heavier than they actually are, especially when compared to fashion models or celebrities. Adolescent males tend to gain height and muscle mass during puberty, and they may view their bodies as smaller than they actually are when compared to bodybuilders or professional athletes.

Body-image distortion also occurs when eating disorders develop. Most experts agree that the development of eating disorders is multifactorial and includes sociocultural, **psychological**, hereditary, and brain chemistry effects. Society plays a role in their development since eating disorders occur

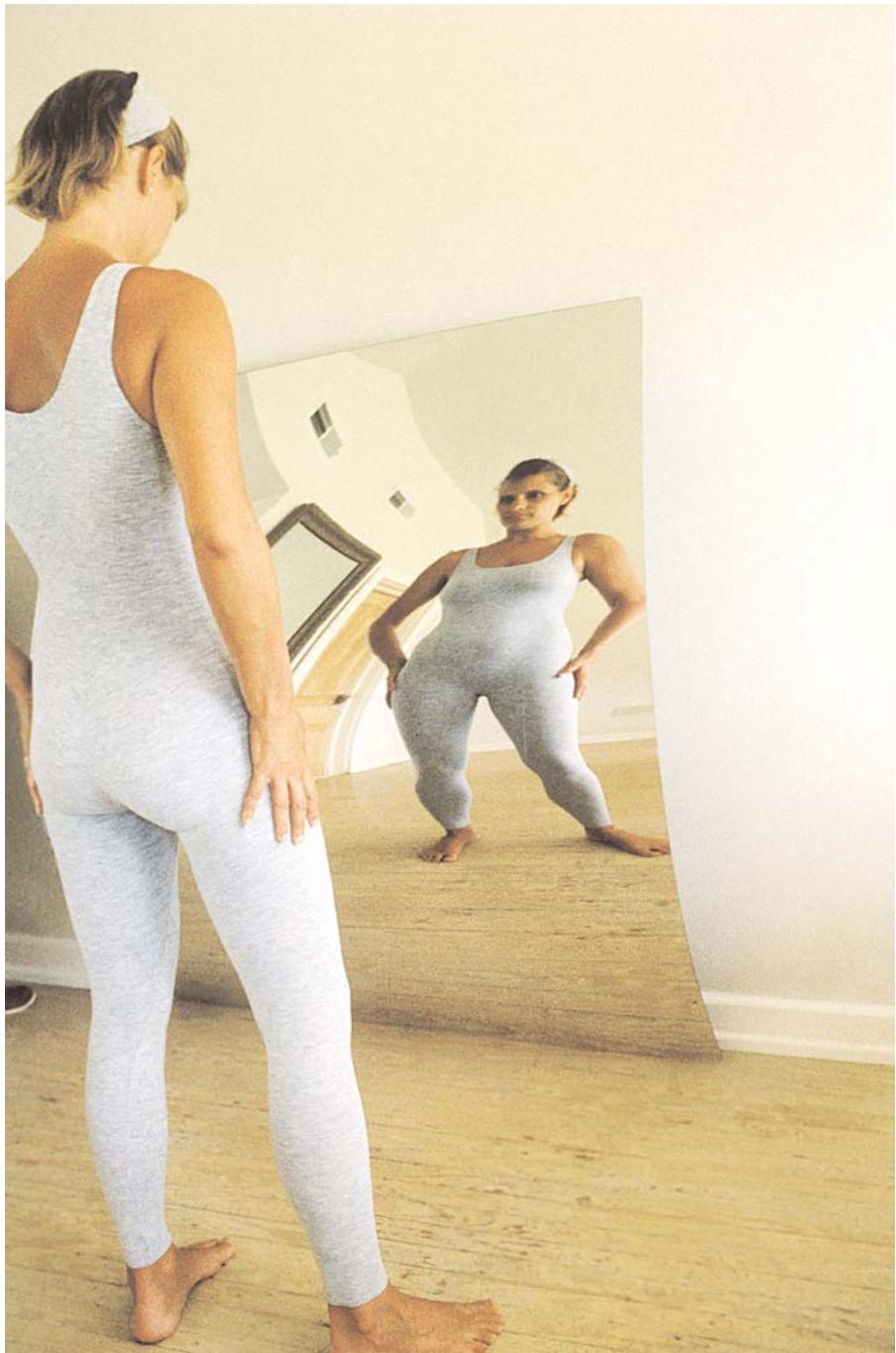
overweight: weight above the accepted norm based on height, sex, and age

obesity: the condition of being overweight, according to established norms based on sex, age, and height

puberty: time of onset of sexual maturity

psychological: related to thoughts, feelings, and personal experiences

Dissatisfaction with one's body can appear in adolescence and could lead to eating disorders. About 1 percent of teenage girls in the U.S. develop anorexia nervosa and up to 10 percent of those may die as a result. [Photograph by Ariel Skelley. Corbis. Reproduced by permission.]



incidence: number of new cases reported each year

anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purgng)

dysmorphia: the belief that one's body is different (fatter, thinner, etc.) than it really is

only in developed nations where food is prevalent and the **incidence** of these diseases increases with wealth. People diagnosed with eating disorders often see their body accurately only at the end of treatment—or not at all. No matter what their eventual weight is, the females with **anorexia** or **bulimia** may see themselves as overweight or fat, and males with muscle **dysmorphia** see themselves as underweight and scrawny. In anorexia, even when severe weight loss has occurred, patients may view their emaciated bodies as overweight. The diagnostic criteria for anorexia includes a “disturbance in the way in which one’s body weight or shape is experienced; undue influence of body weight or shape on self-evaluation, or denial of the seri-

ousness of current low body weight" (American Psychiatric Association). The diagnostic criteria for bulimia nervosa includes self-evaluation that is "unduly influenced by body shape and weight" (American Psychiatric Association). Body size or shape dissatisfaction appears to be one of the best predictors of dieting behavior. Another characteristic associated with body-image dissatisfaction, dieting, and **binge** eating is low self-esteem.

The earlier the treatment or intervention in eating disorders occurs, the better the prognosis is. With early diagnosis and treatment, body-image distortion may be minimal and can return to normal. The goals of body-image treatment are to correct distortions in body image and create a more positive body image. The longer the **eating disorder** has occurred, the more persistent the body-image distortion tends to be. Some female patients may never view their bodies as anything but overweight, and they may even view normal-weight women as fat. In males, the opposite is true: normal-weight men are viewed as scrawny, and only bodybuilders with significantly higher lean body mass than usual are considered ideal. Cognitive-behavioral therapy is commonly used as a major form of treatment for eating disorders and is often provided with a nondiet approach to improve self-esteem as bingeing or purging behaviors are reduced. SEE ALSO DIETING; EATING DISORDERS; EATING DISTURBANCES; WEIGHT MANAGEMENT.

Catherine Christie

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Body Mass Index

Body weight is used as an indicator of an individual's health. It is usually compared to tables that list "ideal" or "desirable" weight ranges for specific heights. Some of these tables use values gathered from research studies, while some include the heights and weights of individuals who have bought life insurance (e.g., the Metropolitan Height and Weight Tables). An individual's weight can be described as a percentage of the ideal or desirable weight listed, and can also be categorized as healthy, underweight, **overweight**, or **obese**. An additional method of comparing an individual to a population group is with the **body mass index**.

Body mass index (BMI) is an estimate of body composition that correlates an individual's weight and height to lean body mass. The BMI is thus an index of weight adjusted for stature. Body mass index is figured by dividing weight in kilograms by height in meters squared and multiplying by 100. It can also be figured by dividing weight in pounds by height in inches squared and multiplying by 705. High values can indicate excessive fat stores, while low values can indicate reduced fat stores. In this way, the BMI

binge: uncontrolled indulgence

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

overweight: weight above the accepted norm based on height, sex, and age

obese: above accepted standards of weight for sex, height, and age

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

BMI, or body mass index, is a number that correlates a person's height and weight. It is a useful tool for diagnosing obesity or malnutrition; however, such diagnosis should take into account a person's age, gender, fitness, and ethnicity. [Ed Bock/Corbis. Reproduced by permission.]



obesity: the condition of being overweight, according to established norms based on sex, age, and height

malnutrition: chronic lack of sufficient nutrients to maintain health

hydration: degree of water in the body

is a diagnostic tool for both **obesity** and protein-energy **malnutrition**. The BMI has also been associated with mortality, with lower values generally correlating with longer life.

However, when evaluating the BMI, several characteristics of an individual need to be known. An individual's age, gender, ethnicity, and level of fitness must be considered when using BMI to determine health risk. Also, the significance of the BMI is affected by disease state and **hydration** status. As with most assessment tools, the BMI is most effective when used in conjunction with other measurements.

Tables are available to identify the significance of the BMI. Calculations based on values for ideal body weight suggest the BMI for normal men and women should be in the range of 19 to 27 kg/m². This range corresponds to the 25th to 75th percentile values recorded from adults followed in the 1971–1974 National Health and Nutrition Examination Survey (NHANES). Tables also list levels of protein-energy malnutrition and obesity. These values were determined by research in which height, weight, and age were associated with functional measurements and health outcomes.

A BMI between 13 and 15 corresponds to 48 to 55 percent of desirable body weight for a given height and describes the lowest body weight that can sustain life. Body weight at this level consists of less than 5 percent fat. The maximum survival body weight is about 500 kg, which corresponds to a BMI of about 150.

Research with children indicates annual increases in BMI are usually due to increases in lean mass rather than fat tissue. Not until late adolescence does fat mass begin to affect the BMI—and adult values begin to be achieved.

There is a strong correlation between BMI and total fat mass, though individual variation in body type or height can cause misclassification. Un-

BODY MASS INDEX

Body mass index equation

$$\text{BMI} = \frac{\text{weight (kg)}}{\text{height (m) (squared)}} \times 100 \quad \text{OR} \quad \frac{\text{pounds}}{\text{inches (squared)}} \times 705$$

Significance of BMI values for adults

Condition Indicated	Men	Women
Protein-calorie malnutrition	< 17	< 17
Underweight	< 20	< 19
Acceptable weight	20.7 – 27.8	19.1 – 27.3
Intervention indicated	> 26.4	> 25.8
Obese	> 27.8	> 27.3
Severely obese	> 31.1	> 32.2
Morbidly obese	> 45.4	> 44

Normal BMI Values for Infants and Children

Infants (at birth)	13
1 year	18
6 years	15

fortunately, the same BMI value can correlate with a range of body-fat percentage. For example, athletes usually have large skeletal muscles (which weigh more than fat) and therefore a high BMI, but they are not obese. Shorter individuals can also be identified as obese, since their BMIs are usually high. An older individual may have a higher body-fat percentage than a younger individual, but have the same BMI. Adult females can have a BMI of 20, which correlates to a body-fat percentage of 13 to 32 percent, while adult males can have a BMI of 27 and a body-fat percentage of 10 to 31 percent.

Findings from the third NHANES (1988–1994) describe misidentification of the elderly when self-reported height, rather than measured height, is used in the BMI equation. Height decreases over an individual's lifetime due to vertebral compression, loss of muscle tone, and postural slump. An individual may, therefore, report a height that is no longer accurate, and the resulting value will be lower than the value that actually describes the individual, possibly leading to the wrong intervention.

Research has shown that both high BMIs and low BMIs can indicate increased **morbidity** and mortality. A low BMI, usually an indication of protein-energy malnutrition or the effects of **wasting** or a disease process, is a significant predictor of mortality among young and old hospitalized patients. A high BMI has been shown to be predictive of mortality only among young hospitalized patients, usually an effect of **cardiovascular** disease and obesity. Risk of mortality is only slightly elevated at the highest BMI for elderly hospitalized patients.

Because ethnicity has been shown to require adjustments to the levels of concern for the BMI, care must be taken when comparing different population groups. For example, Asian populations may require a lower BMI to describe health risk, while Pacific populations, specifically Hawaiian, may require a higher threshold to indicate that an individual is at risk. This variation can be explained by body type.

BMI and waist circumference have been used to evaluate health risks associated with overweight and obesity. Because both are easy measures to

morbidity: illness or accident

wasting: loss of body tissue often as a result of cancer or other disease

cardiovascular: related to the heart and circulatory system

do, standardization of both are encouraged for widespread use as a reference. Additionally, the two measurements have been used in an algorithm with a cardiovascular risk index to determine which individuals would benefit most from weight loss.

BMI is an easy measurement to make—only requiring a tape measure, scale, and, perhaps, a calculator. However, for individuals who have trouble standing up straight for an accurate height measurement—either from disease process, weakness, or kyphosis (abnormal backward curvature of the spine)—BMI may not be an easy or accurate assessment tool to use. Comparisons between BMI and mid-upper arm circumference (MUAC) measurements show that they identify the same level of malnutrition in individuals. MUAC is also easily measured (it requires only a tape measure), and it is a good indicator of change in body weight and muscle mass. Standardization of these two assessment tools for reference would benefit the science of nutrition assessment. SEE ALSO AGING AND NUTRITION; BODY FAT DISTRIBUTION; DIET; MALNUTRITION; NUTRITION ASSESSMENT; OBESITY; OVERWEIGHT; UNDERWEIGHT; WAIST-TO-HIP RATIO.

Carole S. Mackey

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Breastfeeding

Before 1900, most mothers breastfed their infants. Breastfeeding rates declined sharply worldwide after 1920, when evaporated cow's milk and infant formula became widely available. These were promoted as being more convenient for mothers and more nutritious than human milk. Breastfeeding rates began rising again in the late 1950s and early 1960s.

BENEFITS OF BREASTFEEDING

Benefits for Infant	Benefits for Mother
<ul style="list-style-type: none"> • Perfect food for infant • Guarantees safe, fresh milk • Enhances immune system • Protects against infectious and noninfectious diseases • Protects against food allergies and intolerances • Decreases risk of diarrhea and respiratory infections • Promotes correct development of jaw, teeth, and speech patterns • Decreases risk of childhood obesity • Increases cognitive function • Increases bonding with mother 	<ul style="list-style-type: none"> • Promotes faster shrinking of the uterus • Promotes less postpartum bleeding • Promotes faster return to pre-pregnancy weight • Eliminates the need for preparing and mixing formula • Saves money not spent on formula • Decreases risk of breast and ovarian cancer • Increases bonding with infant • Enhances self-esteem in the maternal role • Delays the menstrual cycle

Breastfeeding, or lactation, is, in fact, the ideal method of feeding and nurturing infants. Most health organizations recommend infants be exclusively breastfed during the first four to six months of life, but ideally through the first year. Premature infants also benefit from their mothers' milk. In developing countries, breastfeeding up to age two, with appropriate supplementary solid foods, maintains good nutritional status and prevents diarrhea.

Benefits of Breastfeeding

Human milk contains the right balance of **nutrients** for human growth and development. It is low in total **protein** and high in **carbohydrates**, making it more digestible and less stressful on the immature kidneys. In addition, each mammal produces milk that is nutritionally and immunologically tailored for its young. In rare cases, such as **galactosemia** and **phenylketonuria**, some infants cannot **metabolize** human milk or other milk products. A significant benefit of human milk is that it contains many **immunologic** agents that protect the infant against **bacteria**, **viruses**, and **parasites**. Breastfeeding also provides many benefits for the mother.

Breastfeeding Trends

Despite the many benefits of breastfeeding, only 64 percent of mothers in the United States initiate breastfeeding, with 29 percent still breastfeeding six months after birth. The U.S. goals for 2000 were to increase to 75 percent the proportion of women who initiate breastfeeding, and to increase to 50 percent the proportion of women who breastfeed for five to six months. In the United States, ethnic minorities are less likely to breastfeed than their white counterparts.

Based on a 2001 report by the World Health Organization (WHO), 35 percent of infants worldwide are exclusively breastfed (no other food or drink, not even water) for the first four months of life. Rates are very low in a number of African countries, especially Nigeria, Central African Republic, and Niger. Some countries, such as Benin, Mali, Zambia, and Zimbabwe have had small increases, due mainly to breastfeeding campaigns, baby-friendly hospitals, and the commitment of trained breastfeeding counselors. In Southeast Asia, the exclusive breastfeeding rate, though low, has increased. Breastfeeding rates are also low in many European countries, especially France, Italy, Netherlands, Spain, Switzerland, and the United Kingdom. Sweden, however, has a rate of 98 percent, the highest level in the world.

nutrient: dietary substance necessary for health

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

galactosemia: inherited disorder preventing digestion of milk sugar, galactose

phenylketonuria: inherited disease marked by the inability to process the amino acid phenylalanine, causing mental retardation

metabolize: processing of a nutrient

immunologic: related to the immune system, which protects the body from infection

bacteria: single-celled organisms without nuclei, some of which are infectious

virus: noncellular infectious agent that requires a host cell to reproduce

parasite: organism that feeds off of other organisms

An increase in breastfeeding could save the lives of millions of children a year worldwide. However, the aggressive marketing campaigns by infant formula companies and the promotion of infant formula by health professionals combine to discourage breastfeeding. Other factors that determine whether a woman will breastfeed include:

- The father's preference for a specific feeding method
- Whether the mother was breastfed as an infant
- Social support
- Whether relatives and/or friends breastfeed
- Whether the mother gets help with household chores
- The mother's need to work
- Hospital policies

Physiology of Breastfeeding

hormone: molecules produced by one set of cells that influence the function of another set of cells

During pregnancy, the body increases its production of a **hormone** called prolactin, which stimulates the breast to make milk. Suckling by the infant stimulates the release of prolactin. The size of the breasts is not a factor in milk production. Oxytocin, another hormone, allows the breast tissue to "let down" or release milk from the milk ducts to the nipples.

Colostrum, the first milk produced, has all the nutrients a newborn infant needs. It also contains many substances to protect against infections. The body produces colostrum for several days until the "mature milk" comes in. Mature milk adjusts to the baby's needs for the rest of the time the infant is breastfed.

Nutritional Needs of the Mother

calorie: unit of food energy

Recommended Dietary Allowances: nutrient intake recommended to promote health

nutritional requirements: the set of substances needed in the diet to maintain health

folate: one of the B vitamins, also called folic acid

iron: nutrient needed for red blood cell formation

niacin: one of the B vitamins, required for energy production in the cell

zinc: mineral necessary for many enzyme processes

diet: the total daily food intake, or the types of foods eaten

drugs: substances whose administration causes a significant change in the body's function

wean: cease breast-feeding

malnourished: lack of adequate nutrients in the diet

Milk production requires about 800 **calories** a day. The **Recommended Dietary Allowances** for calories during breastfeeding is 500 more calories a day than is required by a nonpregnant woman. **Nutritional requirements** do not change significantly from pregnancy, with the exception of decreases in **folate** and **iron**, and increases in vitamin A, vitamin C, **niacin**, and **zinc**. The **diet** can be the same as during pregnancy, plus an additional glass of milk. Women who are on medication should check with their physicians, since most **drugs** are absorbed in breast milk.

Weaning

The decision to **wean** should be based on the desires and needs of the mother and child. Weaning should be gradual. Women returning to work can pump and store their milk for later use. Solid foods should be given based on the age and developmental stage of the child. In some countries, many toddlers become **malnourished** because they are given too many high carbohydrate foods, such as cassava, potatoes, and other root vegetables, too early. These foods are filling, but they are low in protein and other nutrients essential for growth and development.

Breast Implants and Breast Reduction

Many women with breast implants breastfeed successfully, though it is not known whether the health of the infant is affected by breast implants.



Human milk contains nutrients and antibodies that keep babies healthy. Although it is considered the ideal feeding method for infants, 36 percent of mothers in the United States do not breastfeed at all. [Photograph by Jim Trois. Photo Researchers, Inc. Reproduced by permission.]

Women who have had a breast reduction may not be able to breastfeed, since the surgical procedure removes glandular tissue and realigns the nipple.

Who Should Not Breastfeed?

Women with HIV/AIDS, **hepatitis**, **cancer**, and other conditions where the **immune system** may be compromised should not breastfeed. A case-by-case assessment should be made with women exposed to certain environmental **toxins** and those who use illicit drugs.

Policies and Recommendations

A woman's ability to breastfeed for the optimal recommended time depends on the support she receives from her family, health care providers, and the workplace. Health care institutions should adopt policies and initiatives that include:

- A written breastfeeding policy
- A breastfeeding education program
- Rooming-in of mother and child
- Breastfeeding on demand
- Limited use of pacifiers, water, and formula

With the increased number of women in the workforce, employers can do a lot to support and encourage breastfeeding, such as providing adequate breaks; flexible hours; **job sharing**; part-time work; refrigerators for storage of breast milk; and on-site child care.

A public health campaign can greatly increase the initiation and duration of breastfeeding. These campaigns should target all social groups, including men, future parents, grandparents, health care providers, and employers. In addition, culturally appropriate programs and materials should

hepatitis: liver inflammation

cancer: uncontrolled cell growth

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

toxins: poisons

job sharing: splitting a single job among two or more people

be available. Breastfeeding saves lives and money, and it benefits all of society. SEE ALSO BEIKOST; INFANT NUTRITION; MASTITIS; PREGNANCY.

Delores C. S. James

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Brillat-Savarin, Jean Anthelme

**French politician and writer
1755–1826**

Jean Anthelme Brillat-Savarin was a French lawyer and politician. He served as mayor of Belley, the city where he was born, but his opposition to the Jacobins during the French Revolution made it necessary for him to flee to Switzerland in 1792. He then made his way to New York, where he taught language and played violin in the John Street Theater Orchestra to support himself.

After two years in New York, Brillat-Savarin spent time in Connecticut familiarizing himself with American culture and food. He took advantage of the opportunity to ask Thomas Jefferson how to prepare a wild turkey. Approximately four years after his exile, Brillat-Savarin was able to return to France after being reinstated as an honorable person. Soon after, he began serving as a judge of the Supreme Court of Appeal in Paris, a post he held for the rest of his life.

Brillat-Savarin embraced Parisian society and intellectual life, but he is best known for his culinary expertise and his twenty aphorisms on food, one of which was, "Tell me what you eat, and I will tell you what you are." Even as a child he loved to be near the kitchen. While in Paris, he wrote *Physiology of Taste, or Meditations on Transcendental Gastronomy*, which he published anonymously. Chapters discussed, among other things, the aphrodisiac properties of certain foods, the nature of digestion, and the dangers of acids in the stomach. The book was a success, and the people of Paris were anxious to learn the identity of this very witty and elegant author. His colleagues were not as impressed as the public and looked down on him, not considering him to be an expert in a relevant field of study. He had pre-



"The destiny of nations depends on the manner in which they are fed." Jean Anthelme Brillat-Savarin, whose culinary writings and passion for food distinguished him in Napoleonic France.
[Photograph by Gianni Dagli Orti. Corbis.
Reproduced by permission.]

viously written various treatises on dueling, economics, and history, but these were not very well known.

Brillat-Savarin contributed to the knowledge of digestion and **nutrition** through his essays on food and taste. He also shared his ideas on food preparation and its role in life and philosophy, and he provided discourses on **obesity** and its cure (and on thinness and its cure). In recognition of his achievements, various dishes, garnishes, and a cheese bear his name.

Brillat-Savarin's work reflects interactions with philosophers and physicians of his time. While he remained a bachelor all his life, he had many prominent guests sitting at his table for meals, and he often sat at the best tables of Paris. Among his guests were Napoleon's doctor, Jean-Nicolas Corvisart, the surgeon Guillaume Dupuytren, the pathologist Jean Cruveilhier, and other great minds. Cruveilhier was such an authority on the stomach that **gastric ulcers** are referred to as Cruveilhier's disease. Through such interactions, Brillat-Savarin undoubtedly gained knowledge about the chemistry of food and how it relates to the physiology of digestion. So passionate was Brillat-Savarin about food that many people identified him more often as a chef rather than a lawyer.

Slande Celeste

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Bulimia Nervosa

Bulimia nervosa is an **eating disorder** characterized by frequent episodes of **binge** eating, which are followed by purging to prevent weight gain. During these incidents, unusually large portions of food are consumed in secret, followed by compensatory behaviors such as self-induced vomiting or diuretic and laxative abuse. Although the types of food chosen may vary, sweets and high-calorie foods are commonly favored. Bulimic episodes are typically accompanied by a sense of a loss of self-control and feelings of shame.

A clinical diagnosis of bulimia nervosa requires that the behavior occur at least two times a week for a minimum of three months. SEE ALSO ADDICTION, FOOD; ANOREXIA NERVOSA; BINGE EATING; BODY IMAGE; EATING DISORDERS; EATING DISTURBANCES.

Karen Ansel

nutrition: the maintenance of health through proper eating, or the study of same

obesity: the condition of being overweight, according to established norms based on sex, age, and height

gastric: related to the stomach

ulcer: erosion in the lining of the stomach or intestine due to bacterial infection

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purging)

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

binge: uncontrolled indulgence

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Caffeine

Caffeine is a naturally occurring stimulant found in the leaves, seeds, or fruit of over sixty plants around the world. Caffeine exists in the coffee bean in Arabia, the tea leaf in China, the kola nut in West Africa, and the cocoa bean in Mexico. Because of its use throughout all societies, caffeine is the most widely used psychoactive substance in the world. The most common caffeine sources in North America and Europe are coffee and tea. Since about 1980, extensive research has been conducted on how caffeine affects health. Most experts agree that moderate use of caffeine (300 milligrams, or about three cups of coffee, per day) is not likely to cause health problems.

How Caffeine Affects the Body

Caffeine is best known for its stimulant, or “wake-up,” effect. Once a person consumes caffeine, it is readily absorbed by the body and carried around in the bloodstream, where its level peaks about one hour after consumption. Caffeine mildly stimulates the nervous and **cardiovascular** systems. It affects the brain and results in elevated mood, decreased **fatigue**, and increased attentiveness, so a person can think more clearly and work harder. It also increases the heart rate, blood flow, respiratory rate, and **metabolic** rate for several hours. When taken before bedtime, caffeine can interfere with getting to sleep or staying asleep.

Exactly how caffeine will affect an individual, and for how long, depends on many factors, including the amount of caffeine ingested, whether one is male or female, one’s height and weight, one’s age, and whether one is pregnant or smokes. Caffeine is converted by the liver into substances that are excreted in the urine.

Some people are more sensitive to the effects of caffeine than others. With frequent use, **tolerance** to many of the effects of caffeine will develop. At doses of 600 milligrams (about six cups of coffee) or more daily, caffeine can cause nervousness, sweating, tenseness, upset stomach, **anxiety**, and insomnia. It can also prevent clear thinking and increase the side effects of certain medications. This level of caffeine intake represents a significant health risk.

Caffeine can be mildly addictive. Even when moderate amounts of caffeine are withdrawn for 18 to 24 hours, one may feel symptoms such as headache, fatigue, irritability, **depression**, and poor concentration. The symptoms peak within 24 to 48 hours and progressively decrease over the course of a week. To minimize withdrawal symptoms, experts recommend reducing caffeine intake gradually.

cardiovascular: related to the heart and circulatory system

fatigue: tiredness

metabolic: related to processing of nutrients and building of necessary molecules within the cell

tolerance: development of a need for increased amount of drug to obtain a given level of intoxication

anxiety: nervousness

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

CAFFEINE IN FOODS AND BEVERAGES.

Food/Beverage	Caffeine (milligrams)
Coffee	
Espresso coffee, brewed, 8 fluid ounces	502
Coffee, brewed, 8 fluid ounces	85
Coffee, instant, 8 fluid ounces	62
Coffee, brewed, decaffeinated, 8 fluid ounces	3
Coffee, instant, decaffeinated, 8 fluid ounces	2
Tea	
Tea, brewed, 8 fluid ounces	47
Tea, herbal, brewed, 8 fluid ounces	0
Tea, instant, 8 fluid ounces	29
Tea, brewed, decaffeinated, 8 fluid ounces	3
Chocolate Beverages	
Hot chocolate, 8 fluid ounces	5
Chocolate milk, 8 fluid ounces	5
Soft Drinks	
Cola, 12 ounce can	37
Cola, with higher caffeine, 12 ounce can	100
Cola or pepper-type, diet, 12 ounce can	49
Cola or pepper-type, regular or diet, without caffeine, 12 ounce can	0
Lemon-lime soda, regular or diet, 12 ounce can	0
Lemon-lime soda, with caffeine, 12 ounce can	55
Ginger ale, regular or diet, 12 ounce can	0
Root beer, regular or diet, 12 ounce can	0
Chocolate	
Milk chocolate bar, 1.55 ounces	9
M & M milk chocolate candies, 1.69 ounces	5
Dark chocolate, semisweet, 1 ounce	20

SOURCE: U.S. Department of Agriculture National Nutrient Database for Standard Reference, Release 16 July 2003.

Caffeine in Food and Drugs

Due to its stimulant properties, caffeine is used around the world in any of its many forms, such as coffee, tea, soft drinks, and chocolate. The accompanying table displays the amount of caffeine in foods. An eight-ounce cup of drip-brewed coffee has about 85 milligrams of caffeine, whereas the same amount of brewed tea contains about 47 milligrams. Twelve-ounce cans of soft drinks (soda) provide about 35 to 45 milligrams of caffeine.

The caffeine content of coffee and tea depends on the variety of the coffee bean or tea leaf, the particle size, the brewing method, and the length of brewing or steeping time. Brewed coffee has more caffeine than instant coffee, and espresso has more caffeine than brewed coffee. Espresso is made by forcing hot pressurized water through finely ground, dark-roast beans. Because it is brewed with less water, it contains more caffeine than regular coffee per fluid ounce.

In soft drinks, caffeine is both a natural and an added ingredient. About 5 percent of the caffeine in colas and pepper-flavored soft drinks is obtained naturally from cola nuts; the remaining 95 percent is added. Caffeine-free drinks contain virtually no caffeine and make up a small part of the soft-drink market.

Numerous prescription and nonprescription drugs also contain caffeine. Caffeine increases the ability of aspirin and other painkillers to do their job, and it is often used in headache and pain-relief remedies as well as in cold products and alertness or stay-awake tablets. When caffeine is an ingredient, it must be listed on the product label.

Though it has mildly addictive properties, caffeine taken in moderation is not considered to be a health risk, and may improve athletic performance. [AP/Wide World Photos. Reproduced by permission.]



Caffeine and Health

Current research on how caffeine affects a variety of health issues is summarized below. Keep in mind that most experts agree that moderate use of caffeine is not likely to cause any health problems.

- Studies have looked at the effects of caffeine on heart health. Moderate caffeine consumption does not appear to adversely affect cardiovascular health.
- Caffeine appears to increase the excretion of **calcium**, a mineral needed for healthy bones. Calcium is particularly important to prevent **osteoporosis**, a bone disease characterized by loss of bone strength and seen especially in older women (although men get it too). Moderate caffeine intake does not seem to cause a problem with calcium, as long as one is consuming the recommended amount (adult men and women should be taking between 1,000 and 1,200 milligrams of calcium, depending on age and gender).
- In the past there have been concerns that the caffeine in coffee may cause **cancer**. Research has shown that caffeine in coffee does not cause breast or intestinal cancer. However, not enough research has been done to determine if caffeine in coffee is involved in urinary bladder or pancreatic cancer. Taken in moderation, it is unlikely that caffeine will cause cancer.
- Evidence suggests that, at levels over 500 milligrams per day, caffeine may delay conception. Moderate caffeine consumption does not appear to be of concern to women trying to get pregnant. Moderate consumption is also important for a healthy pregnancy. Excessive caffeine intake has been associated with **miscarriages** and low birth weight babies.
- Because children have developing nervous systems, it is important to moderate their caffeine consumption. For children, major sources of caffeine include soft drinks and chocolate.

cancer: uncontrolled cell growth

miscarriage: loss of a pregnancy

- Caffeine may be useful as part of a weight control program because it increases the rate at which the body burns **calories** for three or more hours after being consumed.
- Caffeine's ability to improve physical performance is well known among well-trained athletes. Through a mechanism that is not completely understood, caffeine seems to increase endurance and speed in some situations. Excessive use of caffeine is restricted in international competitions.

Karen Eich Drummond

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Calcium

Calcium is one of the most important elements in the **diet** because it is a structural component of bones, teeth, and soft tissues and is essential in many of the body's **metabolic** processes. It accounts for 1 to 2 percent of adult body weight, 99 percent of which is stored in bones and teeth. On the cellular level, calcium is used to regulate the permeability and electrical properties of **biological** membranes (such as cell walls), which in turn control muscle and nerve functions, glandular secretions, and blood vessel dilation and contraction. Calcium is also essential for proper **blood clotting**.

Because of its biological importance, calcium levels are carefully controlled in various compartments of the body. The three major regulators of blood calcium are parathyroid **hormone** (PTH), **vitamin D**, and calcitonin. PTH is normally released by the four parathyroid glands in the neck in response to low calcium levels in the bloodstream (hypocalcemia). PTH acts in three main ways: (1) It causes the **gastrointestinal** tract to increase calcium **absorption** from food, (2) it causes the bones to release some of their

calorie: unit of food energy

calcium: mineral essential for bones and teeth

diet: the total daily food intake, or the types of foods eaten

metabolic: related to processing of nutrients and building of necessary molecules within the cell

biological: related to living organisms

blood clotting: the process by which blood forms a solid mass to prevent uncontrolled bleeding

hormone: molecules produced by one set of cells that influence the function of another set of cells

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

gastrointestinal: related to the stomach and intestines

absorption: uptake by the digestive tract

calcium stores, and (3) it causes the kidneys to excrete more phosphorous, which indirectly raises calcium levels.

Vitamin D works together with PTH on the bone and kidney and is necessary for intestinal absorption of calcium. Vitamin D can either be obtained from the diet or produced in the skin when it is exposed to sunlight. Insufficient vitamin D from these sources can result in **rickets** in children and **osteomalacia** in adults, conditions that result in bone deformities. Calcitonin, a hormone released by the thyroid, parathyroid, and thymus glands, lowers blood levels by promoting the deposition of calcium into bone.

Most dietary calcium is absorbed in the small intestine and transported in the bloodstream bound to albumin, a simple **protein**. Because of this method of transport, levels of albumin can also influence blood calcium measurements. Calcium is deposited in bone with phosphorous in a crystalline form of calcium phosphate.

Deficiency and Toxicity

Because bone stores of calcium can be used to maintain adequate blood calcium levels, short-term dietary deficiency of calcium generally does not result in significantly low blood calcium levels. But, over the long term, dietary deficiency eventually depletes bone stores, rendering the bones weak and prone to fracture. A low blood calcium level is more often the result of a disturbance in the body's calcium regulating mechanisms, such as insufficient PTH or vitamin D, rather than dietary deficiency. When calcium levels fall too low, nerve and muscle impairments can result. Skeletal muscles can spasm and the heart can beat abnormally—it can even cease functioning.

Toxicity from calcium is not common because the gastrointestinal tract normally limits the amount of calcium absorbed. Therefore, short-term intake of large amounts of calcium does not generally produce any ill effects aside from **constipation** and an increased risk of **kidney stones**. However, more severe toxicity can occur when excess calcium is ingested over long periods, or when calcium is combined with increased amounts of vitamin D, which increases calcium absorption. Calcium toxicity is also sometimes found after excessive **intravenous** administration of calcium. Toxicity is manifested by abnormal deposition of calcium in tissues and by elevated blood calcium levels (hypercalcemia). However, hypercalcemia is often due to other causes, such as abnormally high amounts of PTH. Usually, under these circumstances, bone density is lost and the resulting hypercalcemia can cause kidney stones and abdominal pain. Some cancers can also cause hypercalcemia, either by secreting abnormal proteins that act like PTH or by invading and killing bone cells causing them to release calcium. Very high levels of calcium can result in appetite loss, **nausea**, vomiting, abdominal pain, confusion, seizures, and even coma.

Requirements and Supplementation

Dietary calcium requirements depend in part upon whether the body is growing or making new bone or milk. Requirements are therefore greatest during childhood, adolescence, pregnancy, and breastfeeding. Recommended daily intake (of **elemental** calcium) varies accordingly: 400 mg for

rickets: disorder caused by vitamin D deficiency, marked by soft and misshapen bones and organ swelling

osteomalacia: softening of the bones

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

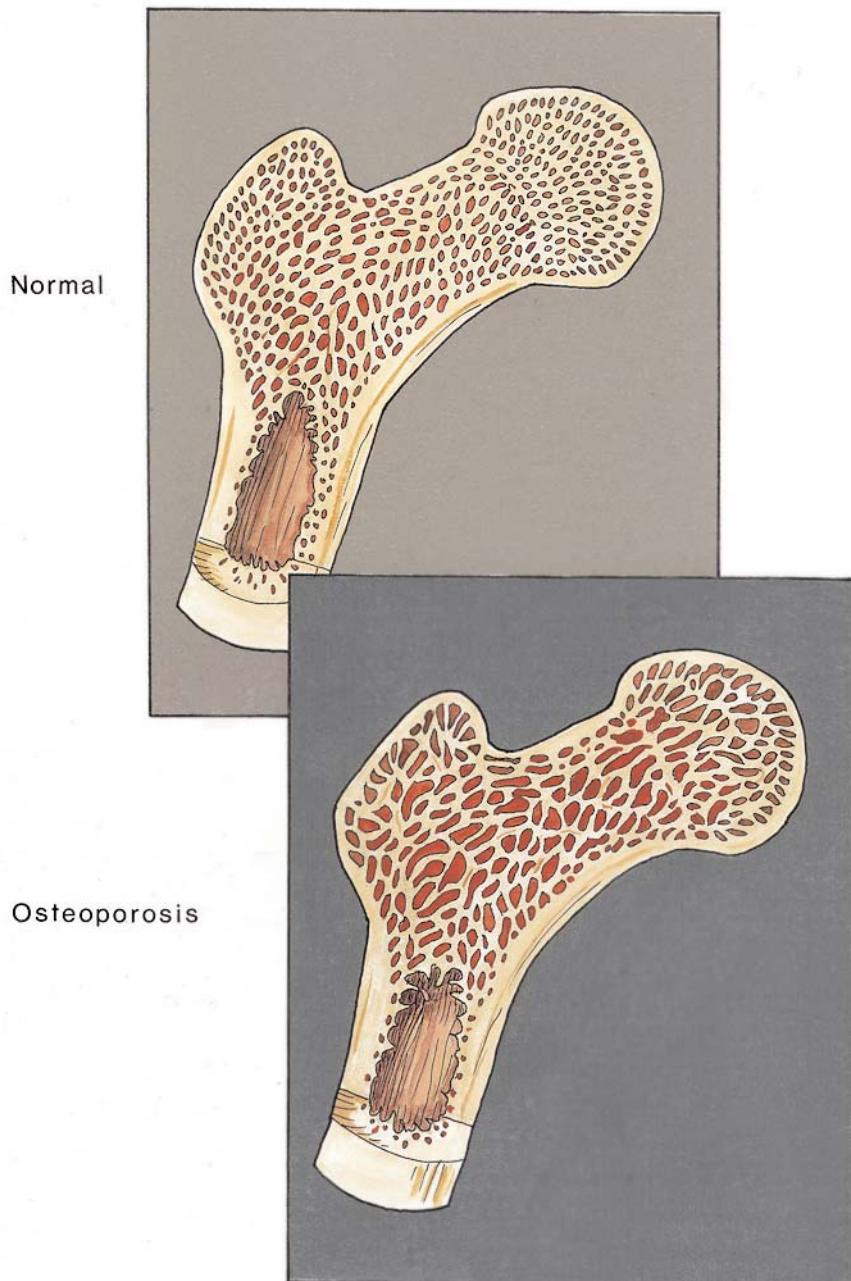
constipation: difficulty passing feces

kidney stones: deposits of solid material in kidney

intravenous: into the veins

nausea: unpleasant sensation in the gut that precedes vomiting

elemental: made from predigested nutrients



Calcium supplements can help prevent osteoporosis, which is a condition that occurs when bone breaks down more quickly than it is replaced. In this illustration, the bone above is normal, but the bone below is more porous and therefore more susceptible to fracture. [Custom Medical Stock Photo, Inc. Reproduced by permission.]

infants 0–6 months, 600 mg for infants 6–12 months, 800 mg for children 1–10 years, 1,200 mg for ages 11–24 years, and 800 mg for individuals over 24 years of age. Pregnant women require additional calcium (RDA 1,200 mg). Many experts believe that elderly persons should take as much as 1,500 mg to help prevent **osteoporosis**, a common condition in which bones become weak and fracture easily due to a loss of bone density. Dairy products, meats, and some seafood (sardines, oysters) are excellent sources of calcium. Spinach, beet greens, beans, and peanuts are among the best plant-derived sources.

Calcium absorption is affected by many factors, including age, the amount needed, and what foods are eaten at the same time. In general,

osteoporosis: weakening of the bone structure

CALCIUM SUPPLEMENTS

Supplement	Elemental calcium by weight	Comment
Calcium carbonate	40%	<ul style="list-style-type: none"> • Most commonly used • Less well absorbed in persons with decreased stomach acid (e.g., elderly or those on anti-acid medicines) • Natural preparations from oyster shell or bone meal may contain contaminants such as lead • Least expensive
Calcium citrate	21%	<ul style="list-style-type: none"> • Better absorbed, especially by those with decreased stomach acid • May protect against kidney stones • More expensive.
Calcium phosphate	38% or 31%	<ul style="list-style-type: none"> • Tricalcium or dicalcium phosphate • Used more in Europe • Absorption similar to calcium carbonate
Calcium gluconate	9%	<ul style="list-style-type: none"> • Used intravenously for severe hypocalcemia • Well absorbed orally, but low content of elemental calcium • Very expensive
Calcium glubionate	6.5%	<ul style="list-style-type: none"> • Available as syrup for children • Low content elemental calcium.
Calcium lactate	13%	<ul style="list-style-type: none"> • Well absorbed, but low content elemental calcium.

SOURCE: Gregory, Philip J. (2000) "Calcium Salts." *Prescriber's Letter*. Document #160313.

growth spurts: periods of rapid growth

fat: type of food molecule rich in carbon and hydrogen, with high energy content

intestines: the two long tubes that carry out the bulk of the processes of digestion

fiber: indigestible plant material which aids digestion by providing bulk

pH: level of acidity, with low numbers indicating high acidity

acidity: measure of the tendency of a molecule to lose hydrogen ions, thus behaving as an acid

hypertension: high blood pressure

cancer: uncontrolled cell growth

cardiovascular: related to the heart and circulatory system

obesity: the condition of being overweight, according to established norms based on sex, age, and height

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

calcium from food sources is better absorbed than calcium taken as supplements. Children absorb a higher percentage of their ingested calcium than adults because their needs during **growth spurts** may be two or three times greater per body weight than adults. Vitamin D is necessary for intestinal absorption, making Vitamin D-fortified milk a very well-absorbed form of calcium. Older persons may not consume or make as much vitamin D as is optimal, so their calcium absorption may be decreased. Vitamin C and lactose (the sugar found in milk) enhance calcium absorption, whereas meals high in **fat** or protein may decrease absorption. Excess phosphorous consumption (as in carbonated sodas) can decrease calcium absorption in the **intestines**. High dietary **fiber** and phytate (a form of phytic acid found in dietary fiber and the husks of whole grains) may also decrease dietary calcium absorption in some areas of the world. Intestinal **pH** also affects calcium absorption—absorption is optimal with normal stomach **acidity** generated at meal times. Thus, persons with reduced stomach acidity (e.g., elderly persons, or persons on acid-reducing medicines) do not absorb calcium as well as others do.

Calcium supplements are widely used in the treatment and prevention of osteoporosis. Supplements are also recommended, or are being investigated, for a number of conditions, including **hypertension**, colon **cancer**, **cardiovascular** disease, premenstrual syndrome, **obesity**, **stroke**, and pre-eclampsia (a complication of pregnancy). There are several forms of calcium salts used as supplements. They vary in their content of elemental calcium, the amount effectively absorbed by the body, and cost. Whatever the specific form, the supplement should be taken with meals to maximize absorption.

Calcium is one of the most important macronutrients for the body's growth and function. Sufficient amounts are important in preventing many diseases. Calcium levels are tightly controlled by a complex interaction of

hormones and **vitamins**. Dietary requirements vary throughout life and are greatest during periods of growth and pregnancy. However, recent reports suggest that many people do not get sufficient amounts of calcium in their diet. Various calcium supplements are available when dietary intake is inadequate. SEE ALSO MINERALS; OSTEOMALACIA; OSTEOPOROSIS; RICKETS.

*Donna Staton
Marcus Harding*

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Calorie

Technically, a **calorie** is the amount of heat needed to raise the temperature of 1 kilogram (kg) of water 1 degree Celsius. One calorie is 1/1000 of a kilocalorie (a kcalorie or Calorie). The kcalorie is the unit by which food, and the amount of **energy** a person takes in is measured. To maintain one's weight, energy intake should equal energy expenditure. If energy intake is negative (if a person consumes fewer kilocalories than he or she needs or expends) then weight loss will occur. If energy intake is positive (if a person consumes more kilocalories than he or she needs and expends), weight gain will occur.

Judith C. Rodriguez

calorie: unit of food energy

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

Cancer

Cancer is a disease characterized by the uncontrolled growth and spread of abnormal cells. Around the world, over 10 million cancer cases occur annually. Half of all men and one-third of all women in the United States will develop some form of cancer during their lifetime. It is one of the most feared diseases, primarily because half of those diagnosed with cancer in the United States will die from it. Cancer is a leading cause of death around the world, causing over 6 million deaths a year. The exact causes of most types of cancer are still not known, and there is not yet a cure for cancer. However, it is now known that the risk of developing many types of cancer can be reduced by adopting certain lifestyle changes, such as quitting smoking and eating a better **diet**.

cancer: uncontrolled cell growth

diet: the total daily food intake, or the types of foods eaten

Prevalence

Cancer is, in general, more common in industrialized nations, but there has been a growth in cancer rates in developing countries, particularly as these nations adopt the diet and lifestyle habits of industrialized countries. Over one million people in the United States get cancer each year. Anyone can get cancer at any age; however, about 80 percent of all cancers occur in people over the age of fifty-five.

Cancer can affect any site in the body. About one hundred human cancers are recognized. The four most common cancers in the United States are: lung, colon/rectum, breast, and **prostate**. Together, these cancers account for over 50 percent of total cancer cases in the United States each year.

prostate: male gland surrounding the urethra that contributes fluid to the semen

incidence: number of new cases reported each year

There is a marked variation among countries in **incidence** of different cancers. Most of the variation in cancer risk among populations, and among individuals, is due to environmental factors, such as cigarette smoking and certain dietary patterns, that can affect one's risk of developing cancer. For example, individuals living in Australia have the highest worldwide lifetime risk of skin cancer, at over 20 percent, due to the high level of exposure to the sun of people in Australia. People in India have twenty-five times the average risk of developing oral cancer sometime during their lives due to the popularity of chewing tobacco in that country. In fact, India has the world's highest incidence of oral cancer, with 75,000 to 80,000 new cases a year. The population of Japan has the highest rates of stomach cancer in the world due to the high consumption of raw fish by the Japanese.

Types of Cancer

epithelial cell: sheet of cells lining organs throughout the body

bone marrow: dividing cells within the long bones that make the blood

lymphatic system: group of ducts and nodes through which fluid and white blood cells circulate to fight infection

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

malignant: spreading to surrounding tissues; cancerous

lymph system: system of vessels and glands in the body that circulates and cleans extracellular fluid

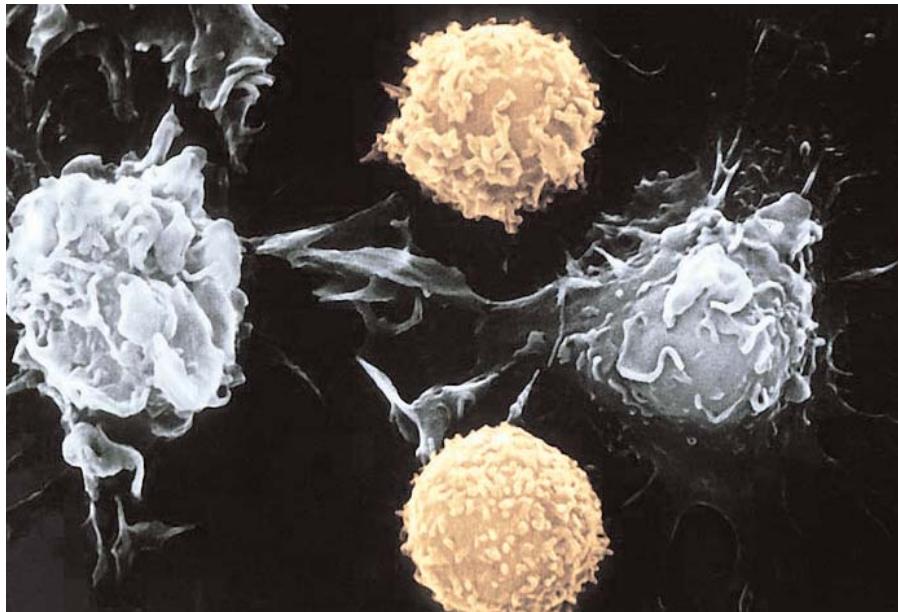
Cancers are classified according to the types of cells in which they develop. Most human cancers are *carcinomas*, which arise from the **epithelial cells** that form the superficial layer of the skin and some internal organs. *Leukemias* affect the blood and blood-forming organs such as **bone marrow**, the **lymphatic system**, and the spleen. *Lymphomas* affect the **immune system**. *Sarcoma* is a general term for any cancer arising from muscle cells or connective tissues.

Growth and Spread of Cancer

Cancer develops when cells in a particular part of the body begin to grow out of control. Normal body cells grow, divide, and die in an orderly way. Cancer cells, however, continue to grow and divide without dying. Instead, they outlive normal cells and continue to form new abnormal cancer cells. As most cancer cells continue to grow, they lump together and form an extra mass of tissue. This mass is called a **malignant** tumor.

As a malignant tumor grows, it damages nearby tissue. Some cancers, like leukemia, do not form tumors. Instead, these cancer cells involve the blood and blood-forming organs and circulate through other tissues, where they grow.

Cancer can begin in one part of the body and spread to others. The spread of a tumor to a new site is called *metastasis*. This process occurs as cancer cells break away from a tumor and travel through the bloodstream or the **lymph system** to other areas of the body. Once in a new location, cancer cells continue to grow out of control and form a new malignant tumor.



An image showing the division of cancer cells (left and right) and two healthy white blood cells (above and below). In normal cells, cell division is balanced by cell death, but cancerous cells continue to divide and accumulate, damaging nearby tissues. [Nbsc/Photo Researchers, Inc. Reproduced by permission.]

Causes of Cancer

The exact cause of cancer is not known. Most cancers result from permanent damage to **genes** or from mutations, which occur either due to internal factors, such as **hormones**, immune conditions, **metabolism**, and the digestion of **nutrients** within cells, or by exposure to environmental or external factors. A chemical or other environmental agent that produces cancer is called a *carcinogen*.

Overall, environmental factors, defined broadly to include tobacco use, diet, **infectious diseases**, chemicals, and radiation, are believed to cause between 75 and 80 percent of all cancer cases in the United States. Tobacco use, including cigarettes, cigars, chewing tobacco, and snuff, can cause cancers of the lung, mouth, throat, larynx, bladder, kidney, esophagus, and pancreas. Smoking alone causes one-third of all cancer deaths in the United States. Heavy consumption of alcohol has also been shown to increase the risk of developing cancer of the mouth, pharynx, larynx, esophagus, liver, and breast.

Overweight and **obesity** are associated with increased risk of cancers of the breast, colon, endometrium, esophagus, kidney, and gallbladder. The following chemicals have been found to cause cancer: coal tars and their derivatives, such as benzene; some hydrocarbons; aniline, a substance used to make dyes; and asbestos. Radiation from a variety of sources, including the ultraviolet light from the sun, is known to lead to skin cancer.

Several infectious agents have also been implicated in cancer. Evidence suggests that **chronic** viral infections are associated with up to one-fifth of all cancers. These include hepatitis B virus (HBV), which can lead to cancer of the liver; the Epstein-Barr virus, a type of herpes virus that causes infectious mononucleosis and has been associated with Hodgkin's disease, non-Hodgkin's lymphomas, and nasopharyngeal cancer; the human immunodeficiency virus (HIV), which is associated with an increased risk of developing several cancers, especially Kaposi's sarcoma and non-Hodgkin's

gene: DNA sequence that codes for proteins, and thus controls inheritance

hormone: molecules produced by one set of cells that influence the function of another set of cells

metabolism: the sum total of reactions in a cell or an organism

nutrient: dietary substance necessary for health

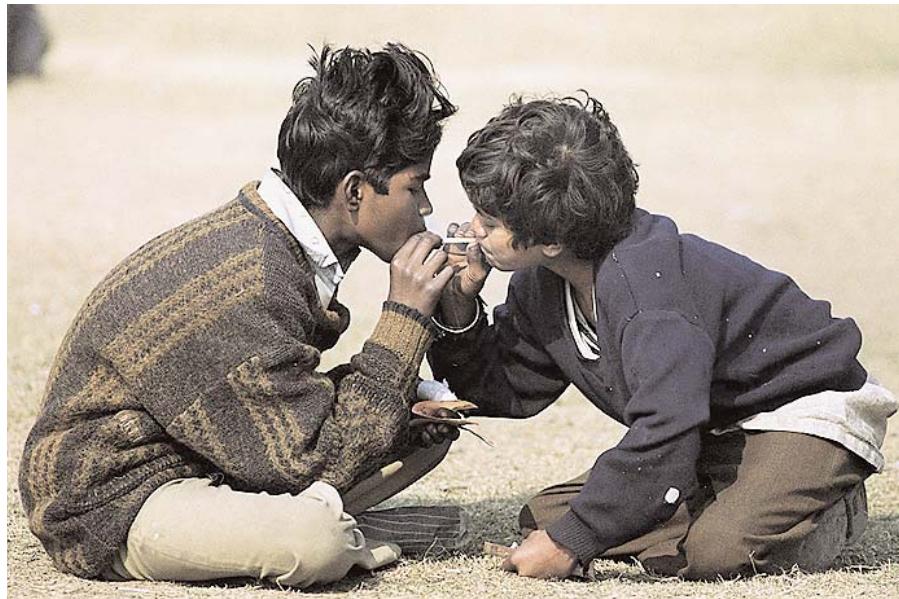
infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

overweight: weight above the accepted norm based on height, sex, and age

obesity: the condition of being overweight, according to established norms based on sex, age, and height

chronic: over a long period

Tobacco use is a major cause of lung, lip, mouth, larynx, and throat cancer, and is a contributing cause of many other cancers. In India, where this photo was taken, the prevalence of tobacco use among students approaches 60 percent in some states. [© AFP/Corbis. Reproduced by permission.]



virus: noncellular infectious agent that requires a host cell to reproduce

DNA: deoxyribonucleic acid; the molecule that makes up genes, and is therefore responsible for heredity

lymph node: pocket within the lymph system in which white blood cells reside

genetic: inherited or related to the genes

When cells in some area of the body divide without control, these cells accumulate and form lumps. A *tumor*, or *neoplasm*, is an abnormal lump or mass of tissue that may compress, invade, and destroy normal tissue. Tumors may be benign or malignant. Cancer is a malignant neoplasm, though not all tumors are malignant. A noncancerous growth is called a benign tumor. Benign tumors do not metastasize and, with very rare exceptions, are not life threatening.

lymphoma; and human papilloma **viruses** (HPV), which have been proven to cause cervical cancer and have also been associated with cancers of the vagina, vulva, penis, and colon. The bacterium *Helicobacter pylori* has been linked to stomach cancer.

About 5 to 10 percent of cancers are hereditary, in that a faulty gene or damaged **DNA** that has been inherited predisposes a person to be at a very high risk of developing a particular cancer. Two genes, BRCA1 and BRCA2, have been found to cause some breast cancers. Other genes have been discovered that are associated with some cancers that run in families, such as cancers of the colon, rectum, kidney, ovary, esophagus, **lymph nodes**, skin melanoma, and pancreas.

Carcinogenesis Process

All cancers involve the malfunction of genes that control cell growth and division. The process by which cancers develop is called *carcinogenesis*. This process usually starts when chemicals or radiation damage DNA, the **genetic** structure inside cells. Viruses induce carcinogenesis by introducing new DNA sequences. Most of the time, when DNA becomes damaged the body is able to repair it. In cancer cells, however, the damaged DNA is not repaired. While normal cells with damaged DNA die, cancer cells with damaged DNA continue to multiply.

There is a long time lag between exposure to a carcinogen and the occurrence of cancer. While cellular mutations cause cancer to develop, it is not exactly clear how this happens. Carcinogenesis is a multistep process, in which as many as ten distinct mutations may have to accumulate in a cell before it becomes cancerous. The fact that so many mutations are needed for a cancer to develop indicates that cell growth is normally controlled through many sets of checks and balances.

The cell cycle is regulated by a large number of cellular genes that are expressed, or exhibited, at different stages of the cycle. The genes code for,

or determine, **growth factors**, growth-factor receptors, and **proteins** that control gene functions and cell survival. Damaged DNA can lead to cancer because the cell cycle is distorted by the alteration and activation of *oncogenes*, genes that stimulate cell growth, or by the inactivation of *tumor suppressor genes*, which ordinarily suppress cell growth. Activated oncogenes drive abnormal, unregulated cell proliferation and lead to tumor formation. Mutations of the tumor suppressor gene p53 are found in about 50 percent of human cancers.

In experimental animals, three stages of chemical carcinogenesis have been identified. These are: (1) initiation, where DNA is irreversibly altered; (2) promotion, which is the multiplication of altered cells; and (3) progression, which involves chromosomal changes, high growth rate, invasiveness, and potential to metastasize.

Prevention

All cancers caused by cigarette smoking and heavy use of alcohol could be prevented completely. Approximately 30 percent of all cancers worldwide are due to tobacco use. Many of the skin cancers could be prevented by protection from sunlight. Certain cancers that are related to infectious exposures, such as HBV, HPV, HIV, and *Helicobacter* could be prevented through **behavioral changes, vaccines, or antibiotics**. Research shows that about 30 to 40 percent of all cancers worldwide are due to dietary factors and lack of physical activity, including obesity, and could therefore have been prevented. By making changes in regard to diet, exercise, healthy weight maintenance, and tobacco use, the incidence of cancer around the world could be reduced by 60 to 70 percent.

The Relationship between Diet, Physical Activity, and Cancer

While the exact mechanisms by which diet is related to cancer have not been completely understood, research has shown that food plays a role in cancer prevention. For example, populations whose diet includes at least five servings of fruits and vegetables a day have lower rates of some of the most common cancers. Fruits and vegetables contain many **antioxidants** and **phytochemicals**, such as vitamins A, C, and E, and beta-carotene, which have been shown to prevent cancer. It is not completely clear, however, whether it is individual phytochemicals, or a combination of them, or the **fiber** in fruits and vegetables that result in reduced risk of cancer.

Studies have shown the risk of prostate cancer drops for men who eat tomato products, possibly because of the phytochemical lycopene. In addition, it has been shown that colon cancer declines among those who drink green tea, which contains antioxidants and phytochemicals, and who regularly eat soy products and foods rich in selenium, an antioxidant.

Those who eat a diet low in **fat**, especially animal fat, also have lower cancer rates, but again it is not clear whether it is the **calories**, the amount and distribution of body fat, or the likelihood that a low-fat diet is high in fiber, fruits, and vegetables that is protective against cancer. High-fiber diets are thought to reduce the risk of colon cancer because the fiber helps move food through the lower digestive tract, possibly reducing the contact of any **carcinogens** with the **bowel** lining.

growth factor: protein that stimulates growth of surrounding cells

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

behavioral: related to behavior, in contrast to medical or other types of interventions

vaccine: medicine that promotes immune system resistance by stimulating pre-existing cells to become active

antibiotic: substance that kills or prevents the growth of microorganisms

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

phytochemical: chemical produced by plants

fiber: indigestible plant material that aids digestion by providing bulk

fat: type of food molecule rich in carbon and hydrogen, with high energy content

calorie: unit of food energy

carcinogen: cancer-causing substance

bowel: intestines and rectum

Scientific evidence indicates that physical activity may reduce the risk of certain cancers. This effect may be due to the fact that physical activity is associated with the maintenance of a healthy body weight. Other mechanisms by which physical activity may help to prevent certain cancers may involve both direct and indirect effects. For colon cancer, physical activity accelerates the movement of food through the intestine, thereby reducing the length of time that the bowel lining is exposed to potential carcinogens. For breast cancer, vigorous physical activity may decrease the exposure of breast tissue to circulating **estrogen**, a hormone that has been implicated in breast cancer. Physical activity may also affect cancers of the colon, breast, and other sites by improving **energy** metabolism and reducing circulating concentrations of **insulin** and related growth factors.

estrogen: hormone that helps control female development and menstruation

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

insulin: hormone released by the pancreas to regulate level of sugar in the blood

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

mineral: an inorganic (non-carbon-containing) element, ion, or compound

Because of these factors, recommendations of the American Cancer Society to reduce the risk of cancer include: consumption of a mostly plant-based diet, including five or more servings of fruits and vegetables each day; consumption of whole grains in preference to processed or refined grains and sugar; limited consumption of high-fat foods, particularly from animal sources; physical activity; and limited consumption of alcohol.

Nutrition for People with Cancer

People with cancer often have increased nutritional needs. As such, it is important for them to consume a variety of foods that provide the nutrients needed to maintain health while fighting cancer. These nutrients include: protein, **carbohydrates**, fat, water, vitamins, and **minerals**. Nutrition suggestions for people with cancer often emphasize eating high-calorie, high-protein foods. Protein helps to ensure growth, repair body tissue, and maintain a healthy immune system. Therefore, people with cancer often need more protein than usual.

Great progress has been made in the fight against cancer, and cancer detection and treatments have improved significantly. However, there is a disparity in cancer death rates between developed and developing countries. Between 80 and 90 percent of cancer patients in developing countries have late-stage and often incurable cancer at the time of diagnosis.

A growing body of evidence shows that simple changes in diet and lifestyle can help prevent many cancers. Further research into the exact mechanisms by which certain diets may help prevent cancer is ongoing. SEE ALSO **ANTIOXIDANTS; FUNCTIONAL FOODS; PHYTOCHEMICALS**.

Gita C. Gidwani

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Carbohydrates

Carbohydrates are one of three macronutrients that provide the body with energy (protein and fats being the other two). The chemical compounds in carbohydrates are found in both simple and complex forms, and in order for the body to use carbohydrates for energy, food must undergo digestion, absorption, and glycolysis. It is recommended that 55 to 60 percent of caloric intake come from carbohydrates.

Chemical Structure

Carbohydrates are a main source of energy for the body and are made of carbon, hydrogen, and oxygen. Chlorophyll in plants absorbs light energy from the sun. This energy is used in the process of photosynthesis, which allows green plants to take in carbon dioxide and release oxygen and allows for the production of carbohydrates. This process converts the sun's light energy into a form of chemical energy useful to humans. Plants transform carbon dioxide (CO_2) from the air, water (H_2O) from the ground, and energy from the sun into oxygen (O_2) and carbohydrates ($\text{C}_6\text{H}_{12}\text{O}_6$) ($6 \text{ CO}_2 + 6 \text{ H}_2\text{O} + \text{energy} = \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{ O}_2$). Most carbohydrates have a ratio of 1:2:1 of carbon, hydrogen, and oxygen, respectively.

Humans and other animals obtain carbohydrates by eating foods that contain them. In order to use the energy contained in the carbohydrates, humans must **metabolize**, or break down, the structure of the molecule in a process that is opposite that of photosynthesis. It starts with the carbohydrate and oxygen and produces carbon dioxide, water, and energy. The body utilizes the energy and water and rids itself of the carbon dioxide.

Simple Carbohydrates

Simple carbohydrates, or simple sugars, are composed of **monosaccharide** or **disaccharide** units. Common monosaccharides (carbohydrates composed of single sugar units) include glucose, fructose, and galactose. Glucose is the most common type of sugar and the primary form of sugar that is stored in the body for energy. It sometimes is referred to as blood sugar or dextrose and is of particular importance to individuals who have **diabetes** or **hypoglycemia**. Fructose, the primary sugar found in fruits, also is found in honey and high-fructose corn syrup (in soft drinks) and is a major source of sugar in the **diet** of Americans. Galactose is less likely than glucose or fructose to be found in nature. Instead, it often combines with glucose to form the disaccharide lactose, often referred to as milk sugar. Both fructose and galactose are metabolized to glucose for use by the body.

Oligosaccharides are carbohydrates made of two to ten monosaccharides. Those composed of two sugars are specifically referred to as disaccharides, or double sugars. They contain two monosaccharides bound by either an alpha bond or a beta bond. Alpha bonds are digestible by the human body, whereas beta bonds are more difficult for the body to break down.

There are three particularly important disaccharides: **sucrose**, maltose, and lactose. Sucrose is formed when glucose and fructose are held together by an alpha bond. It is found in sugar cane or sugar beets and is refined to make granulated table sugar. Varying the degree of purification alters the

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

absorption: uptake by the digestive tract

glycolysis: cellular reaction that begins the breakdown of sugars

oxygen: O_2 , atmospheric gas required by all animals

metabolize: processing of a nutrient

glucose: a simple sugar; the most commonly used fuel in cells

diabetes: inability to regulate level of sugar in the blood

hypoglycemia: low blood sugar level

diet: the total daily food intake, or the types of foods eaten

sucrose: table sugar

SUGAR COMPARISON			
Sugar	Carbohydrate	Monosaccharide or disaccharide	Additional information
Beet sugar (cane sugar)	Sucrose	Disaccharide (fructose and glucose)	Similar to white and powdered sugar, but varied degree of purification
Brown sugar	Sucrose	Disaccharide (fructose and glucose)	Similar to white and powdered sugar, but varied degree of purification
Corn syrup	Glucose	Monosaccharide	
Fruit sugar	Fructose	Monosaccharide	Very sweet
High-fructose corn syrup	Fructose	Monosaccharide	Very sweet and inexpensive Added to soft drinks and canned or frozen fruits
Honey	Fructose and glucose	Monosaccharides	
Malt sugar	Maltose	Disaccharide (glucose and glucose)	Formed by the hydrolysis of starch, but sweeter than starch
Maple syrup	Sucrose	Disaccharide (fructose and glucose)	
Milk sugar	Lactose	Disaccharide (glucose and galactose)	Made in mammary glands of most lactating animals
Powdered sugar	Sucrose	Disaccharide (fructose and glucose)	Similar to white and brown sugar, but varied degree of purification
White sugar	Sucrose	Disaccharide (fructose and glucose)	Similar to brown and powdered sugar, but varied degree of purification

SOURCE: Mahan and Escott-Stump, 2000; Northwestern University; Sizer and Whitney, 1997; and Wardlaw and Kessel, 2002.

final product, but white, brown, and powdered sugars all are forms of sucrose. Maltose, or malt sugar, is composed of two glucose units linked by an alpha bond. It is produced from the chemical decomposition of starch, which occurs during the germination of seeds and the production of alcohol. Lactose is a combination of glucose and galactose. Because it contains a beta bond, it is hard for some individuals to digest in large quantities. Effective digestion requires sufficient amounts of the **enzyme** lactase.

enzyme: protein responsible for carrying out reactions in a cell

nutrition: the maintenance of health through proper eating, or the study of same

glycogen: storage form of sugar

fiber: indigestible plant material that aids digestion by providing bulk

Complex Carbohydrates

Complex carbohydrates, or *polysaccharides*, are composed of simple sugar units in long chains called polymers. Three polysaccharides are of particular importance in human **nutrition**: starch, **glycogen**, and dietary **fiber**.

Starch and glycogen are digestible forms of complex carbohydrates made of strands of glucose units linked by alpha bonds. Starch, often contained in seeds, is the form in which plants store energy, and there are two types: amylose and amylopectin. Starch represents the main type of digestible complex carbohydrate. Humans use an enzyme to break down the bonds linking glucose units, thereby releasing the sugar to be absorbed into the bloodstream. At that point, the body can distribute glucose to areas that need energy, or it can store the glucose in the form of glycogen.

Glycogen is the polysaccharide used to store energy in animals, including humans. Like starch, glycogen is made up of chains of glucose linked by alpha bonds; but glycogen chains are more highly branched than starch. It is this highly branched structure that allows the bonds to be more quickly broken down by enzymes in the body. The primary storage sites for glycogen in the human body are the liver and the muscles.

Another type of complex carbohydrate is dietary fiber. In general, dietary fiber is considered to be polysaccharides that have not been digested at the point of entry into the large intestine. Fiber contains sugars linked by bonds that cannot be broken down by human enzymes, and are there-



Pastas and whole-grain breads contain complex carbohydrates, which are long strands of glucose molecules. Nutritionists recommend that 55–60 percent of calories come from carbohydrates, and especially complex carbohydrates. [Photograph by James Noble. Corbis. Reproduced by permission.]

fore labeled as indigestible. Because of this, most fibers do not provide energy for the body. Fiber is derived from plant sources and contains polysaccharides such as **cellulose**, hemicellulose, pectin, gums, mucilages, and lignins.

The indigestible fibers cellulose, hemicellulose, and lignin make up the structural part of plants and are classified as **insoluble** fiber because they usually do not dissolve in water. Cellulose is a nonstarch carbohydrate polymer made of a straight chain of glucose **molecules** linked by beta bonds and can be found in whole-wheat flour, bran, and vegetables. Hemicellulose is a nonstarch carbohydrate polymer made of glucose, galactose, xylose, and other monosaccharides; it can be found in bran and whole grains. Lignin, a noncarbohydrate polymer containing alcohols and acids, is a woody fiber found in wheat bran and the seeds of fruits and vegetables.

In contrast, pectins, mucilages, and gums are classified as soluble fibers because they dissolve or swell in water. They are not broken down by human enzymes, but instead can be metabolized (or fermented) by **bacteria**.

cellulose: carbohydrate made by plants; indigestible by humans

insoluble: not able to be dissolved in water

molecule: combination of atoms that form stable particles

bacteria: single-celled organisms without nuclei, some of which are infectious

legumes: beans, peas, and related plants

present in the large intestine. Pectin is a fiber made of galacturonic acid and other monosaccharides. Because it absorbs water and forms a gel, it is often used in jams and jellies. Sources of pectin include citrus fruits, apples, strawberries, and carrots. Mucilages and gums are similar in structure. Mucilages are dietary fibers that contain galactose, manose, and other monosaccharides; and gums are dietary fibers that contain galactose, glucuronic acid, and other monosaccharides. Sources of gums include oats, **legumes**, guar, and barley.

Digestion and Absorption

Carbohydrates must be digested and absorbed in order to transform them into energy that can be used by the body. Food preparation often aids in the digestion process. When starches are heated, they swell and become easier for the body to break down. In the mouth, the enzyme amylase, which is contained in saliva, mixes with food products and breaks some starches into smaller units. However, once the carbohydrates reach the acidic environment of the stomach, the amylase is inactivated. After the carbohydrates have passed through the stomach and into the small intestine, key digestive enzymes are secreted from the pancreas and the small intestine where most digestion and absorption occurs. Pancreatic amylase breaks starch into disaccharides and small polysaccharides, and enzymes from the cells of the small-intestinal wall break any remaining disaccharides into their monosaccharide components. Dietary fiber is not digested by the small intestine; instead, it passes to the colon unchanged.

Sugars such as galactose, glucose, and fructose that are found naturally in foods or are produced by the breakdown of polysaccharides enter into absorptive intestinal cells. After absorption, they are transported to the liver where galactose and fructose are converted to glucose and released into the bloodstream. The glucose may be sent directly to organs that need energy, it may be transformed into glycogen (in a process called glycogenesis) for storage in the liver or muscles, or it may be converted to and stored as fat.

Glycolysis

The molecular bonds in food products do not yield high amounts of energy when broken down. Therefore, the energy contained in food is released within cells and stored in the form of adenosine triphosphate (ATP), a high-energy compound created by cellular energy-production systems. Carbohydrates are metabolized and used to produce ATP molecules through a process called glycolysis.

enzymatic: related to use of enzymes, proteins that cause chemical reactions to occur

cytoplasm: contents of a cell minus the nucleus

lactic acid: breakdown product of sugar in the muscles in the absence of oxygen

Krebs Cycle: cellular reaction that breaks down numerous nutrients and provides building blocks for other molecules

Glycolysis breaks down glucose or glycogen into pyruvic acid through **enzymatic** reactions within the **cytoplasm** of the cells. The process results in the formation of three molecules of ATP (two, if the starting product was glucose). Without the presence of oxygen, pyruvic acid is changed to **lactic acid**, and the energy-production process ends. However, in the presence of oxygen, larger amounts of ATP can be produced. In that situation, pyruvic acid is transformed into a chemical compound called *acetyl coenzyme A*, a compound that begins a complex series of reactions in the **Krebs Cycle** and the electron transport system. The end result is a net gain of up to thirty-nine molecules of ATP from one molecule of glycogen (thirty-eight

molecules of ATP if glucose was used). Thus, through certain systems, glucose can be used very efficiently in the production of energy for the body.

Recommended Intake

At times, carbohydrates have been incorrectly labeled as “fattening.” Evidence actually supports the consumption of more, rather than less, starchy foods. Carbohydrates have four **calories** per gram, while dietary fats contribute nine per gram, so diets high in complex carbohydrates are likely to provide fewer calories than diets high in fat. Recommendations are for 55 to 60 percent of total calories to come from carbohydrates (approximately 275 to 300 grams for a 2,000-calorie diet). The majority of carbohydrate calories should come from complex rather than simple carbohydrates. Of total caloric intake, approximately 45 to 50 percent of calories should be from complex carbohydrates, and 10 percent or less from simple carbohydrates.

It is important to consume a minimum amount of carbohydrates to prevent **ketosis**, a condition resulting from the breakdown of fat for energy in the absence of carbohydrates. In this situation, products of fat breakdown, called ketone bodies, build up in the blood and alter normal **pH** balance. This can be particularly harmful to a fetus. To avoid ketosis, daily carbohydrate intake should include a minimum of 50 to 100 grams. In terms of dietary fiber, a minimum intake of 20 to 35 grams per day is recommended.

calorie: unit of food energy

ketosis: build-up of ketone bodies in the blood, due to fat breakdown

pH: level of acidity, with low numbers indicating high acidity

Low-Carb Diets

Low-carbohydrate diets, such as the Atkins and South Beach diets, are based on the proposition that it's not fat that makes you fat. Allowing dieters to eat steak, butter, eggs, bacon, and other high-fat foods, these diets instead outlaw starches and refined carbohydrates on the theory that they are metabolized so quickly that they lead to hunger and overeating. This theory, which was first popularized in the nineteenth century, came under scathing criticism from the medical establishment during the early 1970s when Dr. Robert Atkins published the phenomenally popular low-carb diet bearing his name. According to the American Medical Association (AMA), the Atkins diet was a “bizarre regimen” that advocated “an unlimited intake of saturated fats and cholesterol-rich foods” and therefore presented a considerable risk of heart disease. Most doctors recommended instead a diet low in fat and high in carbohydrates, with plenty of grains, fruits, and vegetables and limited red meat or dairy products. This became the received wisdom during the 1980s, at the same time that the U.S.

waistline began to expand precipitously. As dieters found that weight loss was difficult to maintain on a low-fat diet, low-carb diets regained popularity—with as many as 30 million people trying a low-carb diet in 2003. Several small-scale studies began to suggest that a low-carb diet may indeed be effective and may not have the deleterious effects its detractors have claimed; other research found that any benefits of a low-carb diet are short-lived, and that the negative effects will take decades to become evident. The National Institutes of Health has pledged \$2.5 million for a five-year study of the Atkins diet with 360 subjects. While the results of this and other large-scale studies are awaited, many researchers stress that the key issue in maintaining a healthy weight is the number of calories consumed, not the type of calories. The National Academy of Sciences recommends that adults obtain 45 to 65 percent of their calories from carbohydrates, 20 to 35 percent from fat, and 10 to 35 percent from protein.

—Paula Kepos

Exchange System

The exchange system is composed of lists that describe carbohydrate, fat, and protein content, as well as caloric content, for designated portions of specific foods. This system takes into account the presence of more than one type of nutrient in any given food. Exchange lists are especially useful for individuals who require careful diet planning, such as those who monitor intake of calories or certain nutrients. It is particularly useful for diabetics, for whom carbohydrate intake must be carefully controlled, and was originally developed for planning diabetic diets.

Diabetes, Carbohydrate-Modified Diets, and Carbohydrate Counting

Diabetes is a condition that alters the way the body handles carbohydrates. In terms of diet modifications, diabetics can control blood sugar levels by appropriately managing the carbohydrates, proteins, and fats in their meals. The amount of carbohydrates, not necessarily the source, is the primary issue. Blood glucose levels after a meal can be related to the process of food preparation, the amount of food eaten, fat intake, sugar absorption, and the combination of foods in the meal or snack.

One method of monitoring carbohydrate levels—carbohydrate counting—assigns a certain number of carbohydrate grams or exchanges to specific foods. Calculations are used to determine **insulin** need, resulting in better control of blood glucose levels with a larger variety of foods. Overall, diabetic diets can include moderate amounts of sugar, as long as they are carefully monitored. SEE ALSO DIABETES MELLITUS; FATS; NUTRIENTS; PROTEIN; WEIGHT LOSS DIETS.

Catherine N. Rasberry

insulin: hormone released by the pancreas to regulate level of sugar in the blood

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Cardiovascular Disease

The **cardiovascular** system comprises the heart, veins, **arteries**, and capillaries, which carry blood back and forth from the heart to the lungs (pulmonary circulation) and from the heart to the rest of the body (systemic circulation). The heart works on electrical impulses and produces them constantly, unless **stress**, fear, or danger is involved, in which case the impulses will increase dramatically. The body's largest artery is the aorta and the largest vein is the vena cava. Veins are thinner than arteries, which resemble rubber bands in that they expand more easily (depending on the amount of blood passing through them). Smaller blood vessels, or capillaries, channel **oxygen** and blood to tissues. The process is a cycle in which the capillaries deliver oxygen-rich blood to the body and pick up oxygen-poor blood, which is then taken into the veins and finally to the heart to be "rejuvenated" or cleansed.

Cardiovascular disease (CVD), and the resulting complications, is the main cause of death for both males and females in the United States and other technologically advanced countries of the world. It usually is in the top five causes of death in lesser-developed countries. Diseases of the cardiovascular system include those that compromise the pumping ability of the heart, cause failure of the valves, or result in narrowing or hardening of the arteries. In addition, **toxins** and infectious agents may damage the heart and blood vessels. Injury or failure of the cardiovascular system, especially the heart, also will affect the peripheral tissues that depend on the delivery of **nutrients** and the removal of wastes through the blood vascular system. CVD is a family of diseases that includes **hypertension**, **atherosclerosis**, **coronary heart disease**, and **stroke**.

Hypertension (High Blood Pressure)

Blood pressure is a measure of the force of blood against the walls of arteries. It is recorded as two numbers: the systolic pressure over the diastolic pressure. Systolic pressure is the pressure as the heart beats, while diastolic pressure measures the pressure when the heart relaxes between beats.

Blood pressure is normally measured at the brachial artery with a sphygmomanometer (pressure cuff) in millimeters of mercury (mm Hg) and given as systolic over diastolic pressure. Normal blood pressure is less than 120 mm Hg systolic and less than 80 mm Hg diastolic—usually expressed as "120 over 80." However, normal for an individual varies with the height, weight, fitness level, age, and health of a person. Blood pressure is normally maintained within narrow limits, but it can drop during sleep or increase during exercise. Hypertension (HTN), or high blood pressure, occurs when the force of blood passing through blood vessels is above normal. The increase in pressure forces the blood to hit the blood vessel walls. HTN is called "the silent killer" because many people do not know they have the condition. Consistently high blood pressure increases the risk for a stroke or a **heart attack**.

cardiovascular: related to the heart and circulatory system

artery: blood vessel that carries blood away from the heart toward the body tissues

stress: heightened state of nervousness or unease

oxygen: O₂, atmospheric gas required by all animals

toxins: poison

nutrient: dietary substance necessary for health

hypertension: high blood pressure

atherosclerosis: build-up of deposits within the blood vessels

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

heart attack: loss of blood supply to part of the heart, resulting in death of heart muscle



The sphygmomanometer around this woman's arm is inflated until it collapses her brachial artery, and then gradually deflated. Blood rushing into the vessel makes Korotkoff sounds that are used to time the measurements of systolic and diastolic pressure. [Photograph by Michael Keller. Corbis. Reproduced by permission.]

diet: the total daily food intake, or the types of foods eaten

obesity: the condition of being overweight, according to established norms based on sex, age, and height

plaque: material forming deposits on the surface of the teeth, which may promote bacterial growth and decay

lipid: fats, waxes and steroids; important components of cell membranes

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

triglyceride: a type of fat

trans-fatty acids: type of fat thought to increase the risk of heart disease

diabetes: inability to regulate level of sugar in the blood

It may be caused by poor **diet**, **obesity**, smoking, stress, and inactivity. The Dietary Approach to Stop Hypertension (DASH) project recommends a diet that is low in sodium and high in fruits, vegetables, and low-fat dairy products. Other approaches to controlling HTN include weight loss, smoking cessation, increased physical activity, and stress management.

Atherosclerosis

Atherosclerosis, or hardening of the arteries, is the cause of more than half of all mortality in developed countries and the leading cause of death in the United States. When the coronary arteries are involved, it results in coronary artery disease (CAD). The hardening of the arteries is due to the build up of fatty deposits called **plaque**, and mineral deposits. As a result, the supply of blood to the heart muscle (myocardium) is reduced and can lead to ischemia (deficiency of blood) to the heart, causing chest pain or a myocardial infarction (heart attack). The hardening of the arteries causes an increase in resistance to blood flow, and therefore an increase in blood pressure. Any vessel in the body may be affected by atherosclerosis; however, the aorta and the coronary, carotid, and iliac arteries are most frequently affected. The process begins early in life. Therefore, physicians should obtain risk-factor profiles and a family history for children.

Coronary Artery Disease

Coronary artery disease (CAD) refers to any of the conditions that affect the coronary arteries and reduces blood flow and nutrients to the heart. It is the leading cause of death worldwide for both men and women. Atherosclerosis is the primary cause of CAD. Controlled risk factors associated with CAD include hypertension, cigarette smoking, elevated blood **lipids** (e.g., **cholesterol**, **triglyceride**), a high-fat diet (especially saturated fats and **trans-fatty acids**), physical inactivity, obesity, **diabetes**, and stress. Lifestyle changes can assist in prevention of CAD. Uncontrolled risk factors include a family history of CAD, gender (higher in males), and increasing age.

Stroke

Stroke, or a cerebrovascular accident (CVA), occurs when the brain does not receive sufficient oxygen-rich blood through blood vessels or when a blood vessel bursts. A stroke may result from blockage of the blood vessels due to a blood clot (ischemic) or from ruptures of the blood vessels (hemorrhagic bursts). Uncontrolled hypertension is a major risk factor for strokes.

Preventing CVD

The symptoms of CVD develop over many years and often do not manifest themselves until old age. Autopsies of young servicemen indicate significant accumulation of plaque and hardening of the arteries (atherosclerosis). Thus, primary prevention for CVD must begin in early childhood. Preventing premature CVD (before age 60) is crucial. Heart attacks between the ages of forty and sixty are primarily due to lifestyle factors.

Smoking, high blood cholesterol, high blood pressure, and lack of physical activity are the most serious risk factors for CVD and heart attack. Controlling one of these risk factors can help control others. For example, regular



This cross section of a coronary artery shows plaque buildup, possibly indicating coronary artery disease—the most common cause of death worldwide. Risk factors for the disease include poor diet, cigarette smoking, and stress, among others. [B&B Photos/Custom Medical Stock Photo. Reproduced by permission.]

exercise can help control cholesterol, blood pressure, weight, and stress levels. Smoking is the most preventable risk factor. Smokers have twice the risk for heart attack that nonsmokers have. Tobacco use alters the blood chemistry and increases **blood clotting**. Nearly one-fifth of all deaths are due to tobacco use, and a smoker lives an average of seven to eight fewer years than a nonsmoker.

The worldwide increase in obesity and type 2 diabetes (in both children and adults) point to a high-fat, high-calorie diet and a **sedentary** lifestyle. Poverty increases the risk for poor dietary habits and poor access to healthful foods. Many of the world's urban poor have more access to highly **processed foods**, **convenience foods**, and fast foods than to fresh fruits and vegetables. But even in the most wealthy and technologically advanced countries, the affluent are choosing to eat more fast foods and processed foods that are high in fat, cholesterol, and sodium. For optimal health, health professionals recommend:

- Maintaining a healthy weight, with a **body mass index** (BMI) of 18.5–24.9.
- Limiting dietary fat to 30 percent or less of total calories—10 percent **saturated fat**, 10 percent **polyunsaturated** fat, and 10 percent monounsaturated fats. Consumers should be aware that ounce for ounce, all sources of fat have approximately the same amounts of calories.
- Limiting saturated fats to 10 percent of calories. Saturated fats come primarily from animal sources (e.g., high-fat dairy and meats), but also are found in coconut and palm oil.

blood clotting: the process by which blood forms a solid mass to prevent uncontrolled bleeding

sedentary: not active

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

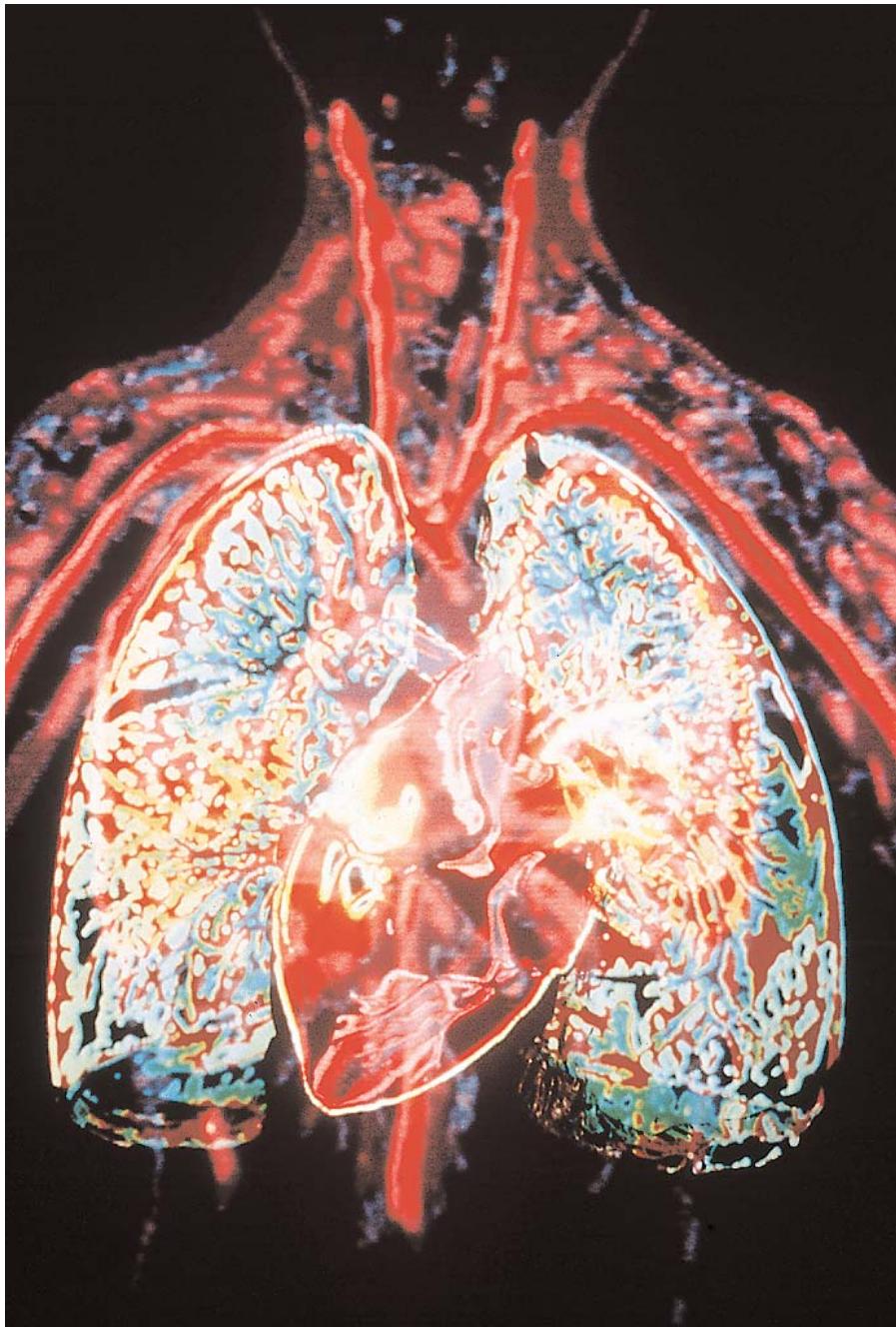
convenience food: food that requires very little preparation for eating

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

polyunsaturated: having multiple double bonds within the chemical structure, thus increasing the body's ability to metabolize it

This scan of the cardiovascular system shows the heart and lungs, with major blood vessels radiating from them. Cardiovascular diseases, which affect the pumping of the heart and the circulation of blood, are the leading cause of death in developed nations. [Photograph by Howard Sochurek. Corbis. Reproduced by permission.]



heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

fatty acids: molecules rich in carbon and hydrogen; a component of fats

- Limiting polyunsaturated fats to 10 percent of calories. Polyunsaturated fats come primarily from vegetable oils (e.g., corn oil, safflower oil).
- Limiting monounsaturated fats to 10 percent of calories. Monounsaturated fats may have a protective role in **heart disease**. Excellent sources of monounsaturated fats include olive oils, nuts, avocado, and canola oil.
- Increasing intake of omega-3 **fatty acids**. Two to four grams daily of omega-3 fatty acids may lower risk for CVD by reducing blood clotting, making platelets less sticky, and lowering triglycerides. Patients should inform their physician if they are using omega-3 supplements, since they may increase the risk of bleeding. Excellent sources of

omega-3 include fatty fish (such as salmon and sardines), fish oils, and flax seed.

- Limiting sodium intake to 2,400 milligrams per day.
- Increasing potassium intake to at least 3,500 milligrams per day.
- Eating at least five servings a day of fruits and vegetables.
- Eating a plant-based diet consisting primarily of whole grains, fruits, and vegetables is also recommended.
- Eating at least 25 grams of **fiber** daily.
- Eating 25 grams of soy **protein** daily.

In addition to diet modification, research is increasingly focused on the role of physical activity in preventing CVD. People who are not physically active have twice the risk of heart disease as those who are active. More than half of U.S. adults do not achieve recommended levels of physical activity. Studies indicate a correlation between the amount of television viewing, playing videos, and other sedentary activities and increased rates of childhood obesity. In general, the more sedentary the activities, the more high-fat and sugary foods are consumed. At least thirty minutes of moderate physical activity, five times a week, is recommended. Moderate physical activity slows down the narrowing of the blood vessels, due to contraction of the smooth muscles in the vessel walls. It also increases coronary blood flow, strengthens the heart muscles, and reduces stress.

Worldwide, HTN is linked to about 50 percent of CVDs and approximately 75 million “lost healthy life years” each year. Thus, controlling HTN may greatly reduce the risk of disability and death from CVD. Secondary prevention involves treating the signs and symptoms of CVD. These strategies include management of hypertension, cholesterol, and other blood lipids. Dietary and lifestyle modification are tried first. However, medication may also be prescribed, depending on other clinical factors. Compliance with a medication regimen is extremely important, as is the monitoring of blood pressure and blood lipids. Recommended total **serum** cholesterol should not exceed 200 milligrams per deciliter (mg/dl); low-density **lipoproteins** (LDLs or “bad cholesterol”) should not exceed 100 mg/dl, and high-density lipoproteins (HDLs or “good cholesterol”) should not be lower than 40 mg/dl.

Conclusion

Surgical intervention may restore cardiovascular function. Vessels may be opened by **angioplasty** or repaired by the use of grafts or stents, heart valves can be repaired or replaced with artificial valves, and pacemakers or **drugs** may aid heart function. A heart transplant may be an individual’s last resort. Many large-scale international studies have focused on preventing cardiovascular disease through smoking cessation, healthful eating, physical activity, hypertension and cholesterol control, health education, and media campaigns. These include the Stanford Three City, the Stanford Five City Projects, the Framingham Heart Study, the Bogalusa Heart Study, the Multiple Risk Factor Intervention Trial (MRFIT), Active Australia, the Whickham Study (based on the Framingham model), and the North Karelia Study (Finland). Small, gradual changes in diet and exercise and smoking cessation are

fiber: indigestible plant material that aids digestion by providing bulk

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

serum: noncellular portion of the blood

lipoprotein: blood protein that carries fats

angioplasty: reopening of clogged blood vessels

drugs: substances whose administration causes a significant change in the body’s function

the best way to produce long-term effects. SEE ALSO ARTERIOSCLEROSIS; ATHEROSCLEROSIS; HEART DISEASE.

Teresa Lyles

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Careers in Dietetics

nutrition: the maintenance of health through proper eating, or the study of same

clinical: related to hospitals, clinics, and patient care

diet: the total daily food intake, or the types of foods eaten

The science and profession of **nutrition** and dietetics is based on the application of foods and nutrition to promote health and treat disease. Most dietitians and nutritionists work in **clinical**, community, public health, or food service settings. Others work as consultants or researchers, in the food industry, in university, worksite, medical school, home health, or fitness center settings. Some persons work for world or regional health organizations. At least a bachelor's degree in dietetics, foods, and nutrition is needed to practice as a dietitian or a nutritionist. Dietetic technicians need an associate's degree.

Practice Roles

Clinical dietitians, also known as medical nutrition therapists, usually work in a hospital setting as generalists or specialists and as part of a health care team. This person is responsible for using **diet** to treat disease and as part

of the treatment plan. Clinical dietitians assess needs, manage the nutrition care of patients, and conduct individual or group counseling sessions. In almost all settings in the United States, a dietitian must be registered (R.D.) to practice medical nutrition therapy.

As generalists, clinical dietitians may rotate through, or work in a variety of the clinical settings, such as the medical and obstetrics areas. As specialists they have additional training. Some dietitians may also be Certified Diabetes Educators (CDE) or Certified in Nutrition Support (CNS).

Community Nutritionist refers to persons that work in community programs that are funded by governmental organizations or private groups. The terms Public Health Nutritionist and Nutrition Educator usually refer to persons that are employed by governmental health agencies. These persons do one-to-one counseling, conduct assessments, design, implement, and evaluate programs. Some are involved in the screening, surveillance or monitoring of community programs.

Dietitians involved in food service work in hospitals, schools, and **long-term care facilities**. They have responsibilities related to the day-to-day preparation and delivery of foods, food acquisition, employee supervision, and fiscal matters. Advanced-level practitioners manage program budgets, design marketing strategies, promote programs, or initiate collaborative ventures, such as a joint program with a local clinic or health club.

As nutrition has gained popularity, so have the opportunities for innovative and entrepreneurial practice. Many nontraditional areas of practice are emerging, especially in the area of consultation. Nutritionists work in mass media, rehabilitation, sports, law, marketing, pharmaceuticals, and **wellness** settings. **Entrepreneurs** participate in a variety of creative activities, such as development of materials, creation or editing of newsletters or websites, or in the use of new technologies to promote nutrition.

For example, a consulting nutritionist may work at a long-term care facility on Mondays, see individual clients at a medical clinic on Tuesdays, spend Wednesdays and Thursdays writing articles for the local newspaper, and provide “brown-bag lunch” lectures to employees of a local company on Fridays.

Academic (Didactic) and Supervised Practice Training

In the United States, preparation for the dietetic profession is a formal process. The Commission on Accreditation of Dietetics Education (CADE) has two career paths for persons who wish to be eligible to take the national Registration Examination. In the more common path, students complete a baccalaureate degree and then a supervised practice experience (**internship**). In the second path, students complete a coordinated undergraduate program (CUP), in which they work on the baccalaureate degree requirements and the supervised practice simultaneously. In either path, the student must complete academic (didactic) and supervised practice (internship) training.

Didactic training emphasizes theoretical knowledge and is generally achieved by completing a baccalaureate-level degree from a CADE-accredited program in a college or university. The supervised practice component is an internship. The student rotates through a series of preplanned learning experiences in community, clinical, food-service, and selected specialty practice

diabetes: inability to regulate level of sugar in the blood

long-term care facilities: hospitals or nursing homes in which patients remain for a long time for chronic care, rather than being treated and quickly discharged

wellness: related to health promotion

entrepreneur: founders of new businesses

internship: training program

Registered dietitians (RDs) use their expertise in food and nutrition to prevent disease and improve health through diet. RDs work at hospitals, at research institutions, for governments, and for private companies. [© 1994 SIU Biomed Comm. Custom Medical Stock Photo, Inc. Reproduced by permission.]



settings. Upon successful completion of these two elements of learning, the individual becomes eligible to take the national Registration Exam. Related professions include culinary careers (e.g., chefs) and the food sciences.

Knowledge and Skills

nutrient: dietary substance necessary for health

Nutritionists and dietitians have a basic knowledge of nutrition, **nutrient** needs throughout the life cycle, medical nutrition therapy, food service, food and consumer science, health education, and food habits and behavior. They have assessment, counseling, program design, marketing, and management skills. Some have advanced training in specialty areas such as pediatric nutrition, nutrition support, or diabetes education.

Registration and Licensure in the United States

health-promotion: related to advocacy for better health, preventive medicine, and other aspects of well-being

The terms *nutritionist* and *dietitian* are sometimes used interchangeably. In most cases a nutritionist, or nutrition educator, works in a community or **health-promotion** setting, while a dietitian works in a clinical setting. In international health and nutrition programs, the term *nutritionist* is generally used, and training, activities, and levels of responsibility can vary greatly. However, some U.S. states have licensure laws that define the requirements and scope of practice for a nutritionist. Persons who wish to practice in these states must meet the eligibility requirements to obtain a license.

Dietitians in the United States are credentialed by the profession's accrediting body, the Commission on Dietetic Registration (CDR) of the American Dietetic Association (ADA), as registered dietitians (RDs). Dietetic technicians, who assist in program service and delivery, are credentialed as dietetic technicians, registered (DTR). In some settings, such as long-term care facilities, DTRs may be responsible for day-to-day operations, with guidance from a consulting dietitian. SEE ALSO AMERICAN DIETETIC ASSOCIATION; DIETETIC TECHNICIAN, REGISTERED (DTR); DIETITIAN; NUTRITIONIST.

Judith C. Rodriguez

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Caribbean Islanders, Diet of

Travel advertisements for the Caribbean Islands portray long stretches of sun-drenched beaches and swaying palm trees, with people dancing to jazz, calypso, reggae, or meringue music. Indeed, the beauty, warmth, and lush landscapes had Christopher Columbus in awe in 1492 when he came upon these tropical islands, stretching approximately 2,600 miles between Florida and Venezuela.

European Settlement

The Arawaks and Caribs, the first natives of the islands, were not treated kindly, however, as the Spanish, French, Dutch, and British conquered the islands at different periods, all but wiping out the native populations. Today, only a few aborigines remain in the Caribbean.

The European settlers soon realized that sugarcane was a profitable crop that could be exported to the European market. However, there was a shortage of European farmers, and slaves were brought from Africa to work on the sugar plantations. The slave trade started in 1698. European settlers fought to keep their territories and hoped for great wealth, while actively pursuing the sugar and slave trades.

Two things changed the situation on the islands. In 1756, missionaries from Germany (Moravian Protestants), came to the islands, though the landowners were opposed to their presence, fearing that any education of the slaves could lead to a revolution. At about the same time a German scientist by the name of Margraf discovered that sugar could be produced from beets, and many European countries began to produce their own sugar.

In 1772, after many revolts and uprisings, the Europeans began to free their slaves. The sugar plantations still needed laborers, however, and indentured workers were brought from China and India to work in the fields. Sugar cane, and its by-products, molasses and rum, brought great prosperity to the settlers. However, not wanting to depend solely on sugar, they began to grow yams, maize, cloves, nutmeg, cinnamon, coconuts, and pineapples on a very

The ancestors of many Caribbean islanders were brought as slaves to work on the sugarcane plantations. In the New World, their traditional African cuisines integrated new flavors both from their new environment and from the cuisines of various European colonial powers.
[Catherine Karnow/ Corbis. Reproduced by permission.]



diet: the total daily food intake, or the types of foods eaten

large scale. Coffee also began to flourish. Many of the islands had wild pigs and cattle on them, and spiced, smoked meat became part of the **diet**. Today, jerk meat is a specialty.

Foods of the Islands

The foods of the Caribbean are marked by a wide variety of fruits, vegetables, meats, grains, and spices, all of which contribute to the area's unique cuisine. Foods of Creole, Chinese, African, Indian, Hispanic, and European origin blend harmoniously to produce mouth-watering dishes.

Fruits and Vegetables. There are many fruits and vegetables found in the various Caribbean Islands, and because many of them have been exported to North America and Europe, people have become familiar with them. This exotic array of fruits and vegetables in vibrant colors forms the heart of island cooking.

Chayote, also called Christophene or Cho-cho, is a firm pear-shaped squash used in soups and stews. The Chinese vegetable bokchoy (or pakchoy) has become widely used on the islands. Plantains, which resemble bananas, are roasted, sautéed, fried, and added to stews and soups. The breadfruit grows profusely, and is either boiled or baked, sliced, and eaten hot, or ground into flour. The breadfruit blossoms make a very good preserve.

Yucca, also known as cassava or manioc, is a slender **tuber** with bark-like skin and a very starchy flesh that must be cooked and served like a potato, or it can be made into cassava bread. Mangoes can be picked from the tree and eaten by peeling the skin and slicing the flesh off the large pit. They are used in salads, desserts, frozen drinks, and salsa. Papaya, which has a cantaloupe-like flavor, contains the **enzyme** papain, which aids in digestion. To be eaten, the black seeds must be removed and the flesh scooped out.

tuber: swollen plant stem below the ground

enzyme: protein responsible for carrying out reactions in a cell

The soursop is a large, oval, dark-green fruit with a thick skin that is soft to the touch when it ripens. The fruit has a creamy flesh with a sweet, tart flavor. Its rich custard-like flavor can be made into a sherbet, ice cream, or refreshing drink.

Spices and Condiments. The food of the Caribbean can be highly spiced. The Scotch bonnet, a colorful pepper with a hot aroma, is widely used in soups, salads, sauces, and marinades. Some other important spices are annatto, curry, pimento, cinnamon, and ginger. Annatto seeds are often steeped in oil and used to flavor soups, stews, and fish dishes. Curry powder is made from a variety of freshly ground spices. Curry dishes and hot sauces, which are used regularly in cooking, were brought to the islands by Indian settlers.

Pimento, also known as allspice, is used in pickles, marinades, soups, and stews and is an important ingredient in jerkling, a method of cooking meat and poultry over an open fire. To bring out the flavor of meat and chicken, they are marinated in a mixture of scallions, garlic, thyme, onion, lemon juice, and salt. The spices and the method of slow cooking over a fire give jerk meat its distinctive flavor.

Protein Sources. Although fish, conch (a pink shellfish), goat meat, pork, and beef are used throughout the Caribbean, **legumes** make up a fair percentage of the region's protein intake. Kidney and lima beans, chickpeas, lentils, black-eyed peas, and other legumes are used in soups, stews, and rice dishes. Accra fritters, made from soaked black-eyed peas that are mashed, seasoned with pepper, and then fried, is a dish of West African origin similar to the Middle Eastern falafel. Sancocho is a hearty Caribbean stew made with vegetables, tubers, and meats.

legumes: beans, peas, and related plants

Cooking Methods. A "cook-up" dish is one made with whatever ingredients an individual has on hand, and is an opportunity to be creative. Such a dish will often include rice, vegetables, and possibly meat. By adding coconut milk, this could turn into an enticing coconut-scented pilaf. Burning sugar to color stews is another technique used in island cooking. This process begins by heating oil, then adding sugar, and stirring until the sugar becomes an amber color.

The roti is a griddle-baked flour wrapping that is filled with curried meat, chicken, or potatoes. Coucou, or fungi, is a cornmeal mush that is served with meat, poultry, fish, or vegetable dishes.

Beverages and Desserts. A variety of fruit beverages are often served in the Caribbean. Beverages include green tea and "bush tea," served sweetened with sugar or honey, with or without milk. Bush tea is an infusion of tropical shrubs, grasses, and leaves that has a number of medicinal uses. People drink it as a remedy for gas, the common cold, **asthma**, **high blood pressure**, fever, and other ailments. Sweetened commercial drinks made from carrot, beet, guava, tamarind, and other fruits and vegetables are also popular.

asthma: respiratory disorder marked by wheezing, shortness of breath, and mucus production

A number of fermented drinks are also popular. *Garapina* is made from pineapple peelings, while *mauby* is made from the bark of the mauby tree. Grated ginger is used to produce ginger beer. *Horlicks* is a malted milk made with barley.

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

POPULAR DISHES OF SELECTED CARIBBEAN ISLANDS

Island	Special dishes
Antigua, Montserrat, Nevis	Fish soup, pepper pot soup (any available fish, meat, chicken, and vegetables cooked in fermented cassava juice); saltfish with avocado and eggplant
Barbados	Flying fish; jug-jug (mashed stew of pigeon peas, usually served at Christmas) Black pudding (a type of sausage made by combining cooked rice mixed with fresh pig's blood, seasoned with salt, pepper, and other condiments, and placed in thoroughly cleaned pieces of pig's intestine, and then tied on both ends and boiled in seasoned water)
Belize	Rice and chicken, tamales, conch fritters, refried beans and iswa (fresh corn tortillas)
Dominica	Tannia (coco, a starch tuber soup); mountain chicken (frog's legs)
Grenada	Callaloo (soup with green vegetables) Lambi souse (conch marinated in lime juice, hot pepper, onion); oil-down (a highly seasoned dish of coconut milk and salted fish)
Guyana	Mellagee (one-pot stew of pickled meat/fish and coconut milk with tubers and vegetables); rice treat (rice with shrimp, vegetables, and pineapple)
Jamaica	Saltfish and ackee (a fruit commonly used as a vegetable, boiled and then sautéed in oil); escoveitch fish (fried fish marinated in vinegar spices, seasoning); roasted breadfruit; asham or brown George (parched dried corn that is finely beaten in a mortar, sifted, and mixed with sugar)
St. Vincent and the Grenadines	Stewed shark
British Virgin Islands	Fish chowder, conch salad, saltfish and rice
Trinidad and Tobago	Pelau (rice with meat, fish, peas, vegetables); pakoras; kachouri; palouri (fried vegetable fritters)
Guadeloupe and Martinique	Mechoui (spit-roasted sheep); pate en pot (finely chopped sheep and lamb parts cooked into a thick, highly seasoned stew)

Fruit is eaten anytime of the day, but is not considered a dessert unless prepared in a fruit salad or some other form. Coconut and banana form the basis for many desserts. A sweet pudding that goes by many names (e.g., duckunoo, blue drawers, pain me, paimee, and konkee) is made from grated banana, plantain, or sweet potato, which is then sugared, spiced, and mixed with coconut milk or grated coconut, and then wrapped in banana leaves and boiled in spiced water. A prepared sweet pone (pudding) cake or pie is a popular dessert. Black fruitcake, made from dried fruits soaked in wine, is popular at Christmas time, and is also used for weddings and other celebrations.

Health Issues

chronic: over a long period

malnutrition: chronic lack of sufficient nutrients to maintain health

calorie: unit of food energy

In the Caribbean region, nutrition-related **chronic** diseases are common, threatening the well-being of the people of the islands. In the 1950s, the governments of the Caribbean were concerned about the **malnutrition** that permeated the region. They were able to increase the protein and **calorie** needs by making meat, fats, oils, and refined sugar more available. The health and nutrition initiatives introduced helped curbed the malnutrition, but new and related health and nutrition problems began to emerge.

The health administrators of the Caribbean region are concerned with the rise of iron-deficiency **anemia** in pregnant women and school-aged children due to inadequate iron intake and poor **absorption**. The increased **incidence** of **diabetes**, **hypertension**, **coronary heart disease**, **cancer**, and **obesity**, especially in the thirty-five-and-over age group, is thought to be directly linked to the existing lifestyle and dietary practices of the islanders.

The Caribbean Islands have seen a proliferation of **fast-food** restaurants, and the increased consumption of meals high in **fat**, sugar, and salt has contributed to the increase in chronic diseases. In addition, there has been a reduction in the amount of cereals, grains, fruits, vegetables, tubers, and legumes that are eaten. The popularity of fast foods among the young has led the government to focus on improving nutrition in the schools. Also contributing to the health problems is the dependency on costly imported **processed foods** that do the body harm. Overconsumption of imported foods high in fat and sodium has led to a deterioration of the health status of people throughout the region, with an increase in health problems such as obesity, diabetes, hypertension, **cardiovascular** disease, and cancer.

Innovative Programs

Due to insufficient resources and less than adequate planning, the school feeding programs on most of the islands exhibit many shortcomings. However, on the island of Dominica, where a self-help initiative involving the parents was introduced, the eating habits of school-aged children improved and the parents and communities adopted many of the program's menus and preparation methods. As a result, school attendance increased and the attention span of the children in class improved.

School nutrition programs need constant monitoring to improve the nutritional status of the children involved. Furthermore, a good nutrition promotion campaign must be designed to educate and promote a healthy lifestyle for the population at large.

The Caribbean region has the tremendous task of putting in place appropriate policies, plans, and programs to address the changing health and disease patterns of the region's people. This effort is made more difficult because of the socioeconomic, political, and cultural differences among the Caribbean countries. The various countries must not only examine the food availability and how it is consumed, but they must also assess and evaluate the quality of the food and the nutrition intake of those most at risk.

The Caribbean Food and Nutrition Institute (CFNI), established in 1967, aims to improve the food and nutrition status in member countries, which include Anguilla, Antigua, Bahamas, Barbados, Belize, the British Virgin Islands, Cayman Islands, Dominica, Grenada, Guyana, Jamaica, Montserrat, St. Christopher-Nevis, St. Lucia, St. Vincent, Suriname, Trinidad and Tobago, and Turks and Caicos Islands.

The governments of the Caribbean have come together under an initiative called Caribbean Cooperation in Health. They hope to work closely together through five types of activities: service, education training, providing information, coordination, and research. The food goals of each country must be analyzed, with care and attention paid to the agricultural policies and economic opportunities in each specific country.

anemia: low level of red blood cells in the blood

absorption: uptake by the digestive tract

incidence: number of new cases reported each year

diabetes: inability to regulate level of sugar in the blood

hypertension: high blood pressure

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

cancer: uncontrolled cell growth

obesity: the condition of being overweight, according to established norms based on sex, age, and height

fast-food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

fat: type of food molecule rich in carbon and hydrogen, with high energy content

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

cardiovascular: related to the heart and circulatory system

Forming Healthy Communities

Desiring a longer and richer quality of life, many governments of the Caribbean Islands have introduced programs to combat chronic diseases and promote a more physically active lifestyle. For example, in Grenada, a campaign to “grow what you eat and eat what you grow” demonstrates a move to increase consumption of local foods.

nutrient: dietary substance necessary for health

Adequate nutrition cannot be achieved without the consumption of sufficient foods containing a wide array of **nutrients**. Poor health status, whether as a result of insufficient food intake, overconsumption, or nutrition imbalance, threatens longevity and increases health care costs. The challenge is to improve the availability of nutritious foods and the eating habits of the varied population. SEE ALSO AFRICANS, DIETS OF; AFRICAN AMERICANS, DIET OF; DIETARY TRENDS, INTERNATIONAL; FAST FOODS.

Paulette Sinclair-Weir

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Internet Resource

Pan American Health Organization. <<http://www.paho.org>>

carotenoid: plant-derived molecules used as pigments

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

cancer: uncontrolled cell growth

macular degeneration: death of cells of the macula, part of the eye's retina

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

artery: blood vessel that carries blood away from the heart toward the body tissues

Carotenoids

Carotenoids are a group of red and yellow fat-soluble compounds that pigment different types of plants, such as flowers, citrus fruits, tomatoes, and carrots, as well as animals, such as salmon, flamingos, and goldfish. The ingestion of carotenoids is essential to human health, not only because some convert into Vitamin A, but also because they have **antioxidant** effects, which may combat such diverse problems as **cancer** and **macular degeneration**. Carotenoids also help prevent **heart disease** by inhibiting low-density lipoprotein (LDL) **cholesterol** (the “bad” cholesterol) from sticking to **artery** walls and creating plaques.

Up to one-third of the Vitamin A consumed by humans comes from the conversion of alpha-carotene and beta-carotene, the two most active of the over 600 carotenoids that have been identified. These two compounds combat early cancers, regulate the **immune system**, and maintain the integrity of the skin, lungs, liver, and urinary tract, among other organs. Food sources include eggs, liver, milk, spinach, and mangos.

Lycopene is a carotenoid that offers protection to the **prostate** and the **intestines**. It has also been associated with a decreased risk of lung cancer. Found in tomatoes, it remains intact despite the processing involved in making ketchup and tomato paste. The carotenoids lutein and zeaxanthin seem to aid in the prevention of **cataracts** and macular degeneration, and can be found in spinach and collard greens. SEE ALSO ANTIOXIDANTS; BETA-CAROTENE; VITAMINS, FAT-SOLUBLE.

Chandak Ghosh

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immune system: the set of organs and cells, including white blood cells, that protect the body from infection

prostate: male gland surrounding the urethra that contributes fluid to the semen

intestines: the two long tubes that carry out the bulk of the processes of digestion

cataract: clouding of the lens of the eye

Central Americans and Mexicans, Diets of

The diets of peoples in Mexico and Central America (Guatemala, Nicaragua, Honduras, El Salvador, Belize, and Costa Rica) have several commonalities, though within the region great differences in methods of preparation and in local recipes exist. The basis of the traditional **diet** in this part of the world is corn (maize) and beans, with the addition of meat, animal products, local fruits, and vegetables. As in other parts of the world, the diet of people in this area has expanded to include more **processed foods**. In many parts of Mexico and Central America, access to a variety of foods remains limited, and **undernutrition**, particularly among children, is a major problem. Although access to an increased variety of foods can improve the adequacy of both **macronutrient** and **micronutrient** status, there is evidence that the use of processed foods is contributing to the rapidly increasing **prevalence** of **obesity** and diet-related **chronic** diseases such as **diabetes**.

Traditional Dietary Habits

The central staple in the region is maize, which is generally ground and treated with lime and then pressed into flat cakes called *tortillas*. In Mexico and Guatemala, these are flat and thin, while in other Central American countries tortillas are thicker. In El Salvador, for example, small, thick cakes of maize, filled with meat, cheese, or beans, are called *pupusas*. Maize is also used in a variety of other preparations, including tacos, tamales, and a thin gruel called *atole*. The complementary staple in the region is beans (*frijoles*), most commonly black or pinto beans. Rice is also widely used, particularly

diet: the total daily food intake, or the types of foods eaten

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

macronutrient: nutrient needed in large quantities

micronutrient: nutrient needed in very small quantities

prevalence: describing the number of cases in a population at any one time

obesity: the condition of being overweight, according to established norms based on sex, age, and height

chronic: over a long period

diabetes: inability to regulate level of sugar in the blood

atole: a porridge made of corn meal and milk

A Tzotzil mother makes tortillas with her daughters. The Tzotzil live in Chiapas, Mexico, near Guatemala. Central Americans traditionally have simple diets that depend on corn, beans, and local fruits and vegetables. [© Corbis. Reproduced by permission.]



in the southernmost countries, such as El Salvador, Honduras, Nicaragua, and Costa Rica. Historically, major changes in the traditional diet occurred during colonial times, when the Spaniards and others introduced the region to wheat bread, dairy products, and sugar. Wheat is commonly consumed in the form of white rolls or sweet rolls, or, in the northern part of Mexico, as a flour-based tortilla. Noodles (*fideos*), served in soups or mixed with vegetables, have also become popular.

The consumption of meat and animal products, although popular, is often limited due to their cost. Beef, pork, chicken, fish, and eggs are all used. Traditional cheeses are prepared locally throughout the region as *queso del país*, a mild, soft, white cheese, and milk is regularly used in *café con leche* and with cereal gruels.

Commonly Used Fruits and Vegetables

The region is a rich source of a variety of fruits and vegetables. Best known among these are the chile peppers, tomatoes, and tomatillos that are used in the salsas of Mexico. Avocado is also very popular in Mexican and Central American cuisines. Other commonly used vegetables include *calabaza* (pumpkin), carrots, plantains, onions, locally grown greens, and cacti. Fruits are seasonal but abundant in the rural areas and include guavas, papayas, mangoes, melons, pineapples, bananas, oranges, and limes, as well as less-known local fruits such as *nances*, *mamey*, and *tunas* (prickly pears from cacti). Traditional drinks (*frescos*, *chichas*, or *liquados*) are made with fruit, water, and sugar.

Methods of Cooking

The traditional preparation of maize involves boiling and soaking dried maize in a lime-water solution and then grinding it to form a soft dough called *masa*. Soaking in lime softens the maize and is an important source of calcium in the diet. The masa is shaped and cooked on a flat metal or

cuisine: types of food and traditions of preparation

calcium: mineral essential for bones and teeth

clay surface over an open fire. In some areas, lard or margarine, milk, cheese, and/or baking powder may be added to the tortilla during preparation. Beans are generally boiled with seasonings such as onion, garlic, and sometimes tomato or chile peppers. They are served either in a soupy liquid or are “refried” with lard or oil into a drier, and higher **fat**, preparation.

Meat, poultry, and fish are commonly prepared in local variations of thin soup (*caldo* or *sopa*), or thicker soups or stews (*cocido*) with vegetables. In Mexico and Guatemala, grilled meats are cut into pieces and eaten directly on corn tortillas as tacos.

These are often served with a variety of salsas based on tomato or tomatillo with onion, chile, coriander leaves (cilantro), and other local seasonings. Tamales are made with corn (or corn and rice) dough that is stuffed with chicken and vegetables. The tamales are steamed after being wrapped in banana leaves. Salvadorian *pupusas* are toasted tortillas filled with cheese, beans, or pork rind eaten with coleslaw and a special hot sauce.

Central American and Mexican Dishes

Beyond the basic **staples**, the cuisine of Mexico and Central America is rich with many regional variations. The tortilla-based Mexican preparations familiar in the United States are generally simpler in form in Mexico. *Tacos* are generally made with meat, chicken, or fish grilled or fried with seasoning and served on tortillas; *enchiladas* are filled tortillas dipped in a chile-based sauce and fried; and *tostadas* are fried tortillas topped with refried beans or meat, and sometimes with vegetables and cream. *Chiles rellenos* are made with the large and sweet chile *poblano* and filled with ground meat. Examples of specialty dishes include *mole*, a sauce made with chocolate, chile, and spices and served over chicken, beef, or enchiladas; and *ceviche*, raw marinated fish or seafood made along the coast throughout Central America and Mexico.

Nutritional Benefits

The staple diet of the region—corn and beans, supplemented with meat, dairy products, and local fruit and vegetables—is nutritionally complete and well suited to a healthful lifestyle. The proper combination of tortilla and beans provides an excellent complement of **amino acids**, thus supplying the necessary amount of complex **protein**. The process of liming the maize makes the calcium and the **niacin** in the tortilla more bioavailable, and this food is a major source of these **nutrients**. In addition, the traditional preparation of tortillas with a hand mill and grinding stones appears to add **iron** and **zinc** to the tortilla. Beans are excellent sources of **B vitamins**, magnesium, **folate**, and **fiber**. The tomato and chile-based salsas, along with several of the tropical fruits such as limes and oranges are important sources of vitamin C, and the variety of vegetables and yellow fruits such as papaya, melon, and mango provide excellent sources of **carotenoids**, which are precursors of vitamin A.

Nutritional Limitations

Unfortunately, limited financial access to this variety of foods for many people in Central America and Mexico means that the diet often does not include sufficient levels of **vitamins** and **minerals**. For low-income groups,

fat: type of food molecule rich in carbon and hydrogen, with high energy content

staples: essential foods in the diet

amino acid: building block of proteins, necessary dietary nutrient

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

niacin: one of the B vitamins, required for energy production in the cell

nutrient: dietary substance necessary for health

iron: nutrient needed for red blood cell formation

zinc: mineral necessary for many enzyme processes

B vitamins: a group of vitamins important in cell energy processes

folate: one of the B vitamins, also called folic acid

fiber: indigestible plant material which aids digestion by providing bulk

carotenoid: plant-derived molecules used as pigments

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion or compound

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

Americanized: having adopted more American habits or characteristics

nutrition: the maintenance of health through proper eating, or the study of same

globalization: development of worldwide economic system

diversity: the variety of cultural traditions within a larger culture

lack of access to animal products contributes to deficiencies in iron, zinc, vitamin A, and other nutrients. When animal products are included, there has been a tendency to choose high-fat products such as sausage and fried pork rinds (*chicharrón*). The use of lard and a preference for fried foods also contributes to high intakes of **saturated fat** and **cholesterol** among subsets of the population.

Influence of Central American and Mexican Culture

As two cultures intermingle, foods and preparations from each tend to infiltrate the other. This is clearly the case near the U.S.-Mexican border, where Mexican immigrants and return immigrants have incorporated foods from U.S. diets into their traditional diets. The result has been a modified form of Mexican cuisine popularly known as “Tex-Mex.” Beyond the border, this **Americanized** version of popular Mexican foods has spread throughout the United States through the popularity of Mexican restaurants. In the United States, tacos and tostadas tend to have less Mexican seasoning, but include lettuce and shredded processed cheese. Flour, rather than corn, tortillas are more widely used along the border. Many foods, such as soups and chiles, prepared along the border have become known for their spicy hotness, due to the Mexican-influenced use of chiles and chile powder.

Changes in Dietary Practices

Throughout the world, the diets of traditional cultures have experienced what has been called the “**nutrition transition**,” particularly during the last few decades of the twentieth century. In Mexico and Central America, as elsewhere, this transition has been fueled by **globalization** and urbanization. Major dietary changes include an increased use of animal products and processed foods that include large amounts of sugar, refined flour, and hydrogenated fats. At the same time, a decline in the intake of whole grains, fruit, and vegetables has been documented. While the increased variety has improved micronutrient status for many low-income groups, the inclusion of more animal fat and refined foods has contributed to a rapid increase in obesity and chronic disease throughout the region.

These changes are more evident among immigrants to the United States, where adoption of U.S. products has been shown to have both positive and negative impacts on nutritional status. Studies that compared diets of Mexican residents to newly arrived Mexican-American immigrants and to second-generation Mexican Americans have documented both nutritionally positive and negative changes with acculturation. On the positive side, acculturated Mexican Americans consume less lard and somewhat more fruit, vegetables, and milk than either newly arrived immigrants or Mexican residents. On the negative side, they also consume less tortilla, beans, soups, stews, gruels, and fruit-based drinks, with greater use of meat, sweetened ready-to-eat breakfast cereals, soft drinks, candy, cakes, ice cream, snack chips, and salad dressings.

Conclusion

The traditional diet of Mexico and Central America is based on corn and beans, but offers a wide **diversity** of preparations. Coupled with locally available fruits, vegetables, meat and dairy products, the diet can be highly nutritious. However, poverty frequently limits access to an adequate variety of

quality foods, resulting in **malnutrition**. At the same time, the increasing use of processed foods is contributing to obesity, diabetes, and other chronic conditions in this region. The balance between improving access to variety and maintaining dietary quality poses a challenge for public health. SEE ALSO HISPANICS AND LATINOS, DIET OF; SOUTH AMERICANS, DIET OF.

Katherine L. Tucker

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malnutrition: chronic lack of sufficient nutrients to maintain health

Central Europeans and Russians, Diets of

A health gap separates Central and Eastern Europe from the United States, Canada, Japan, and the Western part of Europe. This East-West gap in health started during the 1960s. Almost half of this gap was due to **cardiovascular** disease (CVD) mortality differentials. There has been a marked increase of CVD in Central and Eastern Europe, which is only partially explainable by the high **prevalence** of the three traditional CVD risk factors (**hypercholesterolemia**, **hypertension**, and smoking) in these countries. There is an extreme nonhomogeneity of the former Soviet bloc, and the data from each country must be analyzed individually. The aim here is to present the latest available data, which show the health status of various regions of postcommunist Europe. All data used are taken from the World Health Organization (WHO) Health for All Database (as updated in June 2003). The last available data from most countries are from the year 2002.

As premature mortality was considered the most important information, the standardized death rate (SDR) for the age interval 0–64 years was used (SDR is the age-standardized death rate calculated using the direct method; it represents what the crude death rate would have been if the population had the same age distribution as the standard European population).

Central Europe (Poland, Hungary, Czech Republic, Slovakia)

Total, CVD and **cancer** mortality in Central Europe was relatively low at the beginning of the 1960s, but then an increase occurred. While the differences in 1970 between the nations of the European Union (EU) and the

cardiovascular: related to the heart and circulatory system

prevalence: describing the number of cases in a population at any one time

hypercholesterolemia: high levels of cholesterol in the blood

hypertension: high blood pressure

cancer: uncontrolled cell growth

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

Central European communist countries were not great, from the mid-1970s on, the relative trends in CVD mortality in EU countries and Central Europe showed a marked change: mortality in Central Europe increased, whereas in EU countries it decreased steadily. Between 1985 and 1990, the male CVD mortality in Central Europe was more than two times higher than in EU countries. A substantial proportion of this divergence was attributable to ischemic **heart disease**. After the collapse of Communism, however, a decrease in CVD mortality in Central Europe was observed.

The Former Soviet Union (Russian Federation)

The most significant changes in CVD mortality have been observed in the region of the former Soviet Union (USSR). Between the years 1980 and 1990, male premature mortality was relatively stable in all regions of the USSR, and two to three times higher than in EU nations, or average. After the collapse of the USSR, CVD mortality began to rise dramatically in all the new independent states within the territory of the former USSR. In 1994 the male CVD mortality in Russia and Latvia was more than five times higher than the EU average. Women in these countries have been affected to almost the same degree as men, and the CVD mortality trends were strongest among young adults and middle-aged individuals. Cancer mortality was stable during this period, however. In 1994 the life expectancy of Russian men was almost twenty years less than that of men in Japan and some European countries. After 1994, however, there was a sudden drop in mortality both in males and females, followed by a further increase.

Lifestyle and Nutrition

Communist period (1970–1989). The socioeconomic situation in the democratic part of Europe and in the United States after World War II was substantially different than that in the Soviet bloc. The United States and the European democratic states were prosperous countries with effective economies and a rich variety of all kinds of foods. The communist states, however, had ineffective centralized economies and lower standards of living. The amount of various foods, especially foods of animal origin, was almost always insufficient in the USSR and the majority of its satellite countries. Data on food consumption compiled by the Food and Agricultural Organization (FAO) confirm that meat consumption was, between 1961 and 1990, substantially lower in the USSR, Poland, Romania, and Bulgaria than in Western Europe or the United States. Similarly, the consumption of milk and butter in Bulgaria, Hungary, and Romania was significantly lower in comparison with Western and Northern Europe.

The increase of CVD mortality within the Soviet bloc seems to be only partially associated with a high prevalence of traditional risk factors. Efforts to apply the experience gained from successful preventive projects in Finland or the United States without analyzing the specificity of risk factors in this region, could lead to an incorrect formulation of priorities when determining preventive measures. The contribution of physical activity remains an open issue, but due to technical backwardness (lower number of cars, lower mechanization, etc.), the physical activity of people working in industry, agriculture, and services was generally higher in Eastern Europe than in the West.



The life-expectancy of Russians dropped sharply during the 1990s. Poor nutrition contributed to higher mortality rates, as did high rates of alcoholism. [Photograph by Alexander Nemenov. AFP/Getty Images. Reproduced by permission.]

Some authors believe that economic conditions were the principal determinant of the gap in health status between the East and West. The close relationship between the gross national product per capita and life expectancy is well known, but the inhabitants of Central Europe were less healthy than their wealth predicted. The dramatic changes that occurred after the onset of communism created a toxic psychosocial environment. A loss of personal perspectives, **chronic stress**, tension, anger, hostility, social isolation, frustration, hopelessness, and apathy led to a lowered interest in health and to a very high **incidence** of alcoholism and suicide. People living for many decades in the informationally polluted environment rejected even useful health education.

It is widely believed that chronic stress can aggravate the development of chronic diseases. However, the reasons for the high cancer and CVD mortality in Eastern Europe are (with the significant exception of male smoking) not yet known. It is possible that in communist countries the effect of traditional risk factors has been intensified unidentified factors. Hypothetically, such factors can comprise psychosocial disorders, alcoholism, environmental pollution and specific **nutritional deficiencies** (e.g., very low intake of **antioxidant vitamins**, folic acid, and bioflavonoids). Very low blood levels of antioxidants, especially of vitamin C and selenium, were found in various regions of Central and Eastern Europe between 1970 and 1990.

Postcommunist period (after 1989). Thanks to its geographical location, Central Europe was best prepared for the democratic changes that occurred after 1989. After the collapse of communism, the decrease in CVD mortality in politically and economically more consolidated countries occurred. The positive changes in Central European countries can be explained by higher consumption of healthful food, including a substantial increase in the consumption of fruit and vegetables, a decrease in butter and fatty milk consumption, and an increase in the consumption of vegetable oils and

chronic: over a long period

stress: heightened state of nervousness or unease

incidence: number of new cases reported each year

nutritional deficiency: lack of adequate nutrients in the diet

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

**MALE AND FEMALE LIFE EXPECTANCY AT BIRTH IN EUROPE
DURING 2000 AND 2001**

Country	Males	Females
Russia	59.1	72.3
Ukraine	62.3	73.6
Hungary	68.3	76.8
Romania	67.7	75.0
Bulgaria	68.6	75.4
Poland	70.3	78.5
Slovakia	69.7	77.7
Czech Republic	72.1	78.7
Portugal	72.6	79.7
Spain	75.2	82.4
United Kingdom	75.7	80.5
Germany	75.2	81.3
Italy	76.2	82.6
Sweden	77.5	82.3
Switzerland	77.0	82.8
France	75.2	82.8

SOURCE: World Health Organization

high-quality margarines. There was also a rapid improvement in the availability and quality of modern CVD health care.

plasma: the fluid portion of the blood, distinct from the cellular portion

free radical: highly reactive molecular fragment, which can damage cells

Finnish and Russian epidemiologists compared the **plasma** ascorbic-acid concentrations among men in North Karelia (Finland) and in the neighboring Russian district. Almost all Russian men had levels suggesting a severe vitamin C deficiency, while more than 95 percent Finns had normal vitamin C levels. Comparison of fifty-year-old men in Sweden and Lithuania found significantly lower plasma concentrations of some antioxidant vitamins (beta-carotene, lycopene, gamma-tocopherol) in Lithuanian men. They also had substantially lowered resistance of low-density lipoprotein to oxidation than Swedish men. It is probable that in Russia an imbalance arose in which factors enhancing the production of **free radicals** (alcoholism, smoking, and pollution) dominated protective antioxidant factors.

High prevalence of smoking and alcoholism has also been an important factor in high CVD mortality rates in Russia. A substantial proportion of CVD deaths in Russia, particularly in the younger age groups, have been sudden deaths due to cardiomyopathies related to alcoholism. Alcoholism has evidently played a key role in the extremely high incidence of CVD mortality, as well as in the numbers of accidents, injuries, suicides, and murders. There is no way to determine a reliable estimation of the actual consumption of alcohol in Russia, since alcohol is being smuggled into the country on a large scale.

Normalization in the Russian Federation will likely be more difficult than in Central Europe. Trends in lifestyle, smoking, food selection, alcohol consumption, and other areas will be determined by both economic and political factors. The successfulness of the economic transformation, which provides hope for a sensible life, will be a key factor in improving health status in postcommunist countries. A significant decrease in cardiovascular and cancer mortality in Central Europe provides hope for the Russian Federation. Unfortunately, differences in life expectancy between these countries and Western Europe are still very great.

Emil Ginther

Internet Resource

World Health Organization. "Health for All Database: Mortality Indicators by Cause, Age, and Sex." Available from <<http://www.euro.who.int/hfadb>>

Childhood Obesity

There have always been **overweight** children. Historically, chubby babies and toddlers were more likely to survive infections and contagious diseases, and overweight children and family members were often signs of affluence and financial security in a community. Thus, in some cultures, overweight was a valued body type.

Today, being overweight puts a child at risk of developing **chronic** diseases such as **type II diabetes**, **hypertension**, and high **cholesterol** levels. **Obesity** can promote degenerative joint disease, which will result in painful knees, hips, feet, and back, and it can severely limit physical activity. These are health concerns previously seen only in adults, usually in those over age forty. Obesity can be measured using a tool called **body mass index** (BMI). The BMI of an individual can be derived from tables or calculated using a formula (weight in kilograms divided by height in meters squared). In the year 2000, the U.S. Centers for Disease Control and Prevention (CDC) released updated growth charts incorporating BMI percentiles for children, beginning with children two years of age and extending the curves to age twenty. Using these gender-specific graphs, children, adolescents, and young adults are at risk for overweight at the 85th through 89.9th percentiles and are classified as overweight at the 95th percentile or greater. Using this criteria, children and teens are not labeled "**obese**"; technically, they are only "at risk of overweight" or "overweight." In much of the scientific literature, however, the terms are used interchangeably.

Nutritionists and researchers have been tracking data that clearly shows an increasing trend of overweight children in the United States. Monitoring the proportion of overweight children was identified as one of the ten leading health indicators in Healthy People 2010. All ethnic, racial, gender, and age groups have shown increases. For example, in the 1963–1970 National Health Examination Survey (NHES), the **prevalence** of overweight among white six to eleven years old was 5.1 percent and 5.3 percent for African-American girls of the same age. The prevalence of overweight in this same age group doubled for white girls (10.2%) and tripled for African-American girls (16.2%) in the 1988–1991 National Health and Nutrition Examination Survey (NHANES III). Preliminary data from 1999 NHANES suggests that the percentage of overweight children has continued to increase in recent years. It is estimated that 13 percent of children ages six to eleven years and 14 percent of adolescents ages twelve to nineteen years are overweight. This represents a 2-3 percentage point increase from NHANES III.

African-American and Hispanic teens are more likely to be at risk or overweight than white or Asian adolescents. Combined data from nine large studies (including NHANES II and NHANES III) of 66,772 children between five to seventeen years old indicates that the highest percentage of overweight exists among Hispanic boys and African-American and Hispanic girls.

overweight: weight above the accepted norm based on height, sex, and age

chronic: over a long period

type II diabetes: inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

hypertension: high blood pressure

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

obesity: the condition of being overweight, according to established norms based on sex, age, and height

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

obese: above accepted standards of weight for sex, height, and age

prevalence: describing the number of cases in a population at any one time



The National Institutes of Health have declared childhood obesity an epidemic in the United States. As with adults, the primary causes of children's obesity are too many calories and not enough exercise. Healthier meals and frequent physical activity are the proper method of prevention. [© Larry Williams/Corbis.]

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Studies also show an increase in overweight rates among Native American children between 1970 and 2000. Second- and third-generation Asian-American children are more likely to be overweight, and certain Asian-American and Pacific Islander groups (Pacific Islanders, Koreans, Asian Indians) are noted to have higher overweight risks than other Asian Americans.

According to Dr. Mikael Fogelholm (at the May 2003 European Conference on Obesity), "the prevalence of obesity among adolescents worldwide has increased more rapidly than in middle-age adults." Outside the United States, obesity rates range from 2 percent in some developing countries to as high as 80 percent on remote Pacific Islands. In the United States, one child in four is now classified as overweight or at risk for becoming overweight. It is generally agreed that the longer and more overweight a child is, the more likely it is that the condition will continue into adulthood. Predisposing factors are complex and include a mix of **genetic**, social, cultural, environmental, and lifestyle factors.

Statistics show that a child with two obese parents has an 80 percent risk of becoming overweight, a child with only one obese parent has a 40 percent risk, and a child with normal weight parents has a 7 percent risk of becoming overweight. Twins who were adopted by different families were found to be more similar in weight to the **biological** parents than to their adoptive parents. Although the exact cause is still unknown, prenatal factors such as maternal obesity, excess pregnancy weight gain, and **diabetes** may also predispose a child to becoming overweight.

Other risk factors include meal patterns (e.g., skipping breakfast, meals and snacks eaten outside of the home, infrequent family dinners), unhealthy dietary intake (e.g., high **fat** intake, low intake of fruit and vegetables, **fast-food** meals, low **fiber** intake, high soft-drink intake), psychosocial factors such as acculturation and parenting style, and declining rates of physical activity. Based on data from NHANES II and III, among children twelve to seventeen years of age the prevalence of overweight increases 2 percent for each additional hour of TV viewed daily.

Prevention is the best treatment. Restricting **calories** can lead to stunted growth, adversely affect bone density, and even lead to eating disorders. Intervention strategies should involve the family and focus on permanent lifestyle changes under the supervision of a primary care physician or a registered dietitian. Parents can begin by limiting dining out to special occasions and by making time to enjoy regular meals at home together as a family. Time involved in **sedentary** activities such as playing video games or using the computer should be monitored and supervised, and the whole family should be encouraged to participate in thirty to sixty minutes of vigorous activity each day. To be successful, the entire family must be willing and ready to institute the many gradual, permanent changes needed.

Pharmacological and surgical treatments are associated with long-term risks and serious complications, and they constitute, at best, a last resort for severely overweight adolescents. Prolonged weight maintenance is recommended for many overweight children and allows a gradual decline in BMI as the child grows in height. However, if medical complications related to obesity already exist (**sleep apnea**, hypertension, **dyslipidemia** and orthopedic problems) weight loss of approximately one pound per month is rec-

genetic: inherited or related to the genes

biological: related to living organisms

diabetes: inability to regulate level of sugar in the blood

fat: type of food molecule rich in carbon and hydrogen, with high energy content

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

fiber: indigestible plant material that aids digestion by providing bulk

calorie: unit of food energy

sedentary: not active

sleep apnea: difficulty breathing while sleeping

dyslipidemia: disorder of fat metabolism

ommended. SEE ALSO EATING DISORDERS; EATING DISTURBANCES; OBESITY; SCHOOL-AGED CHILDREN, DIET OF.

Nadine Pazder

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College Students, Diets of

When students first enter college, their diets often deteriorate and they often gain weight. There are many factors responsible for these changes. However, there are also several actions that can be taken to avoid the weight gain and decline in **diet** quality that may occur during the college years.

The term "freshman 15" refers to the number of pounds many students gain during their first year in college. This weight gain is related to **stress**, a **sedentary** lifestyle, and changes in food intake and diet patterns, and it is not unique to American college students—international students attending American universities become heavier, too.

Meal and Snack Patterns and Serving Sizes

Meals are often skipped by college students, and management of weight and food intake is often nonexistent or disordered. Class and work schedules change daily, as well as every semester. However, structured eating patterns help students' academic performance. A study by Mickey Trockel, Michael Barnes, and Dennis Eggett, for example, found a positive relationship between eating breakfast and first-year college students' grade-point averages.

Lifestyle changes, peer pressure, limited finances, and access to food also contribute to erratic eating patterns. College students have little variety in their diet and often turn to high-fat snacks. A common error is underestimating serving sizes, meaning they often eat more than they think they are eating.

Food and Nutrient Intakes of College Students

Of the three nutrients that provide **calories** (**carbohydrates**, **proteins**, and fats), carbohydrate (particularly sugar) and fat intake often exceeds recommended levels. College students also tend to have a low intake of dietary **fiber**,

diet: the total daily food intake, or the types of foods eaten

stress: heightened state of nervousness or unease

sedentary: not active

calorie: unit of food energy

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

fiber: indigestible plant material that aids digestion by providing bulk



Irregular class schedules, part-time jobs, and variable homework loads can disrupt normal eating patterns among college students, leading to unhealthy habits that may be hard to break. Despite these difficulties, it is important for students to find time for nutritious and varied foods. [AP/Wide World Photos. Reproduced by permission.]

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

calcium: mineral essential for bones and teeth

iron: nutrient needed for red blood cell formation

zinc: mineral necessary for many enzyme processes

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

which is important for intestinal health. In terms of **vitamins**, a low vitamin C status has been associated with college students' low intake of fruits and vegetables (with levels of vitamin C being even lower among smokers). In terms of **minerals, calcium, iron, and zinc** intake are low, while sodium intake is generally higher than recommended.

Male college students are more likely to meet dietary intake recommendations for the meat, poultry, fish, dry beans, and nuts group; from the bread, cereal, rice, and pasta group; and from the vegetable food group than are females. Males seem to consume more food overall, and thus have a higher **energy** (calorie) intake. Female college students tend to eat too few breads, grains, and dairy products. In addition, it is estimated that about 10 percent of college students drink more than fifteen alcoholic beverages per week, further impairing the quality of their diet.

Eating disorders such as **anorexia** and **bulimia** are more prevalent among college females than among the general population. This is related

to body image dissatisfaction—females that are underweight, as measured by their **body mass index** (BMI), sometimes consider themselves to be **overweight**. The **incidence** of anorexia and bulimia may increase when there is excessive preoccupation with weight, academic achievement, body image, and eating, as well as during stressful periods, such as final exams.

The **prevalence** of disordered eating is especially high among female athletes. College athletes may manipulate diet and fluid intake, putting their health at risk. They may also jeopardize their health by taking dangerous or excessive amounts of supplements as a result of misinformation, or of pressure from coaches or peers. Athletes may feel pressured to restrict their food intake if they are on an athletic scholarship or competing in weight-classification sports such as wrestling. Female athletes may be underweight or have an extremely low amount of body fat. The *female athlete triad* (disordered eating, **amenorrhea**, and **osteoporosis**) is estimated to occur in 15 to 62 percent of female college athletes.

Recommendations for Improvement

There are many actions that college students can take to eat in a healthful way and enjoy their college years without jeopardizing their health from excessive weight gain or weight loss. Among some recommendations are:

- Get at least eight hours of sleep a night. Lack of sleep affects one's ability to concentrate and makes one feel tired. Sleep deprivation also seems to be connected with weight problems.
- Avoid skipping meals. When a meal is skipped, the subsequent hunger may cause one to overeat.
- Eat breakfast, which helps concentration and increases the likelihood of consuming calcium, folic acid, and vitamin C. These nutrients are often low in the diet of college students.
- Manage portion sizes. If portion sizes are underestimated, one may eat more calories than are needed. Also, the availability of a wide variety and mass quantities of "dorm" food (pizza, soda, etc.) may promote overeating and a significant increase of total energy intake.
- Drink water and eat fruit throughout the day. Water is calorie-free and fruits help manage urges to eat and contribute fiber, vitamins, and minerals.
- Exercise regularly. Physical activity helps burn off calories, helps manage stress, and promotes mental and physical stamina.
- Become familiar with the campus **environment** and the foods that are available. Most colleges and universities have a variety of eateries, each with a different format, theme, and food options.
- Try the low-calorie, low-fat, and vegetarian options available around campus. As part of a well-planned diet, these items can help manage total energy intake and introduce one to items that can become part of a regular diet.
- Keep low-fat and low-calorie snacks in the dorm room. This will help manage calorie intake when snacking, especially when eating late at night.

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purgung)

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

overweight: weight above the accepted norm based on height, sex, and age

incidence: number of new cases reported each year

prevalence: describing the number of cases in a population at any one time

amenorrhea: lack of menstruation

osteoporosis: weakening of the bone structure

environment: surroundings

Most universities offer a variety of meal plans. Students who take the time to acquaint themselves with the various foods available around campus, and who strive for nutritional balance, may find their academic performance improves along with their physical health. [AP/Wide World Photos. Reproduced by permission.]



Many universities have required or optional meal plans, which provide access to campus food for a flat rate paid either by semester or academic year. Per meal, these plans are a good value and provide access to a regular food resource. Among the things to consider are the hours the facilities are open, their proximity to student housing and classes, the quality and variety of items, and whether favorite foods are regularly available.

wellness: related to health promotion

Universities can also take a variety of steps to promote healthful food behaviors. Campus and residence hall **wellness** programs can provide students with information and point-of-purchase information at dining halls can help students make on-the-spot decisions that support healthful choices. Education programs for university personnel can help them recognize and properly refer at-risk students.

College students will eat healthful foods if they are available. During the college years, students form a foundation and create eating habits that impact future health, so it is important to practice healthful eating during these years.
SEE ALSO ADULT NUTRITION; EATING DISORDERS; EATING DISTURBANCES.

Judith C. Rodriguez

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Commodity Foods

The United States Department of Agriculture (USDA) administers several programs that distribute commodity foods, which are foods that the federal government has the legal authority to purchase and distribute in order to support farm prices. The first commodity distribution program began during the Great Depression of the 1930s, when it was known as the Needy Family Program. This was the main form of food assistance for low-income people in the United States until the Food Stamp Program was expanded in the early 1970s. The Needy Family Program distributed surplus agricultural commodities such as cheese, butter, and other items directly to low-income people. Today, the Food and Nutrition Service (FNS), an agency of the U.S. Department of Agriculture, administers the nation's commodity food distribution programs. The programs continue to improve the nutrition status of low-income people, while providing a means for using surplus agricultural commodities from U.S. farm programs.

Commodity Supplemental Food Program

The Commodity Supplemental Food Program (CSFP) works to improve the health of low-income pregnant and breastfeeding women, other new mothers up to one year postpartum, infants, children up to age six, and low-income elderly persons sixty years of age and older by supplementing their diets with commodity foods. Eligible people cannot participate in USDA's Special Supplemental Program for Women, Infants, and Children (WIC) and CSFP at the same time.

The USDA purchases food and makes it available to state agencies and Indian tribal organizations, along with funds for administrative costs. The commodity foods provided to participants do not provide a complete **diet**, but are designed to supplement the nutritional needs of participants and may include canned fruit juice, canned fruits and vegetables, farina, oats, ready-to-eat cereal, nonfat dry milk, evaporated milk, egg mix, dry beans, peanut butter, canned meat, poultry or tuna, dehydrated potatoes, pasta, rice, cheese, butter, honey, and infant cereal and formula. Distribution sites make packages available on a monthly basis.

As of 2003, the program operates in thirty-two states and the District of Columbia. An average of more than 410,000 people participated in the program each month in 2002, including more than 337,000 elderly people and more than 73,000 women, infants, and children.

diet: the total daily food intake, or the types of foods eaten

Food Distribution Program on Indian Reservations (FDPIR)

The FDPIR provides monthly food packages of commodity foods to low-income American Indian households living on or near Indian reservations. Currently there are some 243 tribes receiving benefits under the FDPIR. Household eligibility for the program is based on income and resource standards set by the federal government. Many people participate in FDPIR as an alternative to the Food Stamp Program because they lack easy access to food stamp offices or authorized grocery stores. Households cannot participate in FDPIR and the Food Stamp Program in the same month.

Each month, participant households receive a food package to help them maintain a nutritionally balanced diet. Participants can select from over seventy products, including items such as frozen ground beef and chicken; canned meats, poultry, and fish; canned fruits and vegetables; canned soups and spaghetti sauce; macaroni and cheese; pasta; cereal; rice and other grains; cheese; egg mix and nonfat dry and evaporated milk; dried beans; dehydrated potatoes; canned juices and dried fruit; peanuts and peanut butter; flour, cornmeal, and crackers; corn syrup; and vegetable oil and shortening.

The Emergency Food Assistance Program (TEFAP)

The Emergency Food Assistance Program is the largest of the commodity food donation programs. TEFAP was designed to reduce the level of government-held surplus commodities by distributing them to low-income households to supplement the recipients' purchased food. Local agencies may also use the commodities to prepare and serve meals in congregate settings, such as soup kitchens.

Most states set eligibility criteria at between 130 and 150 percent of the poverty line. In many states, food stamp participants are automatically eligible for TEFAP. The types of foods USDA purchases for TEFAP distribution vary depending on the preferences of states and agricultural market conditions. Typical foods include canned and dried fruits, fruit juice, canned vegetables, dry beans, meat, poultry, fish, rice, oats, grits, cereal, peanut butter, nonfat dried milk, dried egg mix, pasta products, vegetable oil, and corn syrup.

Food Assistance for Disaster Relief

Food assistance for disaster relief is furnished to state relief agencies and organizations (e.g., Red Cross, Salvation Army) in times of emergency, such as hurricanes, earthquakes, floods, and winter storms. FNS may provide commodity foods for distribution to shelters and mass feeding sites, or distribute commodity food packages directly to persons in need.

Disaster relief organizations request food assistance through state agencies that run USDA's food and nutrition assistance programs. Emphasis is on food that requires little or no preparation, including such items as canned juice, canned meat, and canned fruits and vegetables. Baby food and infant formula are provided as needed.

Commodity Distribution to Other Programs

The USDA also donates food commodities to a variety of programs. The largest donations go to school food programs at more than 94,000 public

The Food and Nutrition Service

The goal of the Food and Nutrition Service (FNS) is to eliminate hunger amid the prosperity of the United States. The FNS administers 15 nutrition assistance programs at a cost of more than \$40 billion per year. While these programs have been extremely successful in reducing widespread hunger in the United States, the U.S. Department of Agriculture estimates that approximately 3.5 percent of American households continue to experience hunger at some time during the year because they can't afford enough food.

—Paula Kepos



Workers prepare to redistribute surplus foods purchased by the U.S. Department of Agriculture. The USDA's commodity foods programs serve a dual purpose, maintaining the price of certain food products and ensuring that at-risk populations get the food they need.
 [Photograph by Ken Hammond. USDA.
 Reproduced by permission.]

and private nonprofit schools. During 2002, the USDA spent over \$700 million on over a billion pounds of commodity foods for Schools/Child Nutrition Commodity Programs. Commodity food donations are also made to the Child and Adult Care Food Program and the nutrition programs for the elderly administered by the Department of Health and Human Services. Food commodities are also distributed to nonprofit, charitable institutions that serve meals to low-income people on a regular basis. These include homes for the elderly, hospitals, soup kitchens, food banks, Meals On Wheels programs, temporary shelters, and summer camps or orphanages not participating in any federal child nutrition program.

For these programs, states select a variety of foods from a list of one hundred different kinds of products. Typical foods include fruits and vegetables; meats; cheese; dry and canned beans; fruit juices; vegetable shortening and vegetable oils; peanut products; rice, pasta products, flour, and other grain products. Additional foods may be offered to states periodically, if they become available as agricultural surpluses. Additional products donated in previous years have included applesauce, beef roasts, dried fruit products, fresh pears, frozen apricots, nonfat dry milk, orange juice, pork products, salmon, and turkey. SEE ALSO NATIVE AMERICANS, DIET OF; NUTRITION PROGRAMS IN THE COMMUNITY; SCHOOL FOOD SERVICE; WIC PROGRAM.

Marie Boyle Struble

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Comprehensive School Health Program

The Comprehensive School Health Program (CSHP) is a national program in the United States that makes efforts in schools to improve the health of children. Since schools profoundly influence the health of young people, the CSHP is very important. The program is supported by a national health organization, the American School Health Association (ASHA), which is actively involved in improving the health of school-age children.

School-Age Children

cardiovascular: related to the heart and circulatory system

cancer: uncontrolled cell growth

diet: the total daily food intake, or the types of foods eaten

fat: type of food molecule rich in carbon and hydrogen, with high energy content

obesity: the condition of being overweight, according to established norms based on sex, age, and height

The major causes of death in America, such as **cardiovascular** disease and **cancer**, are greatly related to lifestyle, behavior, education, and prevention efforts are best focused on physical activity and **diet**. School-age children often have poor diets, making this a critical area for CSHPs to focus on. Few students are meeting the Dietary Guidelines for Americans. Their diets generally lack fruit and vegetables and contain an excess of foods that are high in **fat**. Childhood **obesity** has reached epidemic proportions, with greater numbers of people becoming affected earlier in their lives. This is an important issue for school health programs, since it has been well documented that the health of school-age children is directly related to their educational success.

American School Health Association

The American School Health Association (ASHA) recognizes that schools can do more than any single agency to help young people. This national organization unites the many professionals who are committed to improving the well being of school-age children. With more than 2,000 members, ASHA is comprised of counselors, health educators, physical educators, school nurses, school physicians, and administrators. Over half of members practice in K-12 schools or advise and oversee health-services programs or health education. The ASHA's mission is to protect and improve the well-being of children. To achieve this mission, ASHA members support the CSHP.

The Comprehensive School Health Program

environment: surroundings

nutrition: the maintenance of health through proper eating, or the study of same

The CSHP is an "organized set of policies, procedures, and activities designed to protect and promote the health and well-being of students and staff" (Cottrell, Girvan, and McKenzie, p. 67). This program traditionally includes three components: health education, a healthful school **environment**, and health services. It was expanded in 1987 (see Allensworth and Kolbe) to include physical education, **nutrition** services, counseling services, community and family involvement, and health promotion for faculty. These eight components promote the health of students, faculty, and the



Physical education is one component of the Comprehensive School Health Program. The benefits of regular physical activity are numerous, and include enhanced bone, joint, and muscle fitness, weight control, and stress relief. [Photo by Denay Wilding.]

community. Since students spend a major part of their lives in school, schools are a good place to influence healthful living before harmful habits are established.

The first component, health education, suggests a planned health curriculum for students in grades K-12. The major content areas suggested for instruction are: community health, consumer health, environmental health, family life, mental and emotional health, injury prevention and safety, nutrition, personal health prevention, control of disease, and substance use and abuse. The individual states and local districts decide the actual content to be taught. Teachers are encouraged to teach healthful behaviors and provide students with skills to live healthier lives.

The second component, a healthful school environment, promotes a healthful physical and emotional environment. It is important that schools are safe and secure for all those who attend and work there. This component includes issues regarding safety, school security, a school's emotional and social atmosphere, the physical environment, and sexual harassment. Each year, many children are hurt on playgrounds, are exposed to environmental hazards, and witness violence among peers. The CSHP works towards making schools as safe as possible.

The third component, school health services, encourages promoting and protecting the health of every child. This may include on-site health clinics, school nurses, school physicians, and providing immunizations and screenings for vision, hearing, healthy weight, and head lice. With clinics and medical professionals located in schools, students have the opportunity for convenient medical care. Many clinics provide both treatment and educational services. For families who cannot afford medical care, this may be their only means to health care.

The fourth component, physical education, promotes regular exercise in schools as part of a healthful lifestyle. Approximately 75 percent of all

junior high schools and high schools offer physical education classes lasting twenty minutes or more, three times per week. Physical education is important to develop strength and improve body image.

The fifth component, nutrition services, encourages balanced, appealing, and varied meals and snacks for students. The CSHP realizes the importance of good nutrition to prevent future illnesses.

The sixth component, counseling services, supports evaluations and counseling for students. By including services from guidance counselors and social workers, students' mental and emotional health is addressed.

The seventh component, community and family involvement, encourages the involvement of parents and the community in the schools. This program recognizes the need for schools to have good relationships with parents and community groups, which can be very beneficial in assisting schools and students with making decision and providing resources.

The final component, health promotion for faculty and staff, promotes a healthy staff. The many benefits of a healthy staff include less sick days, increased productivity, and positive role models for students.

wellness: related to health promotion

The CSHP encourages all schools to address their students' health on various levels. The program's mission is to promote **wellness**, motivate health improvement, and offer educational opportunities for students, families, and community members. By implementing the planned, ongoing services of the CSHP, schools have the ability to improve both education and the health of students and school personnel. SEE ALSO AMERICAN SCHOOL HEALTH ASSOCIATION; SCHOOL-AGE CHILDREN, DIET OF.

Elise M. Howard-Barr

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Convenience Foods

Convenience foods are foods that have had preparation steps incorporated into their processing, or have been completely prepared during processing. This decreases preparation steps and time for the consumer. The "convenience" can mean the premixing of the ingredients for a cake or offering a fully prepared frozen meal. The term convenience food is generic and can apply to just about any food, but it is generally used in reference to canned items, instant foods or mixes, frozen foods or meals, and fast foods. Although they can be more costly than home-cooked meals, the trend is toward their

increased use throughout the world. SEE ALSO DIETARY TRENDS, AMERICAN; DIETARY TRENDS, INTERNATIONAL; FAST FOODS.

Judith C. Rodriguez

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Corn- or Maize-Based Diets

Maize, the American Indian word for corn, literally means “that which sustains life.” After wheat and rice, it is the most important cereal grain in the world, providing **nutrients** for humans and animals. It also serves as a basic raw material for the production of starch, oil, **protein**, alcoholic beverages, food sweeteners, and fuel. Maize has the highest average yield per hectare.

Maize is an important food in Asia, Africa, Latin America, and parts of the former Soviet Union. Each country has one or more maize dishes that are unique to its culture. Examples are *ogi* (Nigeria), *kenkey* (Ghana), *koga* (Cameroon), *tô* (Mali), *injera* (Ethiopia), and *ugali* (Kenya). Most of these products are processed in traditional ways. In Africa, ground maize is cooked into a paste or mush and eaten while still warm, accompanied by a thick low-alcoholic beer. In some areas of Africa, maize mush is fried or baked. In Central and Latin American, maize is consumed in the form of maize bread or tortillas.

Maize is also used as animal feed and raw material for industrial use. In industrialized countries, a larger proportion of the grain is used as livestock feed and as industrial raw material for food and nonfood uses. On the other hand, the bulk of maize produced in developing countries is used as human food, although its use as animal feed is increasing. Maize is the largest food crop of the United States, which is responsible for 40 percent of the world’s production.

Maize constitutes an important source of **carbohydrates**, protein, vitamin B, and **minerals**. As an **energy** source, it compares favorably with root and **tuber** crops, and it is similar in energy value to dried **legumes**. Furthermore, it is an excellent source of carbohydrate and is complete in nutrients compared to other cereals.

Varieties of Maize

Six general varieties of maize or corn are differentiated by the characteristics of the kernel. Dent corn is the leading type of corn grown on U.S. farms. The sides of the kernel consist of hard, so-called horny starch, and the crown contains soft starch. As the grain matures, this soft starch shrinks, forming the characteristic dent. In flint corn, the horny starch extends over the top of the kernel, so there is no denting. Popcorn, a light, highly popular snack throughout the United States, is a variant of flint corn with small kernels of great hardness. When heated, the moisture in the kernels expands, causing the kernels to pop open. Flour corn contains a preponderance of soft or less densely packed starch, and it is readily ground into meal. Sweet corn is

nutrient: dietary substance necessary for health

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

mineral: an inorganic (non-carbon-containing) element, ion or compound

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

tuber: swollen plant stem below the ground

legumes: beans, peas, and related plants



Many Africans depend on some variation of this mush, which is made with water and ground maize. It can be eaten as a porridge or a dumpling, depending on the thickness of the batter and the cooking method. [AP/Wide World Photos. Reproduced by permission.]

the type commonly grown in the United States for human consumption. The sugar produced by the sweet-corn plant is not converted to starch during growth, as it is in other types. Pod corn is seldom used as food but is often grown as a decorative plant—each kernel is enclosed in its own set of diminutive husks. Another decorative corn, commonly called Indian corn, consists of multicolored varieties of flour and flint types.

Protein Quality

amino acid: building block of proteins, necessary dietary nutrient

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

nitrogen: essential element for plant growth

metabolic: related to processing of nutrients and building of necessary molecules within the cell

The nutritional quality of maize is determined by the **amino acid** makeup of its protein. Maize is deficient in two essential amino acids: lysine and tryptophan, making it a poor protein food. The kernel is made up of the endosperm, the germ, the pericarp, and the tip cap. The protein concentration is highest in the germ, but the quality is better in the endosperm. The germ proteins contribute significantly to essential amino acids, so maize food products without the germ, including quality protein maize (QPM) endosperm, are lower in protein quality compared to the whole kernel.

The germ contributes most of the oil, sugar, **vitamins**, and minerals of the kernel. The germ also has a lower leucine to isoleucine ratio, giving it a higher biological value. Biological value is defined as the amount of absorbed **nitrogen** needed to provide the necessary amino acids for the different **metabolic** functions in the body.

The high consumption of maize by the human population and the well-established lysine and tryptophan deficiencies in maize protein motivated researchers to develop the QPM to increase concentrations of these essential amino acids in its protein. Newer varieties provide higher protein content (18%) by increasing the prolamine (zein) fraction in maize endosperm. An example of QPM is one opaque-2 maize.

QPM varieties have almost double the percentages of lysine and tryptophan compared to normal maize, but are similar in overall protein content. However, the QPM varieties have a greatly reduced amount of the major storage protein, zein. The biological value of common maize is 45 percent whereas the QPM is about 80 percent. Hence the production and consumption of QPM maize in countries that use maize as their chief grain crop would have a beneficial effect on the nutritional state of the people and significant economic implications from the better use of what is produced and consumed.

Compared to normal maize, production of QPM varieties may have some disadvantages. QPM varieties have softer, floury endosperms, providing a slightly lower yield and making the plant more susceptible to storage insects. Furthermore, QPM varieties have lower zein content, which is associated with lysine deficiency and a higher imbalance of essential amino acids. Hence they are considered to be of a lower quality. They are also susceptible to weevils in storage.

Minerals and Vitamins

niacin: one of the B vitamins, required for energy production in the cell

The nutritional disease pellagra, which is caused by a deficiency in **niacin**, is associated with maize-based diets in the Americas and Africa. While niacin is readily available in corn, it exists in a bound form (niacytin) that is not biologically available to monogastric (single-stomach) animals. Furthermore,



In the early twentieth century, hundreds of thousands of people in the southern United States suffered from pellagra, a serious disease that affects people whose diet does not include enough niacin. Pellagra occurs in cultures that depend on corn as a dietary staple, because the niacin in corn is difficult to digest and is often removed during processing. [Photograph by Ed Bohon. Corbis. Reproduced by permission.]

most of the niacin in the kernel (63%) occurs in the outermost layer of the endosperm. This layer is often removed with the pericarp during dehulling. In Mexico, Guatemala, and other countries, maize is treated with an alkaline solution of lime, which releases the niacin and helps prevent pellagra. Furthermore, pellagra seldom occurs among people in Latin America, since they eat tortillas—tortilla preparation greatly increases the **bioavailability** of the niacin in maize.

bioavailability: availability to living organisms, based on chemical form

dementia: loss of cognitive abilities, including memory and decision-making

Persons suffering from pellagra usually appear to be poorly nourished, and they are often weak and underweight. They also exhibit dermatitis, diarrhea, and **dementia**. If untreated, pellagra can result in death. Niacin supplements

diet: the total daily food intake, or the types of foods eaten

polyunsaturated: having multiple double bonds within the chemical structure, thus increasing the body's ability to metabolize it

fatty acids: molecules rich in carbon and hydrogen; a component of fats

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

calcium: mineral essential for bones and teeth

nutrition: the maintenance of health through proper eating, or the study of same

lipid: fats, waxes and steroids; important components of cell membranes

fiber: indigestible plant material which aids digestion by providing bulk

are available to aid in the treatment of the disease. There are also several methods of increasing niacin content in maize-based diets, including:

- Complementing maize-based diets with nuts and fish, which are rich in niacin.
- Preparing maize in a way that retains the outer layer of the endosperm, contributing more niacin to the **diet**.
- Cooking maize in alkaline solution to increase niacin availability, a procedure commonly used in Latin America in the preparation of tortillas.

Maize is a good source of vitamin B and B₁₂. Yellow maize can provide substantial amounts of vitamin A, and the maize germ is rich in vitamin E. Furthermore, maize oil contains a high level of **polyunsaturated fatty acids** and natural **antioxidants** (Okoruwa, 1996). However, of the three major cereal grains (wheat, maize, and rice), maize has the lowest concentration of protein, **calcium**, and niacin.

Dietary preferences, processing, and mode of preparation affect the contributions of maize in human **nutrition**. For example, the nutritive value of the grain may increase or decrease depending upon the method in which it is processed (the milling of maize reduces the concentration of protein, **lipids**, and **fiber**). Diets that rely heavily on corn may require the consumption of complementary foods to supplement its deficiency in certain amino acids and vitamins. SEE ALSO NATIVE AMERICANS, DIET OF; RICE-BASED DIETS.

Ranjita Misra

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Cravings

Most people, at some time, have a strong desire for some particular food, such as ice cream or pizza. Such a desire for a particular food, even when one is not hungry, is called a craving. There are a number of theories as to why people crave certain foods, including:

- Self-imposed food restriction.
- A **psychological** desire for a "comfort" food.
- Hormonal changes.
- Gender differences.
- Response to **stress**.

psychological: related to thoughts, feelings, and personal experiences

stress: heightened state of nervousness or unease

Food Restriction. The theory of food restriction holds that people desire those foods that they feel should be avoided. According to the dietitian Debra Waterhouse, food cravings do not cause weight gain, but denying the cravings does. This creates a vicious cycle. For example, a person may feel guilty for wanting a giant cinnamon roll that he or she smells upon entering a shopping mall. The urge is avoided, but a couple of hours later, the person may want the cinnamon roll more than ever, give in to the craving, and quickly eat the entire cinnamon roll. This leads to even stronger feelings of guilt, along with the resolve not to eat anything remotely similar for some period of time. Soon, however, the craving strikes again. The cycle becomes one of denial leading to deprivation, then to overindulgence, and then back to denial. This denial-deprivation-overindulgence pattern confirms the negative view of all food as either good or bad. It would be better, however, to imagine a world where foods are not designated as bad and not allowed, but where reasonable portions of any food can be part of a healthful **diet**. Portion control is the key.

Comfort Foods. Certain foods are usually served during holidays or special occasions. These foods become associated with comfort and happy times, eliciting feelings of relaxation and reduced stress, and are thus called “comfort foods.” Some common comfort foods are ice cream, macaroni and cheese, meatloaf, pudding, cookies, and chicken. One’s cultural background plays a large part in comfort-food choices. Mood also plays a role in cravings for comfort food. Women are more likely to eat when they are sad, mad, or anxious, while men look to food when bored or lonely.

Those who find themselves reaching for comfort foods frequently should ask themselves if they are truly hungry, or whether they are using food to soothe their mood. For those who are feeding emotions with food, it is helpful to begin to replace the food with healthier activities, such as taking a walk, participating in a favorite form of exercise, or reading a good book.

Hormones and Cravings. How do **hormone** changes affect food cravings? For women, these cravings can be more intense than for men. Hormonal changes tied to the menstrual cycle are often a cause of cravings. Immediately prior to the menstrual period, the body’s **estrogen** level drops, as does the **serotonin** level in the brain.

Serotonin is a **neurotransmitter**, or brain chemical, that plays a role in maintaining a relaxed feeling. When the level decreases, irritability and mood swings increase as does the craving for carbohydrate- and fat-rich foods such as chocolate, cookies, cake, potato chips, and roasted nuts. There is nothing wrong with eating a piece of chocolate, of course, but when chocolate and other craved foods become the mainstay of the diet and healthier choices get overlooked, then the cravings have gotten out of control and health may be compromised.

Gender Differences. Is there a difference between the sexes when it comes to food cravings? According to Waterhouse, the foods most frequently craved or preferred by men include hot dogs, eggs, and meat, which are all **protein** foods, while women reach for chocolate, ice cream, and bread. She attributes these differences to sex hormones and body composition. Men have larger amounts of the hormone **testosterone** and about forty pounds

Pregnancy Cravings

Is there any truth to the belief that pregnant women suffer intense cravings for particular foods, sometimes in odd combinations? Absolutely. According to medical researchers, pregnant women experiencing changes in hormones and an increased need for calories frequently exhibit changes in the types of foods they prefer. Common cravings include fruit, milk products, salty foods, chocolate, and other sweets. In the early stages of pregnancy, women often have a strong aversion to bitter tastes, which scientists think may serve as a warning against ingesting toxic plants or fruits during the period when a fetus is most vulnerable. In later stages of pregnancy, women often exhibit preferences for salty foods (which satisfy their increased need for sodium) and sour foods (which contribute to a varied diet). Thus the lure of pickles and potato chips.

—Paula Kepos

diet: the total daily food intake, or the types of foods eaten

hormone: molecules produced by one set of cells that influence the function of another set of cells

estrogen: hormone that helps control female development and menstruation

serotonin: chemical used by nerve cells to communicate with one another

neurotransmitter: molecule released by one nerve cell to stimulate or inhibit another

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

testosterone: male sex hormone

Women may crave ice cream when they're feeling anxious, and men may hunger for hot dogs when they get bored. These food cravings can be quieted by eating regular, healthy meals.

[Photograph by Mark Peterson. Corbis.
Reproduced by permission.]



more muscle mass than women. They eat increased amounts of protein to build, repair, and synthesize muscle.

Stress Response. Many people today lead stressful lives, which can lead to stress eating. Increased stress results in a need for carbohydrates to provide **energy** for the stress response, also known as the *fight-or-flight* response (a defense reaction of the body that prepares it to fight or flee by triggering certain **cardiovascular**, hormonal, and other changes). When coping with stress, a person needs increased energy to deal with the demands placed on the body. Carbohydrates provide a fairly rapid source of fuel to the body by raising blood-glucose levels. However, when life becomes hectic and feels out of control, it is common to reach for any available food regardless of **calories** or nutritional content.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

cardiovascular: related to the heart and circulatory system

calorie: unit of food energy

Conquering Cravings

Life will always have its stresses, but dealing with stress in a healthful, nutritional way can have a positive impact on self-esteem, energy level, emotional outlook, and weight. There are a number of positive ways to deal with cravings, including:

- Start the day off with breakfast, which helps prevent overwhelming hunger later in the day.
- Eliminate feelings of guilt related to labeling food as either good or bad. Some choices are healthier than others, but snacks and treats can be consumed in reasonable amounts.
- Plan ahead for each new week. Think about one's school, work, and activity schedule and how healthful snacks can be incorporated into it.
- Keep healthful snacks close at hand, both at home and at work.
- Try not to go for long periods of time without eating.

- Combine lean protein foods with high-fiber carbohydrate sources to provide energy that lasts for several hours, such as a slice of vegetable pizza or a bean burrito.

Cravings can be the exception instead of the rule when it comes to one's diet. Developing a lifestyle that includes healthful food selections and regular meals and snacks can help control cravings. The extra time it takes in planning meals or snacks, whether eating at home or eating on the run, is easily made up for in increased energy and improved mood. SEE ALSO EATING DISORDERS; PICA; WEIGHT MANAGEMENT.

Susan Mitchell

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Cultural Competence

Despite notable progress in the overall health of Americans, there are continuing disparities in health status among African Americans, Hispanics, Native Americans, and Pacific Islanders, compared to the U.S. population as a whole. In addition, the health care system is becoming more challenged as the population becomes more ethnically diverse. Therefore, the future health of the U.S. population as a whole will be influenced substantially by improvements in the health of racial and ethnic minorities.

Cultural, ethnic, linguistic, and economic differences impact how individuals and groups access and use health, education, and social services. They can also present barriers to effective education and health care interventions. This is especially true when health educators or health care practitioners stereotype, misinterpret, make faulty assumptions, or otherwise mishandle their encounters with individuals and groups viewed as different in terms of their backgrounds and experiences. The demand for culturally competent health care in the United States is a direct result of the failure of the health care system to provide adequate care to all segments of the population.

Cultural Competence, Cultural Sensitivity, and Culturally Effective Health Care

The term *cultural competence* refers to the ability to work effectively with individuals from different cultural and ethnic backgrounds, or in settings where several cultures coexist. It includes the ability to understand the language, culture, and behaviors of other individuals and groups, and to make appropriate recommendations. Cultural competence exists on a continuum from incompetence to proficiency.

Cultural sensitivity, which is a necessary component of cultural competence, means that health care professionals make an effort to be aware of



Cultural competence cannot be achieved through short workshops or classes. A long-term commitment is required to learn a second language and become familiar with other cultures to deliver effective health care for the ethnically diverse U.S. population. [AP/Wide World Photos. Reproduced by permission.]

diversity: the variety of cultural traditions within a larger culture

pluralistic: of many different sources

monocultural: from a single culture

the potential and actual cultural factors that affect their interactions with a client. It also means that they are willing to design programs and materials, to implement programs, and to make recommendations that are culturally relevant and culturally specific.

The terms *cultural competence* and *culturally effective health care* are sometimes used synonymously. Culturally effective health care is, indeed, related to cultural competence and cultural sensitivity. However, it goes beyond these concepts in describing the dynamic relationship between provider and client. Effective communication between providers and clients may be even more challenging when linguistic barriers exist.

Becoming Culturally Competent

Cultural competence is a developmental process that requires a long-term commitment. It is not a specific end product that occurs after a two-hour workshop, but it is an active process of learning and practicing over time. Becoming culturally competent is easier to talk about than to accomplish. Individuals working with different ethnic and cultural groups can become more culturally competent by advancing through three main stages: developing awareness, acquiring knowledge, and developing and maintaining cross-cultural skills.

Developing Awareness. Developing cultural awareness includes recognizing the value of population **diversity**. It also means an honest assessment of one's biases and stereotypes.

Acquiring Knowledge. One can never learn everything about another culture. However, acquiring knowledge about other groups is the foundation of cultural competence. In addition to understanding other cultures, it is essential to understand how different cultural groups view one's own culture. Knowledge of another culture includes assessments of facts not only about relevant norms, values, worldviews, and the practicality of everyday life, but also about how one's culture and the services one provides are viewed.

Developing and Maintaining Cross-Cultural Skills. Even though the United States is a **pluralistic** society, most health professionals have been trained in a **monocultural** tradition. In addition, many continue to practice as if ethnic and cultural differences are insignificant. Cross-cultural skills are developed through formal coursework, informal interaction and networking, and experience.

Organizational Responsibilities

It is important for health care organizations and professional preparation programs to articulate a commitment to cultural competence and to initiate cultural-competence initiatives. Many organizations are getting social and legal pressures to do this from different segments of the population. In addition to the social impact of diversity, these organizations are beginning to realize that a commitment to diversity makes good business sense.

Professional preparation programs can play a significant role in providing the knowledge and skills for culturally competent health professionals. These programs can provide courses and other formats developed with the sole purpose of addressing cultural competence and/or cultural sensitivity.

Steps to Becoming Culturally Competent

Developing Awareness

- Admitting personal biases, stereotypes, and prejudices
- Becoming aware of cultural norms, attitudes, and beliefs
- Valuing diversity
- Willingness to extend oneself psychologically and physically to the client population
- Recognizing comfort level in different situations

- Establishing professional and working relationships with people of different cultures
- Learning another language
- Learning verbal and nonverbal cues of other cultures
- Becoming more comfortable in cross-cultural situations
- Assessing what works and what does not
- Assessing how the beliefs and behaviors of the cultural group affect the client or family
- Learning to negotiate between the person's beliefs and practices and the culture of your profession
- Being more flexible
- Attending continuing education seminars and workshops
- Learning to develop culturally relevant and appropriate programs, materials, and interventions
- Learning to evaluate culturally relevant and appropriate programs, materials, and interventions
- Ongoing evaluation of personal feelings and reactions
- Overcoming fears, personal biases, stereotypes, and prejudices

Acquiring Knowledge

- Knowing how your culture is viewed by others
- Attending classes, workshops, and seminars about other cultures
- Reading about other cultures
- Watching movies and documentaries about other cultures
- Attending cultural events and festivals
- Sharing knowledge and experiences with others
- Visiting other countries

Developing and Maintaining Cross-Cultural Skills

- Making friends with people of different cultures

They also can provide specific educational components on cultural competence and/or cultural sensitivity within the curricula, **internship** and residency programs, continuing education programs, and in-service programs. Organizations need to go beyond educating their employees and providing workshops on cultural sensitivity, however. They must also change institutional policies and procedures.

internship: training program

The Office of Minority Health and the Department of Health and Human Services made specific recommendations for culturally effective health care in the document, "Assuring Cultural Competence in Health Care: Recommendations for National Standards and an Outcomes-Focused Research Agenda." Some of these recommendations include:

- Developing and implementing a strategy to recruit, retain, and promote qualified, diverse, and culturally competent administrative, **clinical**, and support staff
- Promoting and supporting the necessary attitudes, behaviors, knowledge, and skills for staff to work respectfully and effectively with patients and each other in a culturally diverse work environment

clinical: related to hospitals, clinics, and patient care

- Developing a comprehensive strategy to address culturally and linguistically appropriate services, including strategic goals, plans, policies, and procedures
- Hiring and training interpreters and bilingual staff
- Providing a bilingual staff or free interpretation services to clients with limited English skills
- Translating and making available signage and commonly used educational materials in different languages
- Developing structures and procedures to address cross-cultural ethical and legal conflicts, complaints, or grievances by patients and staff
- Preparing and distributing an annual progress report documenting the organizations' progress in implementing these standards, including information on programs, staffing, and resources

While cultural competence has increased significantly, there is still much to be done on the personal, organizational, and societal levels. Education and training to enhance the provision of culturally effective health care must be integrated into lifelong learning. Through these activities, current and future health professionals will be prepared to meet the needs of clients from all segments of the population.

Delores C. S. James

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D

dehydration: loss of water

nausea: unpleasant sensation in the gut that precedes vomiting

fatigue: tiredness

Dehydration

Dehydration is the excessive loss of water from the body. Water can be lost through urine, sweat, feces, respiration, and through the skin. Symptoms of dehydration in order of severity are: thirst, **nausea**, chills, clammy skin, increased heart rate, muscle pain, reduced sweating, dizziness, headache, shortness of breath, dry mouth, **fatigue**, lack of sweating, hallucinations, fainting, and loss of consciousness. Dehydration can affect mental alertness, renal function, circulation, and total physical capacity.

The following can help to avoid dehydration:

1. Drink before feeling thirsty
2. Drink enough fluid to have pale yellow urine
3. Avoid caffeine and alcohol, which act as **diuretics**

diuretic: substance that depletes the body of water

4. Drink two to three cups of fluid two hours before exercise or heavy outside work in hot temperatures
5. Drink one to two cups of fluid every fifteen minutes during exercise or heavy outside work in hot temperatures
6. Avoid exercising during midday heat, and wear appropriate clothing that allows airflow around the body

Athletes, elderly persons, young children, and those with specific illnesses that affect fluid balance, such as severe diarrhea, are at higher risk for dehydration than the average person. SEE ALSO MALNUTRITION; ORAL REHYDRATION THERAPY; SPORTS NUTRITION.

Mindy Benedict

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Diabetes Mellitus

Diabetes mellitus is a common **metabolic** disorder resulting from defects in **insulin** action, insulin production, or both. Insulin, a **hormone** secreted by the pancreas, helps the body use and store **glucose** produced during the digestion of food. Characterized by **hyperglycemia**, symptoms of diabetes include frequent urination, increased thirst, **dehydration**, weight loss, blurred vision, **fatigue**, and, occasionally, coma. Uncontrolled hyperglycemia over time damages the eyes, nerves, blood vessels, kidneys, and heart, causing organ dysfunction and failure. A number of risk factors are attributed to the **incidence** of diabetes, including family history, age, ethnicity, and **social group** characteristics, as well as **behavioral**, lifestyle, **psychological**, and clinical factors.

The World Health Organization estimates that 150 million people had diabetes worldwide in 2002. This number is projected to double by the year 2025. Much of this increase will occur in developing countries and will be due to population growth, aging, unhealthy diets, **obesity**, and **sedentary** lifestyles. In the United States, diabetes is the sixth leading cause of death. While 6.2 percent of the population has diabetes, an estimated 5.9 million people are unaware they have the disease. In addition, about 19 percent of all deaths in the United States for those age twenty-five and older are due to diabetes-related complications.

The **prevalence** of diabetes varies by age, gender, race, and ethnicity. In the United States, about 0.19 percent of the population less than twenty years of age (151,000 people) have diabetes, versus 8.6 percent of the population twenty years of age and older. In addition, adults sixty-five and older account for 40 percent of those with diabetes, despite composing only 12 percent of the population. Considerable variations also exist in the prevalence of diabetes among various racial and ethnic groups. For example, 7.8 percent of non-Hispanic whites, 13 percent of non-Hispanic blacks, 10.2 percent of Hispanic/Latino Americans, and 15.1 percent of American Indians and Alaskan Natives have diabetes. Among Asian Americans and Pacific

diabetes: inability to regulate level of sugar in the blood

metabolic: related to processing of nutrients and building of necessary molecules within the cell

insulin: hormone released by the pancreas to regulate level of sugar in the blood

hormone: molecules produced by one set of cells that influence the function of another set of cells

glucose: a simple sugar; the most commonly used fuel in cells

hyperglycemia: high level of sugar in the blood

dehydration: loss of water

fatigue: tiredness

incidence: number of new cases reported each year

social group: tribe, clique, family, or other group of individuals

behavioral: related to behavior, in contrast to medical or other types of interventions

psychological: related to thoughts, feelings, and personal experiences

obesity: the condition of being overweight, according to established norms based on sex, age, and height

sedentary: not active

prevalence: describing the number of cases in a population at any one time

The standard method of measuring blood glucose level is called a *fingerstick*, which is a small blood sample taken from the fingertip. Diabetics must monitor their blood glucose levels daily in order to avoid dire complications such as kidney disease, blindness, stroke, and poor blood circulation. [Photograph by Tom Stewart. Corbis. Reproduced by permission.]



Islanders, the rate of diabetes varies substantially and is estimated at 15 to 20 percent. The prevalence of diabetes is comparable for males and females—8.3 and 8.9 percent respectively. Nevertheless, the disease is more devastating and more difficult to control among women, especially African-American and non-Hispanic white women. In fact, the risk for death is greater among young people (3.6 times greater for people from 25 to 44 years of age) and women (2.7 times greater for women ages 45 to 64 than men of the same age).

Types of Diabetes

Diabetes mellitus is classified into four categories: type 1, type 2, gestational diabetes, and other. In type 1 diabetes, specialized cells in the pancreas are destroyed, leading to a deficiency in insulin production. Type 1 diabetes frequently develops over the course of a few days or weeks. Over 95 percent of people with type 1 diabetes are diagnosed before the age of twenty-five. Estimates show 5.3 million people worldwide live with type 1 diabetes. Although the diagnosis of type 1 diabetes occurs equally among men and women, an increased prevalence exists in the white population. Type 1 diabetes in Asian children is relatively rare.

diet: the total daily food intake, or the types of foods eaten

toxins: poison

Family history, **diet**, and environmental factors are risk factors for type 1 diabetes. Studies have found an increased risk in children whose parents have type 1 diabetes, and this risk increases with maternal age. Environmental factors such as viral infections, **toxins**, and exposure to cow's milk are being contested as causing or modifying the development of type 1 diabetes.

Type 2 diabetes is characterized by insulin resistance and/or decreased insulin secretion. It is the most common form of diabetes mellitus, accounting for 90 to 95 percent of all diabetes cases worldwide. Risk factors for type 2 diabetes include family history, increasing age, obesity, physical inactivity, ethnicity, and a history of gestational diabetes. Although type 2

diabetes is frequently diagnosed in adult populations, an increasing number of children and adolescents are currently being diagnosed. Type 2 diabetes is also more common in blacks, Hispanics, Native Americans, and women, especially women with a history of gestational diabetes.

Genetics and environmental factors are the main contributors to type 2 diabetes. Physical inactivity and adoption of a Western lifestyle (particularly choosing foods with more animal **protein**, animal fats, and processed **carbohydrates**), especially in indigenous people in North American and within ethnic groups and migrants, have contributed to weight gain and obesity. In fact, obesity levels increased by 74 percent between 1991 and 2003. Increased body **fat** and abdominal obesity are associated with insulin resistance, a precursor to diabetes. Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) are two prediabetic conditions associated with insulin resistance. In these conditions, the blood glucose concentration is above the normal range, but below levels required to diagnose diabetes. Subjects with IGT and/or IFG are at substantially higher risk of developing diabetes and **cardiovascular** disease than those with normal glucose tolerance. The conversion of individuals with IGT to type 2 diabetes varies with ethnicity, **anthropometric** measures related to obesity, fasting blood glucose (a measurement of blood glucose values after not eating for 12 to 14 hours), and the two-hour post-glucose load level (a measurement of blood glucose taken exactly two hours after eating). In addition to IGT and IFG, higher than normal levels of fasting insulin, called *hyperinsulinemia*, are associated with an increased risk of developing type 2 diabetes. Insulin levels are higher in African Americans than in whites, particularly African-American women, indicating their greater predisposition for developing type 2 diabetes.

The complexity of inheritance and interaction with the environment makes identification of **genes** involved with type 2 diabetes difficult. Only a small percentage (2–5%) of diabetes cases can be explained by single gene defects and are usually atypical cases. However, a “thrifty gene,” although not yet identified, is considered predictive of weight gain and the development of type 2 diabetes. Thrifty-gene theory suggests that indigenous people who experienced alternating periods of feast and **famine** gradually developed a way to store fat more efficiently during periods of plenty to better survive famines. Regardless of the thrifty gene, the contribution of **genetic** mutations in the development of type 2 diabetes has not been established, due to the number of genes that may be involved.

Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy. This definition applies regardless of whether insulin or diet modification is used for treatment, and whether or not the condition persists after pregnancy. GDM affects up to 14 percent of the pregnant population—approximately 135,000 women per year in United States. GDM complicates about 4 percent of all pregnancies in the U.S. Women at greatest risk for developing GDM are **obese**, older than twenty-five years of age, have a previous history of abnormal glucose control, have first-degree relatives with diabetes, or are members of ethnic groups with a high prevalence of diabetes. Infants of a woman with GDM are at a higher risk of developing obesity, impaired glucose tolerance, or diabetes at an early age. After a pregnancy with GDM, the mother has an increased risk of developing type 2 diabetes.



Type 1 diabetics are more likely than other diabetics to require insulin injections to regulate blood glucose levels. Insulin pumps like the one shown here can provide an extra measure of control by administering a very accurate dose of insulin on a set schedule.
[Photograph by Paul Sakuma. AP/Wide World Photos. Reproduced by permission.]

genetics: inheritance through genes

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fat: type of food molecule rich in carbon and hydrogen, with high energy content

cardiovascular: related to the heart and circulatory system

anthropometric: related to measurement of characteristics of the human body

gene: DNA sequence that codes for proteins, and thus controls inheritance

famine: extended period of food shortage

genetic: inherited or related to the genes

obese: above accepted standards of weight for sex, height, and age

drugs: substances whose administration causes a significant change in the body's function

plasma: the fluid portion of the blood, distinct from the cellular portion

hemoglobin: the iron-containing molecule in red blood cells that carries oxygen

ketoacidosis: accumulation of ketone bodies along with high acid levels in the body fluids

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

triglyceride: a type of fat

ketones: chemicals produced by fat breakdown; molecule containing a double-bonded oxygen linked to two carbons

pneumonia: lung infection

electrolyte: salt dissolved in fluid

Other forms of diabetes are associated with genetic defects in the specialized cells of the pancreas, drug or chemical use, infections, or other diseases. The most notable of the genetically linked diabetes is *maturity onset diabetes of the young* (MODY). Characterized by the onset of hyperglycemia before the age of twenty-five, insulin secretion is impaired while minimal or no defects exist in insulin action. **Drugs**, infections, and diseases cause diabetes by damaging the pancreas and/or impairing insulin action or secretion.

Diabetes Complications

People with diabetes are at increased risk for serious long-term complications. Hyperglycemia, as measured by fasting **plasma** glucose concentration or **glycosylated hemoglobin** (HbA1c), causes structural and functional changes in the retina, nerves, kidneys, and blood vessels. This damage can lead to blindness, numbness, reduced circulation, amputations, kidney disease, and cardiovascular disease. Type 1 diabetes is more likely to lead to kidney failure. About 40 percent of people with type 1 diabetes develop severe kidney disease and kidney failure by the age of fifty. Nevertheless, between 1993 and 1997, more than 100,000 people in the United States were treated for kidney failure caused by type 2 diabetes.

African Americans experience higher rates of diabetes-related complications such as eye disease, kidney failure, and amputations. They also experience greater disability from these complications. The frequency of diabetic retinopathy (disease of the small blood vessels in the retina causing deterioration of eyesight) is 40 to 50 percent higher in African Americans than in white Americans. In addition, the rate of diabetic retinopathy among Mexican Americans is more than twice that of non-Hispanic white Americans. Furthermore, African Americans with diabetes are much more likely to undergo a lower-extremity amputation than white or Hispanic Americans with diabetes. Little is known about these complications in Asian and Pacific Islander-Americans.

Diabetic **ketoacidosis** (DKA) and hyperosmolar hyperglycemia state (HHS) are serious diabetic emergencies and the most frequent cause of mortality. Both DKA and HHS result from an insulin deficiency and an increase in counter-regulatory hormones (a.k.a. hyperglycemia). Hyperglycemia leads to glycosuria (glucose in the urine), increased urine output, and dehydration. Because the glucose is excreted in the urine, the body becomes starved for **energy**. At this point, the body either continues to excrete glucose in the urine making the hyperglycemia worse (HHS), or the body begins to break down **triglycerides** causing the release of **ketones** (by-products of fat breakdown) into the urine and bloodstream (DKA). The mortality rate of patients with DKA is less than 5 percent while the mortality rate of HHS patients is about 15 percent. Infection (urinary tract infections and **pneumonia**) account for 30 to 50 percent of cases), omission of insulin, and increased amounts of counter-regulatory hormones contribute to DKA and HHS. Type 1 and type 2 diabetic patients may experience DKA and HHS. However, DKA is more common in type 1 diabetic patients, while HHS is more common in type 2 diabetic patients. Treatment of DKA and HHS involves correction of dehydration, hyperglycemia, ketoacidosis, and **electrolyte** deficits and imbalances.

Diabetes, Heart Disease, and Stroke

Many people with diabetes are not aware that they are at particularly high risk for heart disease and stroke, which can result from the poor blood flow that is a symptom of diabetes. In addition, people with type 2 diabetes have higher rates of hypertension and obesity, which are additional risk factors. Diabetics are two to four times more likely to have a heart attack than nondiabetics, and at least 65 percent of people with diabetes die from heart attack or stroke. While deaths from heart disease have

been declining overall, deaths from heart disease among women with diabetes have increased, and deaths from heart disease among men with diabetes have not declined nearly as rapidly as they have among the general male population. The National Diabetes Education Program has launched a campaign to bring the problem to public attention. Patients are advised to work with medical personnel to control their glucose level, blood pressure, and cholesterol level and, of course, to avoid smoking.

Treatment for Diabetes

Treatment for diabetes involves following a regimen of diet, exercise, self-monitoring of blood glucose, and taking medication or insulin injections. Although type 1 diabetes is primarily managed with daily insulin injections, type 2 diabetes can be controlled with diet and exercise. However, when diet and exercise fail, medication is added to stimulate the production of insulin, reduce insulin resistance, decrease the liver's output of glucose, or slow **absorption** of carbohydrate from the **gastrointestinal** tract. When medication fails, insulin is required.

Following the diagnosis of diabetes, a diabetic patient undergoes medical **nutrition** therapy. In other words, a registered dietitian performs a nutritional assessment to evaluate the diabetic patient's food intake, metabolic status, lifestyle, and readiness to make changes, along with providing dietary instruction and goal setting. The assessment is individualized and takes into account cultural, lifestyle, and financial considerations. The goals of medical nutrition therapy are to attain appropriate blood glucose, lipid, **cholesterol**, and triglyceride levels, which are critical to preventing the **chronic** complications associated with diabetes. For meal planning, the diabetic exchange system provides a quick method for estimating and maintaining the proper balance of carbohydrates, fats, proteins, and **calories**. In the exchange system, foods are categorized into groups, with each group having food with similar amounts of carbohydrate, protein, fat, and calories. Based on the individual's diabetes treatment plan and goals, any food on the list can be exchanged with another food within the same group.

Exercise and blood glucose monitoring are also critical components of a diabetic patient's self-management. Exercise improves blood glucose control, increases sensitivity to insulin, reduces cardiovascular risk factors, contributes to weight loss, and improves well-being. Exercise further contributes to a reduction in the risk factors for diabetes-related complications. Daily self-monitoring of blood glucose levels allows diabetic patients to evaluate and make adjustments in diet, exercise, and medications. Self-monitoring also assists in preventing **hypoglycemic** episodes.

Diabetes mellitus is a chronic and debilitating disease. Attributed to genetics, physical inactivity, obesity, ethnicity, and a number of environmental

absorption: uptake by the digestive tract

gastrointestinal: related to the stomach and intestines

nutrition: the maintenance of health through proper eating, or the study of same

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

chronic: over a long period

calorie: unit of food energy

hypoglycemic: related to low level of blood sugar

factors, diabetes requires lifestyle changes and medication adherence in order to control blood glucose levels. Due to the damage caused by hyperglycemia, diabetic patients also experience a number of complications related to the disease. With good self-management practices, however, individuals with diabetes can live a long and productive life. SEE ALSO CARBOHYDRATES; EXCHANGE SYSTEM; GLYCEMIC INDEX; HYPERGLYCEMIA; HYPOGLYCEMIA; INSULIN.

Julie Lager

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Diarrhea

Diarrhea, a condition that has a major impact on global health, is highly correlated with nutritional status. It is an important area of focus due not only to its high worldwide **prevalence** and health costs, but also because it can be significantly reduced by appropriate interventions and treatment.

Diarrhea has various causes and symptoms, resulting in a wide range of definitions for this illness. The U.S. National Institutes of Health (NIH) defines diarrhea as loose, watery stools occurring more than three times a day, which is the most common definition. The term **acute diarrhea** is used to describe an episode lasting less than three weeks. *Persistent diarrhea* is an episode that lasts more than fourteen days, and **chronic diarrhea** is the term for recurring episodes of diarrhea. *Dysentery* is diarrhea that contains blood. The severity of diarrhea ranges from **asymptomatic** to severe **dehydration** resulting in death.

Causes of Diarrhea

Diarrhea can present in many ways because it has many potential causes. Most cases of diarrhea are caused by some type of infection. For example, surveillance studies in rural Bangladesh have cited infection as the cause of 86 percent of the cases of diarrhea in that population. This is the case in much of the developing world. Regardless of the cause, diarrhea results from an alteration of the lining of the wall of the **intestines**. Normal digestion occurs when there is a balance of fluid and **nutrients** across the **bowel** wall. Disruption of this process can be caused directly by organisms, **toxins**, or immune reactions. Any imbalance alters the composition of the stool and the motility (motion) of the bowel wall, resulting in an increased loss of fluid and nutrients. Dehydration is the result of loss of body fluids and **electrolytes**. A loss of 5 percent of body weight can result in a rapid heart rate, dizziness, decreased urination, disorientation, and even coma. A 10 percent loss of body weight caused by severe diarrhea can lead to **acidosis**, **shock**, and death.

People in developing countries suffer most from infectious forms of diarrhea. Most infections pass through a fecal-oral route. This results from environmental causes such as poor sanitation, decreased access to clean water, and a poor understanding of transmission and treatment of disease. These are conditions that arise most frequently in the developing world, though they affect both rural and urban populations. Improvements in these areas result in a dramatic reduction of cases of infectious diarrhea, as shown in studies in numerous developing nations, such as India, Gambia, and elsewhere, where poor **socioeconomic status** affects a large percentage of the population. *Traveler's diarrhea* is the result of exposure to such infectious agents when visiting countries where sanitation is inadequate.

Diarrhea in Developing Nations

Diarrhea is a major cause of death in much of the world, particularly in developing nations, where the effect is greatest among the young. The World Health Organization (WHO) attributes 3.5 million deaths a year to diarrhea, with 80 percent of these deaths occurring in children under the age of five, and most occurring in children between six months and three years of age. Children are the most susceptible because a smaller amount of fluid

prevalence: describing the number of cases in a population at any one time

acute: rapid-onset and short-lived

chronic: over a long period

asymptomatic: without symptoms

dehydration: loss of water

intestines: the two long tubes that carry out the bulk of the processes of digestion

nutrient: dietary substance necessary for health

bowel: intestines and rectum

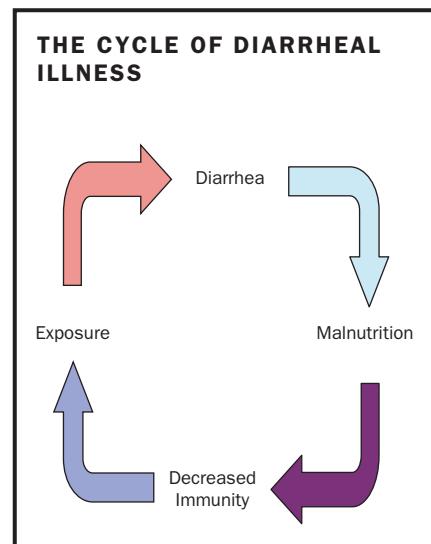
toxins: poison

electrolyte: salt dissolved in fluid

acidosis: elevated acid level in the blood

shock: state of dangerously low blood pressure and loss of blood delivered to the tissues

socioeconomic status: level of income and social class



CAUSES OF DIARRHEA

Causes	Examples
Viral infections	Rotavirus, Norwalk virus
Bacterial infections	E. coli, Vibrio cholerae, Campylobacter, Shigella
Parasites	Giardia, Entamoeba
Helminths (intestinal worms)	Strongyloides
Allergic	Lactose intolerance, celiac sprue, medication side effects
Autoimmune	Ulcerative colitis, Crohn's disease
Malabsorptive	Pancreatic deficiency, biliary disease
Nutritional	Zinc deficiency, vitamin A deficiency, enteral feedings consisting of liquid nutritional formulas delivered straight to the bowels
Functional	Irritable bowel syndrome, short bowel syndrome, cancer

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

malnutrition: chronic lack of sufficient nutrients to maintain health

absorption: uptake by the digestive tract

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

malnourished: lack of adequate nutrients in the diet

zinc: mineral necessary for many enzyme processes

catabolism: breakdown of complex molecules

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

calorie: unit of food energy

wean: cease breastfeeding

loss is necessary to result in significant dehydration, because they have fewer internal resources, and because their **energy** requirements are higher.

Children in developing nations suffer from an average of four cases of diarrhea a year. Most of these cases are infectious diarrhea. Infectious diarrhea also contributes to **malnutrition** due to a decreased nutritional intake and diminished **absorption** of vital nutrients during the acute episode and recovery period. Malnutrition, in turn, decreases the ability of the **immune system** to fight further infections, making diarrheal episodes more frequent.

Studies have shown that poor nutritional status can double the risk of contracting diarrhea when exposed to an infectious agent. In addition, the duration of the acute episode can be up to three times as long in **malnourished** children. In addition, reduced immunity and deficiencies of nutrients such as vitamin A and **zinc**, which are common in malnourished individuals, can increase the health risks from diarrhea. Diarrhea also causes decreased appetite and food intake, decreased absorption of nutrients from the food that is ingested, and increased **catabolism** of body **proteins**. The resulting **undernutrition** stunts future mental and physical development.

Eating patterns before and after diarrheal episodes play an important role in this cycle. In developing countries, environmental factors, such as pervasive bacterial contamination of water used for drinking, cooking, and cleaning, contribute to continued exposure to agents that cause diarrhea. Maternal practices related to feeding are also a factor. Reduced breastfeeding rates in developing nations mean that fewer children receive the protective and nutritional benefits of breast milk. Nursing allows for the delivery of milk high in fats, proteins, and **calories** in a sterile fashion. When illness causes mothers to **wean** their children too early, nutritious breast milk is replaced with cereals and gruels that are often low in calories and proteins and are made with contaminated water. Commercial formulas are also often diluted with contaminated water and put in bottles that are not sterile.

A lack of maternal education often leads to the common practice of withholding food during acute episodes of diarrhea out of fear that eating will exacerbate the symptoms. Because of the nutritional losses from diarrhea, children actually need up to a 30 percent increase in calories and a 100 per-

cent increase in protein intake during the acute and recovery stages of diarrhea. Studies have shown that children who receive increased nourishment during this time suffer less from the acute and long-term effects of diarrhea. The WHO recommends the continuation of breastfeeding throughout an acute episode, as well as the use of mixed food cereals high in calories and protein. There is also evidence to support zinc supplementation, which can reduce the **morbidity** rates from diarrhea.

morbidity: illness or accident

Treatment

The mainstay of treatment for diarrhea is rehydration to replace the fluid and electrolyte losses. This is the cornerstone of oral rehydration therapy (ORT), which has greatly reduced the morbidity and mortality from diarrheal illnesses throughout the world. Rehydration must be combined with the fulfillment of increased nutritional demands. **Antibiotics** have a very limited role in effectively reducing morbidity and mortality from diarrhea, and antimotility and absorbent agents have virtually no role.

antibiotic: substance that kills or prevents the growth of microorganisms

It is evident that the morbidity and mortality from diarrhea results from a complex interplay of environmental hazards, risk factors, and treatment response. Interventions to reduce the global impact of diarrhea must therefore be multifactorial in their approach. This is an illness that imposes a large health burden on society, but has avenues for effective intervention.
SEE ALSO MALNUTRITION; ORAL REHYDRATION THERAPY.

Seema Pania Kumar

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Diet

The term *diet* refers to a person's pattern of eating and drinking. Diet is influenced by many factors, including income, culture, religion, geographic location, and lifestyle. A balanced diet contains food from several food groups and supplies the body with the **energy** and essential **nutrients** it needs (as defined by the Food Guide Pyramid and **Dietary Reference Intakes**).

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

The Food Guide Pyramid lists food categories and serving recommendations. Dietary Reference Intake values provide a range of dietary recommendations, including the **Recommended Dietary Allowances** (RDAs), which provide the daily intake needed to meet the needs of "nearly all healthy persons." Dietary recommendations, and how they are represented, vary around the world. Most, however, convey a common message: balance,

nutrient: dietary substance necessary for health

Dietary Reference Intakes: set of guidelines for nutrient intake

Recommended Dietary Allowances: nutrient intake recommended to promote health

variety, and moderation in food choices. SEE ALSO EATING HABITS; DIETARY REFERENCE INTAKES; FOOD GUIDE PYRAMID; RECOMMENDED DIETARY ALLOWANCES.

Delores Truesdell

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Dietary Assessment

nutrition: the maintenance of health through proper eating, or the study of same

clinical: related to hospitals, clinics, and patient care

anthropometric: related to measurement of characteristics of the human body

body mass index: weight in kilograms divided by square of the height in meters times 100; a measure of body fat

diet: the total daily food intake, or the types of foods eaten

biochemical: related to chemical processes within cells

chronic: over a long period

malnutrition: chronic lack of sufficient nutrients to maintain health

anemia: low level of red blood cells in the blood

A dietary assessment is a comprehensive evaluation of a person's food intake. It is one of four parts of a **nutrition** assessment done in a **clinical** setting. These four parameters of assessment include: (1) an assessment of **anthropometrics** (weight, height, weight-to-height ratio, head circumference, **body mass index**, etc.); (2) dietary assessment, which includes a **diet** history or food frequency analysis; (3) a physical examination with a medical history; and (4) **biochemical** exams or blood/urine tests.

Reviewing a person's dietary data may suggest risk factors for **chronic** diseases and help to prevent them. Laboratory tests may uncover **malnutrition** and detect problems before any side effects appear, such as the tiredness and apathy associated with iron-deficiency **anemia**. The strengths of a simple blood test and food intake record are that these are easy to do and are affordable and appropriate for most people.

Problems with using diet histories can occur because a person's memory about what he or she ate earlier may not be accurate. It can also be time-consuming to collect food intake records. There are also problems with interpreting food intakes, laboratory values, and appropriate weights and heights.

A final area of concern related to dietary assessment is what to do with the information once it has been gathered. Providing nutrition education and counseling to people of different ages and from different backgrounds requires a great deal of skill and a good understanding of diet quality, normal eating, and normal physical and psychosocial development. It is important to treat people as individuals with unique needs and concerns. Dietitians are trained to do this, but many health care workers are not trained to measure diet quality, define dietary moderation, or provide counseling. SEE ALSO NUTRITIONAL ASSESSMENT.

Delores Truesdell

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Dietary Guidelines

The Dietary Guidelines for Americans are the foundation of national **nutrition** policy for the United States. They are designed to help Americans make food choices that promote health and reduce the risk of disease. The guidelines are published jointly by the U.S. Department of Agriculture (USDA) and U.S. Department of Health and Human Services (HHS). The first set of guidelines was published as *Nutrition and Your Health: Dietary Guidelines for Americans* in 1980. Since then, an advisory committee has been appointed every five years to review and revise the guidelines based on the latest research in nutrition and health.

Early Dietary Advice in the United States

The first half of the twentieth century was a period of enormous growth in nutrition knowledge. The primary goal of nutrition advice at this time was to help people select foods to meet their **energy (calorie)** needs and prevent **nutritional deficiencies**. During the Great Depression of the 1930s, food was rationed and people had little money to buy food. They needed to know how to select an adequate **diet** with few resources, and the USDA produced a set of meal plans that were affordable for families of various incomes. To this day, a food guide for low-income families—the Thrifty Food Plan—is issued regularly by the USDA and used to determine food stamp allotments. In addition to meal plans, the USDA developed food guides—tools to help people select healthful diets. Over the years the food guides changed, based on the current information available.

Food Guides versus Dietary Guidelines

Food guides are practical tools that people can use to select a healthful diet. Food guide recommendations, such as how many servings of grains to eat, are based on dietary guidelines that are overall recommendations for healthful diets. For example, the Dietary Guidelines for Americans include the recommendation that Americans “choose a variety of grains daily, especially whole grains.” To help people reach this goal, the USDA’s Food Guide Pyramid is built on a base of grain foods and recommends six to eleven servings daily with several servings from whole grains. Thus, the Food Guide Pyramid supports the recommendations of the Dietary Guidelines.

Evolution of the Dietary Guidelines

During the 1970s, scientists began identifying links between people’s usual eating habits and their risk for **chronic** diseases such as **heart disease** and **cancer**. They realized that a healthful diet was important not only to prevent **nutrient** deficiencies, but because it might play a role in decreasing the risk for chronic diseases. Since heart disease and cancer were, and still are, major causes of death and disability in the United States, there was a need to help Americans select health-promoting diets.

The first major step in federal dietary guidance was the 1977 publication of *Dietary Goals for the United States* by the Senate Select Committee on Nutrition and Human Needs, which recommended an increased intake of **carbohydrates** and a reduced intake of **fat, saturated fat, cholesterol**,

nutrition: the maintenance of health through proper eating, or the study of same

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

calorie: unit of food energy

nutritional deficiency: lack of adequate nutrients in the diet

diet: the total daily food intake, or the types of foods eaten

chronic: over a long period

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

cancer: uncontrolled cell growth

nutrient: dietary substance necessary for health

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fat: type of food molecule rich in carbon and hydrogen, with high energy content

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

salt, and sugar. There was heated debate among nutrition scientists when the Dietary Goals were published. Some nutritionists believed that not enough was known about effects of diet and health to make suggestions as specific as those given.

In 1980, the first edition of Dietary Guidelines for Americans was released by the USDA and HHS. The seven guidelines were: (1) Eat a variety of foods; (2) Maintain ideal weight; (3) Avoid too much fat, saturated fat, and cholesterol; (4) Eat foods with adequate starch and **fiber**; (5) Avoid too much sugar; (6) Avoid too much sodium; and (7) If you drink alcohol, do so in moderation. The second edition, released in 1985, made a few changes, but kept most of the guidelines intact. Two exceptions were the weight guideline, which was changed to "Maintain desirable weight" and the last guideline, in which "alcohol" was changed to "alcoholic beverages."

Following publication of the second edition of the Dietary Guidelines, two influential reports concerning diet and health were issued. The *Surgeon General's Report on Nutrition and Health* was published in 1988, and the National Research Council's report *Diet and Health—Implications for Reducing Chronic Disease Risk* was published in 1989. These two reports supported the goal of the Dietary Guidelines to promote eating habits that can help people stay healthy. In 1990, the third edition of the guidelines took a more positive tone than previous editions, using phrases such as "Choose a diet..." or "Use ... only in moderation," rather than "Avoid too much..." This was seen as a positive step by many nutrition educators.

The fourth edition was the first to include the Food Guide Pyramid, which had been introduced in 1992. It also was the first edition to address vegetarian diets and the recently introduced "Nutrition Facts" panel for food labels. The fifth edition, issued in 2000, expanded the number of guidelines to ten and organized them into three messages: "Aim for Fitness, Build a Healthy Base, and Choose Sensibly" (ABC).

The Dietary Guidelines for Americans have evolved since they were first published in 1980. Their recommendations represent the latest research in diet and health promotion, and, as new research emerges, the guidelines will continue to change to reflect new insights into diet and health. People can take steps toward healthier lifestyles by following the recommendations of the Dietary Guidelines and using tools like the Food Guide Pyramid to guide their food choices. SEE ALSO DIETARY TRENDS, AMERICAN; FOOD GUIDE PYRAMID.

Linda Benjamin Bobroff

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The 2000 Dietary Guidelines for Americans

Aim for Fitness

- Aim for a healthy weight
- Be physically active each day

Build a Healthy Base

- Let the Pyramid guide your food choices
- Choose a variety of grains daily, especially whole grains
- Choose a variety of fruits and vegetables daily
- Keep food safe to eat

Choose Sensibly

- Choose a diet that is low in fat and cholesterol and moderate in fat
- Choose beverages and foods to moderate your intake of sugar
- Choose and prepare foods with less salt
- If you drink alcoholic beverages, do so in moderation

Dietary Reference Intakes

Dietary Reference Intakes (DRIs) are a set of **nutrient** reference values. They are used to help people select healthful diets, set national **nutrition** policy, and establish safe upper limits of intake. DRIs include four sets of nutrient standards: Estimated Average Requirement (EAR), Recommended Dietary Allowance (RDA), Adequate Intake (AI), and Tolerable Upper Intake Level (UL). Starting in the mid-1990s, DRIs began to replace RDAs and Recommended Nutrient Intakes for Canadians, which had been the standards for the United States and for Canada, respectively.

Each component of the DRIs has a unique purpose. The EARs are average nutrient requirements for a population group (e.g., females ages 19–30). They are used in nutrition research and to set nutrition policy. RDA values are based on the EARs. RDA values represent a level of nutrient intake that would meet the needs of about 97 percent of people in a particular group.

If there is not enough information to set RDA values, then an AI may be established for that nutrient. The AI is based on information about average intake of the nutrient by a healthy group of people. RDA and AI are both used to plan healthful diets for individuals.

Not only is it important to know how much of a nutrient is needed for good health, it is also critical to know how much of a nutrient is too much. The UL is the highest intake of a nutrient that does not pose a threat to health for most people. Intake higher than the UL can cause adverse health effects, especially over time. SEE ALSO DIETARY ASSESSMENT; RECOMMENDED DIETARY ALLOWANCES; NUTRIENTS.

Linda Benjamin Bobroff

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Dietary Supplements

The demand for dietary supplements in the United States catapulted what was once a cottage industry into a \$14 billion per year business in the year 2000. In 1994, the U.S. Congress formally defined the term *dietary supplement* as a product taken by mouth that contains a “dietary ingredient” intended to supplement the **diet**. The dietary ingredients in these products may include **vitamins**, **minerals**, herbs, **amino acids**, **enzymes**, organ tissues, glandulars, and **metabolites**. Dietary supplements can also be extracts or concentrates, and may be found in many forms, such as tablets, capsules, liquids, or powders.

The use of dietary supplements is widespread—they are taken by half of American adults. But the use of supplements is not limited to adults. A study

nutrient: dietary substance necessary for health

nutrition: the maintenance of health through proper eating, or the study of same

diet: the total daily food intake, or the types of foods eaten

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

amino acid: building block of proteins, necessary dietary nutrient

enzyme: protein responsible for carrying out reactions in a cell

metabolite: the product of metabolism, or nutrient processing within the cell

Baby Boomers and Nutritional Supplements

Informed, prosperous, and health-conscious, the baby boomers are known as a generation that plans to fight vigorously against the encroachments of age. During the 1990s, as the boomers began reaching their fifties, they increasingly turned to supplements to ward off osteoporosis, memory loss, and a host of other ailments. With increased demand, the vitamins, minerals, and herbs they sought migrated from health food stores to mass merchandisers. Between 1997 and 2002 the supplement industry experienced a 34 percent jump in sales, to more than \$19 billion annually.

—Paula Kepos

published in the November 2001 *Journal of the American Dietetic Association* showed that dietary supplement use is prevalent among students as well, with 17.6 percent of 1,532 eighth-graders reporting the use of a vitamin-mineral supplement. Herbs, one type of dietary supplement, are widely used throughout the world. In China, traditional medicine encompasses a holistic approach to healing, and herbal remedies are routinely included in self-care. The World Health Organization (WHO) estimates that in developing countries up to 80 percent of indigenous populations rely on herbs for primary health care needs. In France and Germany, 30 to 40 percent of all medical doctors rely on herbal preparations as their primary medicines.

Regulation of Dietary Supplements

In 1994 the U.S. Congress passed the Dietary Supplement Health and Education Act (DSHEA), which President Bill Clinton signed into law the same year. One provision of DSHEA clarified the definition for dietary supplements outlined above. DSHEA also mandated the establishment of the Office of Dietary Supplements (ODS) within the National Institutes of Health. The ODS coordinates research on dietary supplements and acts as a clearinghouse for regulatory issues. It also maintains an excellent resource for consumers, the International Bibliographic Information on Dietary Supplements (IBIDS), which is a database that contains citations published in scientific journals on the topic of dietary supplements. The public can access IBIDS on the ODS website.

DSHEA established a new regulatory framework for supplement safety and for the labeling of dietary supplements by the U.S. Food and Drug Administration (FDA). Dietary supplements are regulated under food law, but with certain provisions that apply only to dietary supplements. For example, dietary supplements escape the stringent approval process that **food additives** and **drugs** must go through before being marketed to the public, unless the manufacturer of a dietary supplement makes a claim for therapeutic **efficacy**.

DSHEA also gave manufacturers the freedom to provide information about product benefits on labels through three types of claims. *Health claims* describe a relationship between a food substance and a disease or health-related condition. For example, the health claim “diets high in **calcium** may reduce the risk of **osteoporosis**” has been authorized by the FDA and may appear on the labels of dietary supplements. *Structure function claims* may state a benefit related to a nutrient-deficiency disease (such as **scurvy**, which is caused by a deficiency of vitamin C), as long as the statement tells how widespread the disease is. These claims may also describe the role of a nutrient intended to affect a structure or function—for example, “**antioxidants** maintain cell integrity,” or “calcium builds strong bones.” *Nutrient content claims* describe the level of a nutrient or dietary substance in a product, using FDA-regulated terms such as “good source,” “high,” or “free.” For example, if a label claims a dietary supplement is fat-free, the supplement must contain less than 0.5 grams of fat per serving.

However, information on supplement labels cannot be false or misleading. For example, statements that a product will treat, cure, or diagnose a disease are reserved for drugs. That is why the label of the popular herbal extract echinacea may boast that the herb “supports good immune function” but will not claim to “cure your cold.”



Because they are not regulated as strictly as drugs, dietary supplements can cause unpredictable side effects. For example, studies have shown an increased risk of prostate cancer among men who take beta-carotene supplements and drink alcohol, and an increased risk of lung cancer among people who take beta-carotene supplements and smoke. [Photograph by Robert J. Huffman. Field Mark Publications. Reproduced by permission.]

In Germany, herbs and herbal products are regulated in a different way than in the United States. In 1978, the German Federal Health Agency established the German Commission E to investigate the safety and efficacy of herbal remedies commonly used in Germany. The commission weighed evidence from the literature, from anecdotal reports, and from clinical studies. They subsequently developed monographs on over 400 herbs. These monographs are now used worldwide as essential references on herbal therapy. The commission also established indications (how an herb is used medicinally) and dosage recommendations, resulting in the successful mainstreaming of herbs into medical practice. German physicians frequently prescribe the herbs ginkgo biloba, hawthorn, St. John's wort, horse chestnut, and saw palmetto. Unlike U.S. law, German law allows herb manufacturers to market herbs with drug claims if the herb is proven safe and effective.

Controversies Surrounding the Use of Dietary Supplements

Opponents of DSHEA claim that the issue of public safety is their primary concern. Steven H. Zeisel, of the University of North Carolina School of

Public Health and School of Medicine, writes that “DSHEA modifies the regulatory environment so that it becomes possible, even likely, that products will be marketed that inadvertently harm people” (Zeisel, p. 1855). Zeisel believes that the DSHEA legislation makes it easy for small enterprises to market products without investing the time and money needed to prove their product’s safety and efficacy. He contrasts the development of a new dietary supplement to that of a new drug or food additive, for which there is a formal process to evaluate safety.

A manufacturer developing a new drug or food additive must conduct safety studies following FDA procedures. Results must be submitted to the FDA for review and approval before the ingredient or drug can be sold to the public. This is not the case for dietary supplements, however, because under DSHEA they are legally in a class by themselves. The FDA must simply be notified of the new product, and the notification must provide information that supports the manufacturer’s claim that its product is safe. Once the product is marketed, the FDA is responsible for proving that a dietary supplement is unsafe before it can take action to restrict that product’s use or remove it from the marketplace.

Another issue critics of DSHEA cite is the scant quality control of dietary supplements. Quality control is important to assure consumers that a product contains the ingredients stated on the label in the stated amounts. Neither the FDA nor any other federal or state agency routinely tests dietary supplements for quality prior to sale. But some manufacturers of dietary supplements do adhere to Good Manufacturing Practices (GMPs) and make every effort to produce a quality product. Also, the FDA has assisted the industry by proposing GMPs that focus on ensuring the identity, purity, quality, strength, and composition of dietary supplements.

DSHEA supporters fear that increased regulation of dietary supplements will decrease access to beneficial products. National opinion surveys show that many supplement users feel so strongly about the potential health benefits of supplements that they would continue to use them even if the supplements were shown to be ineffective in clinical studies. Consumers value freedom of choice, and many view regulation as an attempt by the government and medical establishment to monopolize treatment options. Clearly, a balance needs to be reached between preserving freedom of choice and ensuring that dietary supplements are safe and effective. SEE ALSO ALTERNATIVE MEDICINES AND THERAPIES; FOOD LABELS; HEALTH CLAIMS; QUACKERY; VITAMINS, FAT-SOLUBLE; VITAMINS, WATER-SOLUBLE.

Jackie Shank

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Dietary Trends, American

Americans have become more aware of what they eat, and how it might affect their health. Concerns about the safety of the food supply are on the rise, and increasing nutritional awareness has led to an increase in vegetarian, organic, and health-food options in supermarkets. "Lite" food is in, and indulgence is out. But are Americans practicing what they preach? A closer look at American dietary trends reveals that parts of the American **diet** are still lacking in nutritional quality, despite consumer demand for healthier options.

Dietary Patterns

Fruit and vegetable intake, although rising, is still below the five servings per day recommended in the USDA's Dietary Guidelines for Americans. The average American eats one and one-half servings of vegetables and one serving of fruit per day. Since the beginning of the twentieth century, consumption of milk and eggs has been declining, while cheese consumption has gone up. Meat, poultry, and fish intake has climbed dramatically. Grain and cereal consumption has also risen. Vegetable fats are increasingly being used instead of animal fats, but total **fat** consumption is still high.

Sixty percent of Americans eat snack food regularly, consuming about 20 percent of their **calories** from snacks. Because half of young adults skip breakfast, and one-fourth skip lunch, between-meal eating contributes significantly to the daily **nutrient** intakes of Americans. Children, in particular, require several small meals per day, as their stomachs cannot hold large amounts of food at one time. Carefully chosen snacks can add to good dietary habits. Most Americans, however, do not snack wisely.

More than 30 percent of men and more than 40 percent of women take a daily multivitamin/mineral supplement. Doses of about 100 percent of the Daily Value (DV) of most nutrients are common in these supplements. Although **nutrition** experts agree that the average American does not need supplements, there is little harm in taking them. Problems can arise, however, when individual nutrients are taken. Megadoses of certain **minerals** and relatively low supplemental doses of certain fat-soluble **vitamins** can lead to toxicity. For example, a surplus of vitamin A can lead to cheilitis (cracking and inflammation of the lips), dryness of the nasal **mucosa** and eyes, hair loss, and, eventually, liver damage. Megadoses of **vitamin D** can lead to the calcification of soft tissues, such as the lungs, heart, and kidneys.

diet: the total daily food intake, or the types of foods eaten

fat: type of food molecule rich in carbon and hydrogen, with high energy content

calorie: unit of food energy

nutrient: dietary substance necessary for health

nutrition: the maintenance of health through proper eating, or the study of same

mineral: an inorganic (non-carbon-containing) element, ion or compound

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mucosa: moist exchange surface within the body

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation



An average American consumes more than fifty pounds of artificial sweeteners per year, which is a 300 percent increase since 1965. Much of the increase is due to the popularity of diet soft drinks.

[Photograph by Kelly A. Quin. Reproduced by permission.]

overweight: weight above the accepted norm based on height, sex, and age

calcium: mineral essential for bones and teeth

convenience food: food that requires very little preparation for eating

fast-food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

Sweet, Quick, and Easy

Since 1965, artificial sweetener use has increased threefold. At the same time, there has been a 14 percent increase in sugar use. It seems Americans are using sugar substitutes in addition to, rather than in place of, sugar. The current consumption of all types of sweeteners is 150 pounds per capita, 99 pounds of which is sugar. According to the USDA Food Guide Pyramid, sugar and sweets should be consumed sparingly. America's preference for sweets only adds to the growing problem of an **overweight** population.

Most sweeteners are consumed in soft drinks. According to the United States Department of Agriculture (USDA) 1998 Continued Survey of Food Intakes by Individuals (CSFII), soft-drink intake has surpassed both men's and women's milk intake (since the 1989–1991 survey). Given that milk is the primary dietary **calcium** source, this trend has contributed to low calcium levels. Total soft-drink use has increased by 300 percent since the 1950s. In 1974 alone, nearly 4.5 billion cases of soft drinks were sold. It has since become nearly impossible to estimate the annual soft-drink consumption of the United States.

The introduction of the Swanson TV dinner in 1953 started the trend for **convenience foods**. In addition, fewer meals are prepared at home as more women have joined the workforce. About 25 percent of calories eaten by adult men and women are eaten away from home (according to the 1998 CSFII, which covered the years 1994–1996). "Home-cooked" meals now often come prewashed, precooked, prebaked, preprocessed, and presliced. Toaster ovens, microwaves, and other home appliances have further reduced preparation times.

The completion of the national highway system in the 1950s triggered the rise of McDonald's and other road-side hamburger chains across the nation. Many meals eaten away from home now come from **fast-food** eateries. In 1978, fast-food sales totaled \$9 billion—a figure that rose to \$106 billion in 1998. Fast-food restaurants have beaten sit-in restaurants in sales since 1994. In addition, serving sizes have continued to increase dramatically, and fast-food diets are low in calcium, riboflavin, vitamin A, folic acid, and vitamin C, as well as being high in fat and **saturated fat**.

Portion Sizes, Caloric Intake, and Obesity

Scientists have begun to trace the link between portion sizes and increased obesity in the United States. According to the Centers for Disease Control and Prevention, between 1971 and 2000 American women increased the number of calories they consumed by 22 percent (from 1,542 to 1,877 per day), while men increased their intake by 7 percent (from 2,450 to 2,618 calories). Government recommendations, by contrast, are a mere 1,600 calories a day for women and 2,200 a day for men. Many of the additional calories consumed have come from carbohydrates, which has led some scientists to theorize that an increased emphasis on

reducing saturated fat in diets led people to believe they could consume all the carbohydrates they wanted. Moreover, many more meals are now consumed outside the home, and serving sizes at national restaurant chains have become two to five times larger than they were in the 1970s. Cookbook publishers have followed suit by increasing portion sizes in recipes. During the thirty-year period covered by the study, obesity rates doubled, and two-thirds of Americans are now considered overweight.

—Paula Kepos

AMERICAN DIETARY TRENDS, BY DECADE

	Historical Events	Food Trends of the Time
1950–1959	- Mothers returning to the home after the war effort - Postwar baby boom - Construction of the national highway system	- Packaged meals available - First TV dinner (Swanson), 1953 - Rise of hamburger chains along highways; Oscar Mayer "Wiener-Mobile"
1960–1969	- Growing middle class with money to spend - Growing social unrest over the Vietnam War in late 1960s	- Introduction of Julia Child's French cooking - "Hippies" bring back demand for unprocessed, made-from-scratch foods - Vegetarian trend starts
1970–1979	- End of Vietnam War - Watergate scandal - Growing inflation - Major influx of Asians due to Immigration Act of 1965	- Continued demand for organic and fresh: "California Cuisine" - Elaborate dinner parties with ethnic dishes - Growing appetite for Asian cuisine
1980–1989	- Stock market plummet of 1987	- "Nouvelle Cuisine" is the thing du jour—diners willing to pay more to eat less - Return to simplicity in late 1980s - Exploration of different tastes (e.g., TexMex, Ethiopian, Southwestern)
1990–1999	- Introduction of the Internet puts foods at consumers fingertips	- Everything reduced-fat, low-fat, fat-free - Naturally healthy cuisines (Mediterranean) - New movement toward simplicity

Nutritional Adequacy

Many adult women fail to meet the **Recommended Dietary Allowances** (RDAs) for calcium, vitamin E, vitamin B₆, magnesium, and **zinc**. Adult men fall short on vitamin E, magnesium, and zinc. Men consume about 4,000 milligrams of sodium each day, while women consume about 3,000. Both exceed the recommended level of no more than 2,400 milligrams of sodium per day.

All age groups above age two exceed the recommended intake of fat (no more than 30 percent of calories) and saturated fat (no more than 10 percent of calories). **Cholesterol** consumption is within the recommendation of no more than 300 milligrams per day. **Iron** intake is often low, especially in adolescents and adult women, and iron-deficiency **anemia** is higher in these groups than in any other. Low calcium intake is of particular concern in adolescent girls and pregnant women.

The main shortcoming of the American diet is the surplus of **energy** (calories). Over one third of adult Americans are **obese** (and many more are overweight), and a growing number of children are overweight. The reason for this increasing trend is two-fold: energy consumption is up, and activity levels are down.

The Third National Health and Nutrition Examination Survey (NHANES III), carried out between 1988 and 1994, showed an increase of between 100 and 300 calories in daily energy intake since NHANES II (1976 to 1980). In addition, a 1993 survey of 87,000 adults undertaken by the Center for Disease Control and Prevention (CDC) showed that 58.1 percent of Americans engaged in little or no physical activity. This lack of exercise, coupled with increased food intake, contributes to many **chronic** diseases, such as **cardiovascular** disease, certain types of **cancer**, and **diabetes**.

Although awareness about proper diet has increased, most Americans do not follow the recommended guidelines for healthful eating. Fast-food

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

Recommended Dietary Allowances: nutrient intake recommended to promote health

zinc: mineral necessary for many enzyme processes

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

iron: nutrient needed for red blood cell formation

anemia: low level of red blood cells in the blood

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

obese: above accepted standards of weight for sex, height, and age

chronic: over a long period

cardiovascular: related to the heart and circulatory system

cancer: uncontrolled cell growth

diabetes: inability to regulate level of sugar in the blood

and convenience-food consumption, snacking, supplementation, and soft-drink use have all increased. Many Americans do not meet the RDAs for key nutrients, yet they exceed their caloric requirements, leading to an increasingly overweight population. Future trends will likely include a higher demand for safer, quicker, and more convenient fast foods that also provide the health benefits Americans need. SEE ALSO CONVENIENCE FOODS; FAST FOODS; OBESITY; RECOMMENDED DIETARY ALLOWANCE.

Kirsten Herbes

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Dietary Trends, International

malnutrition: chronic lack of sufficient nutrients to maintain health

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fiber: indigestible plant material that aids digestion by providing bulk

fat: type of food molecule rich in carbon and hydrogen, with high energy content

calorie: unit of food energy

diet: the total daily food intake, or the types of foods eaten

What foods an individual eats is affected by the ability to access foods. Economic status, geography, and politics have influenced the diets of people throughout history. Poverty is linked to **malnutrition**, while economic growth and a rise in population pose new nutritional problems. Ironically, diets high in complex **carbohydrates** and **fiber** in poor economic times give way to consumption of foods high in sugars and **fat** when economic conditions improve.

Between 1995 and 1997, among countries that showed an increase in per capita incomes, average caloric consumption also showed a significant increase. Between 1970 and 1972, and between 1996 and 1997, world consumption of **calories** from complex carbohydrates fell by 30 percent while the consumption of calories from meat increased by a third (33%) and those from vegetable oil by almost half (46.2%). As nations become wealthier, people move from eating "a poor man's **diet**" of high levels of grains, fruits, and vegetables to consuming diets with more fats and sugar. Fat still remains the food for the rich—with more income, people start to eat more meat and poultry, and vegetable oils become more available. Combined with cane and corn sugars, vegetable oils are used to produce baked goods and snack foods high in calories.



Young Chinese attend a weight-loss lecture in Shanghai. A trend toward obesity in many nations is accompanied by obsession over body image. During 2002, several citizens of Asian nations died and hundreds were sickened when they took a popular diet pill that was known to cause health problems.

[AP/Wide World Photos. Reproduced by permission.]

The Westernization of Dietary Patterns

Toward the end of the twentieth century, economic growth among developing countries caused the phenomenon of the Westernization of traditional eating patterns. Industrialization and modern transportation brought baking technology and Western food styles to developing countries. New and tasty foods high in fat, sugar, and salt became the choice of the new rich. Trendy fast foods, soft drinks, and meat products replaced traditional ethnic foods.

Fortunately, in many emerging societies the poor are still unable to afford Western fast foods, and are thus spared the ills of high consumption of fats, meat, and sugars. For example, many people in India still spend more than half their income on food consumed at home, compared to the average American, who spends less than 8 percent of his or her disposable income on home-cooked food.

The American diet, much like that of many industrialized nations, derives its calories from fats, sugars, and animal products in foods prepared or processed away from home. One out of every three meals in America is consumed away from home. From 1990 to 2000 there was a 14 percent decrease in the number of meals eaten at home. In 1977 only 16 percent of all meals and snacks were eaten way from home. By 1995, this rose to 27 percent. In 1995, away-from-home foods provided 34 percent of total caloric intake, an increase from 18 percent in 1977. In addition, eating at home does not always mean cooking. Supermarkets and grocery stores provide thousands of ready-made meals, frozen foods, and processed meals that require little preparation at home.

Total fat consumption in the United States increased from 18 percent in 1977 to 38 percent in 1995. According to Lin and Frazao, away-from-home foods deliver more calories in fat and **saturated fat** and are lower in fiber and **calcium** than home-cooked foods. The average total calories consumed by Americans rose from 1,807 calories in 1987 to 2,043 calories in

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

calcium: mineral essential for bones and teeth

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

obesity: the condition of being overweight, according to established norms based on sex, age, and height

overweight: weight above the accepted norm based on height, sex, and age

obese: above accepted standards of weight for sex, height, and age

chronic: over a long period

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

hypertension: high blood pressure

hyperlipidemia: high levels of lipids (fats or cholesterol) in the blood

cancer: uncontrolled cell growth

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

type II diabetes: Inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

incidence: number of new cases reported each year

food additive: substance added to foods to improve nutrition, taste, appearance or shelf-life

food poisoning: illness caused by consumption of spoiled food, usually containing bacteria

bacteria: single-celled organisms without nuclei, some of which are infectious

virus: noncellular infectious agent that requires a host cell to reproduce

toxins: poison

parasite: organism that feeds off of other organisms

1995. Since away-from-home foods deliver more fat and more calories, the trend of eating out can become a health hazard. People tend to eat more from restaurants and **fast-food** places because many eating establishments “supersize” their portions. Customers feel that they get their money’s worth when they receive more food than they need.

Influence of Diet on Health

Childhood and adulthood **obesity** are on the rise. Between 1988 and 1994, 11 percent of U.S. children and adolescents aged six to nine years of age were **overweight** or **obese**. During this same period, 35 percent of the American adult population aged twenty and over were obese, compared to 25 percent during the years 1976 through 1980. The rising trend in obesity pervades the Middle East, the Caribbean, Europe, Latin America, Brazil, Japan, South East Asia, Australia, and China.

Since being overweight is associated directly with many **chronic illnesses**, such as **heart disease**, **hypertension**, **hyperlipidemia**, **cancer**, **stroke**, and **type II diabetes**, an increase in the **incidence** of overweight and obesity is a serious concern. The top three leading causes of death in the United States during the 1990s were heart disease, cancer, and stroke. Diabetes ranked seventh in 1997—it was not even in the top ten in 1987. The U.S. Surgeon General reported in 1998 that type II diabetes, an adult health problem related to obesity, was being seen in children as young as four years old. Diabetes among adults increased by 70 percent between 1990 and 1998 among individuals 30 to 39 years of age; by 41 percent among individuals 40 to 49; and by 31 percent among those 50 to 59. By 1998, 16 million American adults suffered from diabetes. In addition to the health threat, obesity can cause emotional pain due to social stigmatization, discrimination, and lowered self-esteem. In 2000, the World Health Organization estimated that there are 1.2 billion obese individuals around the world.

Food Safety

The increase in the number of fast-food restaurants, supermarkets, and restaurants in developing countries, and the rising trend of eating meals away from home, present a global challenge to ensure that food is appealing and safe. Many countries have agencies that set and regulate standards for food safety. In the United States, the U.S. Department of Agriculture (USDA) has the task of regulating and inspecting meats and poultry during slaughter and processing, while the Food and Drug Administration (FDA) is responsible for conducting tests, setting standards, and enforcing laws regulating food quality and processing. FDA inspectors check restaurants to make sure that they practice food safety regulations. FDA officials also review the safety of chemicals that manufacturers use as **food additives**. Importing foods from countries where food safety is not strictly monitored presents a global health threat.

The biggest problem with food safety is **food poisoning**. Some **bacteria** and **viruses** that cause food poisoning are: *Escherichia coli*, *Salmonella*, *Listeria monocytogenes*, *Shigella*, *Campylobacter*, and *yersinia*. Bacteria, viruses, **toxins**, **parasites**, and chemical contaminants can all cause food-borne illnesses, and it takes only a small amount of contaminated food to cause severe food illnesses.



Abaya-wearing women in Saudi Arabia wait in the ladies-only line to order a quick meal. In developing nations, the popularity of fast-food alternatives to traditional cuisines has prompted debate over the nutritional and cultural impacts of Westernization. [Photograph by Saleh Rifai. AP/Wide World Photos. Reproduced by permission.]

Signs and symptoms of food-borne illness may present within thirty minutes of eating contaminated food, or they may not show up for up to three weeks. While some food-borne illnesses may last for a couple of days, some may last for weeks. Severe cases can be life threatening. SEE ALSO CONVENIENCE FOODS; FAST FOODS; OBESITY.

Kweethai C. Neill

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nutrition: the maintenance of health through proper eating, or the study of same

diet: the total daily food intake, or the types of foods eaten

Dietetic Technician, Registered (DTR)

A dietetic technician, registered (DTR) is a professional who is knowledgeable about food, **nutrition**, and **diet** therapy, which is the use of diet and nutrition in the treatment of diseases. A person seeking DTR credentials must complete a two-year associate's degree in an accredited dietetic technician (DT) program, a minimum of 450 hours of supervised practice experience (gained under the direction of an accredited DT program), and successfully complete the national registration examination for DTR.

The goal of a DTR is to provide safe and effective food and nutrition services to the public. DTRs work independently or with registered dietitians in a variety of settings, such as hospitals, food service operations, and public health. Thus, they may provide nutrition services to individuals, manage food service operations, or provide nutrition education. SEE ALSO AMERICAN DIETETIC ASSOCIATION; CAREERS IN DIETETICS.

Susan Himburg

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Dietetics

nutrient: dietary substance necessary for health

Dietetics is the study of food, food science, and nutrition, and of the interactions of food and **nutrients** in people and populations. It can also refer to the management of food service and the provision of health guidance in a variety of settings, including hospitals, nursing homes, health departments, clinics, and in private practice.

The study of dietetics prepares students to apply the principles of food, nutrition, and food service management to caring for the health of individuals and groups of people. Individuals who graduate from an approved dietetics program are eligible to take the RD (registered dietitian) examination. The goal of dietetics programs, which are offered at both undergraduate and graduate levels, is to promote health and decrease disease by training health care professionals in nutrition science, thus enabling them to foster good nutritional health for individuals and diverse populations across the lifespan. These programs also provide information on health care policy and administration, delivery systems, reimbursement issues, and regulations. SEE ALSO AMERICAN DIETETIC ASSOCIATION; CAREERS IN DIETETICS; DIETETIC TECHNICIAN, REGISTERED; DIETITIAN; NUTRITIONIST.

Delores Truesdell

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Dieting

The term *dieting* refers to restrictive eating or nutritional remedies for conditions such as iron-deficiency **anemia**, **gastrointestinal** diseases, pernicious anemia, **diabetes**, **obesity**, or **failure to thrive**. Someone can be on a heart-healthy **diet** that encourages the consumption of reasonable amounts of whole grains and fresh fruits, vegetables, beans, and fish, but limits foods high in **saturated fat** and sodium, or one can be on a weight loss diet. Examples of weight loss diets include: the Atkins New Diet Revolution, the Calories Don't Count Diet, the Protein Power Diet, the Carbohydrate Addict's Diet, and Weight Watchers. There is a lack of research, however, on whether these diets (except for Weight Watchers) are helpful, especially over the long term (defined as two to five years from the date of weight loss).

The recommended approach to dieting for weight loss is to eat in moderation so as to control calories (do not go below 1,200 per day) and to increase activity to lead to a gradual, safe weight loss. A recommended method is to decrease calories each day by 125 (the amount in a small soft drink or full cup of juice) and to increase **energy** expenditure by 125 (walking for about 30 minutes). That is, a 250-calorie deficit a day should result in about a one- to two-pound weight loss over the course of a month. The goal is to slowly change eating and exercise routines and maintain a lifelong healthy weight. Quicker weight losses are hard to maintain. Most people can lose weight on any diet, even on fad diets, but the trick is to keep the weight off.

So-called fad diets are diets that come and go in the marketplace and are typically deficient in various ways. For example, they may lack variety (e.g., the Grapefruit Diet, the Cabbage Soup Diet), be too low in calories and protein (the Rice Diet), and/or simply too bizarre (the Rotation Diet for food **allergies**). People should be especially wary of any "breakthrough" quick-fix diets. If a diet sounds too good to be true, it probably is.

Delores Truesdell

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anemia: low level of red blood cells in the blood

gastrointestinal: related to the stomach and intestines

diabetes: inability to regulate level of sugar in the blood

obesity: the condition of being overweight, according to established norms based on sex, age, and height

failure to thrive: lack of normal developmental progress or maintenance of health

diet: the total daily food intake, or the types of foods eaten

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

allergy: immune system reaction against substances that are otherwise harmless

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Dietitian

nutrition: the maintenance of health through proper eating, or the study of same

physiology: the group of biochemical and physical processes that combine to make a functioning organism, or the study of same

internship: training program

entrepreneur: founders of new businesses

clinical: related to hospitals, clinics, and patient care

diabetes: inability to regulate level of sugar in the blood

cancer: uncontrolled cell growth

A clinical dietitian helps her patient design a nutritious weight-loss program. Such work is increasingly valuable in the United States, where three out of five adults are overweight or obese. [© 1992 SIU Biomed Comm. Custom Medical Stock Photo. Reproduced by permission.]

A dietitian is a professional nutritionist—an educated food and **nutrition** specialist who is qualified by training and examination to evaluate people's nutritional health and needs. Most dietitians are registered and are referred to as RDs. To become an RD, a person must earn an undergraduate degree in nutrition, food science, or food management, including courses in several other related subjects (chemistry, anatomy and **physiology**, management, psychology, etc.); complete a 900-hour **internship**; pass a national exam administered by the Commission on Dietetic Registration (the credentialing arm of the American Dietetic Association), and maintain up-to-date knowledge and registration by participating in required continuing education activities, such as attending workshops, doing research, taking courses, or writing professional papers.

Administrative dietitians are sometimes called dietary directors. They are **entrepreneurs**, disturbance handlers, resource allocators, and negotiators who work in local health departments or manage the **clinical** and food service systems in hospitals, correctional facilities, or long-term care institutions. Clinical dietitians or nutrition managers provide patient care in hospitals and in outpatient clinics especially related to **diabetes** and **cancer**. Nutrition-support-team dietitians coordinate nutrition care with other health care professionals; they may work in teaching hospitals, outpatient clinics, or in pediatric and diabetes clinics. In school food service, dietitians manage the overall operation, including the purchasing of food. In the food and pharmaceutical industry, dietitians conduct research, develop and market products, and represent companies at various food and health shows.



Some states require people who provide nutrition advice to be licensed, but not necessarily registered. Others allow anyone to use the title *nutritionist*. However, the title *registered dietitian* is usually used only by those who have completed the appropriate course work. The purpose of registration is to protect the health and welfare of the public by encouraging high standards of performance. SEE ALSO AMERICAN DIETETIC ASSOCIATION; CAREERS IN DIETETICS; DIETETICS.

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Digestion and Absorption

Digestion is the breakdown of food into smaller particles or individual **nutrients**. It is accomplished through six basic processes, with the help of several body fluids—particularly digestive juices that are made up of compounds such as saliva, mucus, **enzymes**, hydrochloric acid, bicarbonate, and **bile**.

The six processes of digestion involve: (1) the movement of food and liquids; (2) the lubrication of food with bodily secretions; (3) the mechanical breakdown of **carbohydrates**, fats, and **proteins**; (4) the reabsorption of nutrients—especially water; (5) the production of nutrients such as vitamin K and **biotin** by friendly **bacteria**; and (6) the excretion of waste products. Comprehension of the tasks or processes needed to break down food are essential to an understanding of how and when food really begins to function within the body. For example, not understanding that carbohydrates break down into **glucose** could lead one to believe that the best source of glucose is in liquid form such as a soft drink. This could cause one to miss out on the nutrients (and great taste) in fruits, vegetables, and grains. Likewise, not understanding the digestion process could lead a person to believe in the myth of “food combining,” or perhaps to think it is normal to be hungry all the time. But, in fact, the digestive processes normal to human **physiology** can simultaneously handle carbohydrates, fats, and proteins—and allow people to go several hours between meals, especially if meals are balanced in **fiber** and the individual nutrients needed.

GI Tract Physiology

Digestion begins in the mouth with the action of salivary amylase. The food material then progresses past the esophagus and into the stomach. A bolus (soft mass) of chewed food moves by muscular wave actions, called *peristalsis*, from the mouth to the pharynx, and then past the epiglottis that covers the larynx. The epiglottis closes off the air passage so that one doesn’t choke. The cardiac sphincter prevents reflux of stomach contents into the esophagus.

From the Stomach to the Small Intestine

Food mixtures leaving the stomach are called *chyme*, and this empties into the small intestine after about two to four hours in the stomach. The small

nutrient: dietary substance necessary for health

enzyme: protein responsible for carrying out reactions in a cell

bile: substance produced in the liver which suspends fats for absorption

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

biotin: a portion of certain enzymes used in fat metabolism; essential for cell function

bacteria: single-celled organisms without nuclei, some of which are infectious

glucose: a simple sugar; the most commonly used fuel in cells

physiology: the group of biochemical and physical processes that combine to make a functioning organism, or the study of same

fiber: indigestible plant material that aids digestion by providing bulk

intestine is where most digestion takes place. A pyloric sphincter controls the rate of flow of chyme from the stomach into the small intestine.

Most digestion occurs in the upper portion of the small intestine, called the *duodenum*. Below the duodenum is the *jejunum*, and then there is the last segment, called the *ileum*. About 5 percent of undigested food products are broken down in the ileum. This is why some people can have a small part of their intestine removed and still seem to digest most foods with little problem.

Digestion of food that enters the small intestine is usually complete after three to ten hours. Once digestion is essentially finished, waste products leave the ileum with the help of fiber, and these solids then enter the large intestine (the colon). In the colon, water is reabsorbed; some nutrients are produced by friendly bacteria (vitamin K, biotin, vitamin B₁₂); fibers are digested to various acids and gases; and **minerals**, such as potassium and sodium, are reabsorbed (when needed). Any fiber that is not broken down—and small amounts of other undigested products—are excreted in the feces.

Protective Factors

During digestion in the stomach, large proteins break down into smaller protein forms, and harmful bacteria can become inactive. Hydrochloric acid is especially important for this because it lowers the **pH** of the stomach contents below 2. Along with the uncoiling of protein in the stomach, a little carbohydrate and lipid are broken down with the help of enzymes (called *amylase* and *lipase*, respectively).

In the stomach, carbohydrates in foods turn to starch, but it is not until the chyme reaches the small intestine and becomes more neutralized that starch turns to simple sugars that are then absorbed into the portal vein, which transports them to the liver. Also in the small intestine, lipids (mostly in the form of **triglycerides**) are emulsified and form **monoglycerides** and free **fatty acids** that can then go through the **lymph system** to the heart and bloodstream.

As previously mentioned, the mouth, stomach, small intestine, and colon are the major organs of digestion. However, the liver, gallbladder, and pancreas are also important to the process. The liver detoxifies foreign compounds, such as natural **toxicants** in foods and **drugs**. The liver also makes bile, an emulsifier, which enters the small intestine and prepares fats and oils for digestion. This bile is stored in the gallbladder prior to delivery to the small intestine. A **hormone** called *cholecystokinin* helps control the release of bile.

The pancreas makes pancreatic juice consisting of enzymes (amylases, lipases, and proteases) and bicarbonate, which helps neutralize acidic secretions produced during digestion. The pancreas delivers the pancreatic juice to the small intestine, in response to a signal of food in the intestine and the release of the hormone *secretin*. The pancreas also has another function, the secretion of the hormones *insulin* and *glucagon*, which helps maintain a steady state of blood sugar in the body (insulin decreases blood glucose concentration, while glucagon increases it).

Food moves from the mouth to the epiglottis, bypassing the trachea, into the esophagus, past the cardiac sphincter into the stomach, past the pyloric valve into the small intestine (duodenum, jejunum, ileum), and then

mineral: an inorganic (non-carbon-containing) element, ion, or compound

pH: level of acidity, with low numbers indicating high acidity

triglyceride: a type of fat

monoglyceride: breakdown product of fats

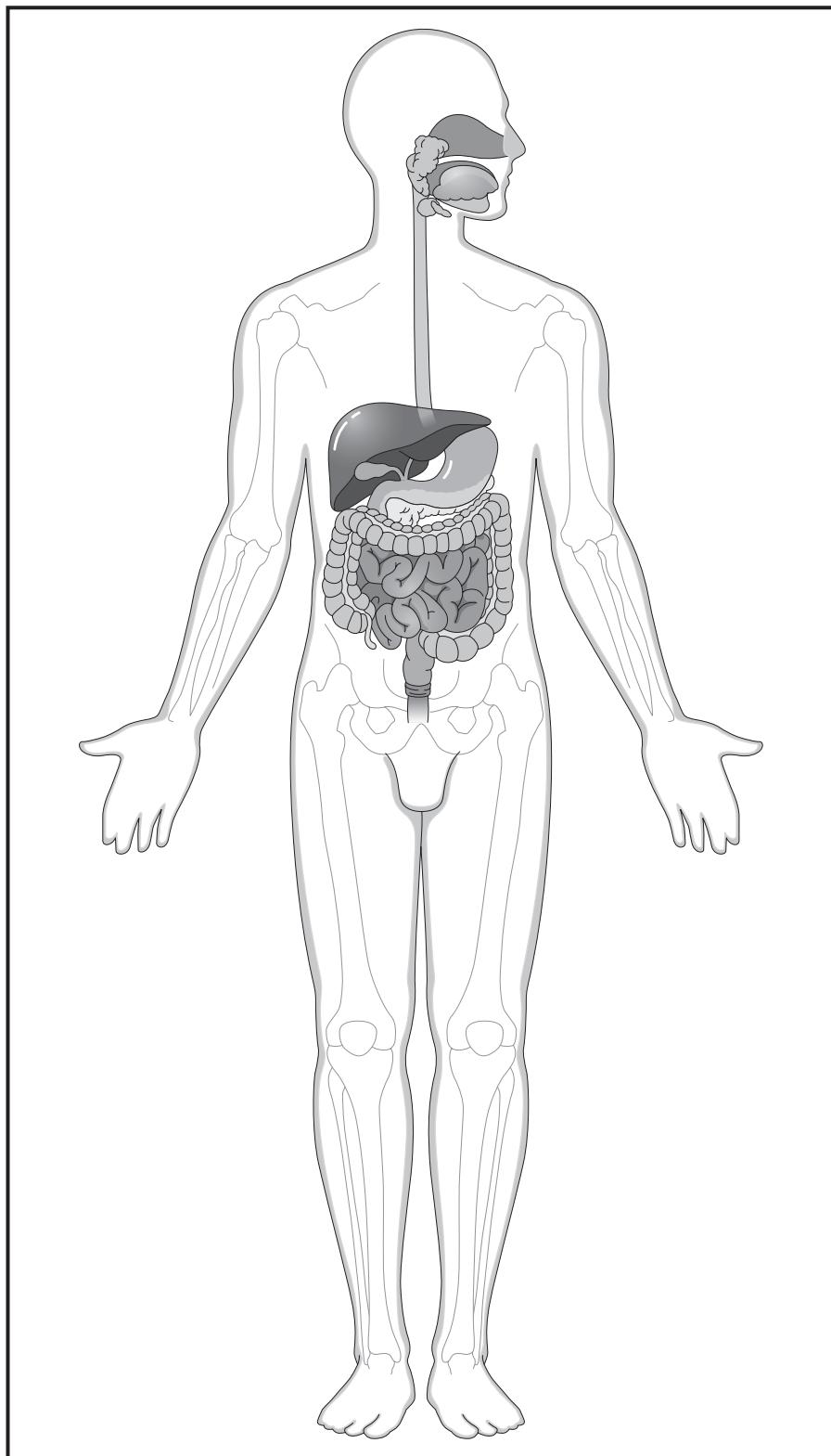
fatty acids: molecules rich in carbon and hydrogen; a component of fats

lymph system: system of vessels and glands in the body that circulates and cleans extracellular fluid

toxicant: harmful substance

drugs: substances whose administration causes a significant change in the body's function

hormone: molecules produced by one set of cells that influence the function of another set of cells



The tract running from the esophagus to the large intestine is called the alimentary canal, and it is where most digestion occurs. As food is pushed through the system, it encounters numerous specialized processes that act on it in different ways, extracting nutrients and rejecting waste. [Illustration by Argosy. The Gale Group.]

past the ileocecal valve into the colon. Waste then leaves the colon through the rectum and anus. When chyme reaches the small intestine, the pancreas and liver contribute to the digestion by providing products such as bicarbonate, enzymes, and bile.

Absorption

molecule: combination of atoms that form stable particles

gastrointestinal: related to the stomach and intestines

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

lactose intolerance: inability to digest lactose, or milk sugar

allergy: immune system reaction against substances that are otherwise harmless

amino acid: building block of proteins, necessary dietary nutrient

lipid: fats, waxes, and steroids; important components of cell membranes

gastric: related to the stomach

ulcer: erosion in the lining of the stomach or intestine due to bacterial infection

nervous system: the brain, spinal cord, and nerves that extend throughout the body

stress: heightened state of nervousness or unease

water-soluble: able to be dissolved in water

lymphatic system: group of ducts and nodes through which fluid and white blood cells circulate to fight infection

Absorption is the movement of **molecules** across the **gastrointestinal** (GI) tract into the circulatory system. Most of the end-products of digestion, along with **vitamins**, minerals, and water, are absorbed in the small intestinal lumen by four mechanisms for absorption: (1) active transport, (2) passive diffusion, (3) endocytosis, and (4) facilitative diffusion. Active transport requires **energy**.

Nutrient absorption is efficient because the GI tract is folded with several surfaces for absorption and these surfaces are lined with villi (hairlike projections) and microvilli cells. As one nutrition textbook puts it, each person has a surface area “equivalent to the surface of a tennis court” packed into his or her gut (Insel et al., p. 81). Efficient absorption can be compromised due to **lactose intolerance**. Lactose intolerance is not uncommon in the world, affecting about 25 percent of the U.S. population and 75 percent of the worldwide population. It is usually due to the lack or absence of the enzyme *lactase*, which breaks down milk sugar.

Lactose intolerance is not a food **allergy**. Food allergies are serious, even life threatening, but most people with lactose intolerance can digest small amounts of milk, especially in yogurt and cheese.

Protein, carbohydrate, lipid, and most vitamin absorption occur in the small intestine. Once proteins are broken down by proteases they are absorbed as dipeptides, tripeptides, and individual **amino acids**. Carbohydrates, including both sugar and starch molecules, are broken down by enzymes in the intestine to disaccharides called *sucrose*, *lactose*, and *maltose*, and then finally into the end-products known as *glucose*, *fructose*, and *galactose*, which are absorbed mostly by active transport. Lipase, an enzyme in the pancreas and the small intestine, and bile from the liver, break down **lipids** into fatty acids and monoglycerides; these end-products then are absorbed through villi cells as triglycerides.

Alcohol is not a nutrient, but 80 percent of consumed alcohol is absorbed in the small intestine. The other 20 percent is absorbed into the stomach. Alcohol is absorbed by simple diffusion, which explains why **gastric ulcers** are not uncommon in people who drink excessively.

Coordination and Transport of Nutrients into the Blood or to the Heart

Hormones and the **nervous system** coordinate digestion and absorption. The presence of food, or the thought or smell of food, can cause a positive response from these systems. Factors that can inhibit digestion include **stress**, cold foods, and bacteria.

After foods are digested and nutrients are absorbed, they are transported to specific places throughout the body. **Water-soluble** nutrients leave the GI tract in the blood and travel via the portal vein, first to the liver and then to the heart. Unlike the vascular system for water-soluble nutrients, the **lymphatic system** has no pump for fat-soluble nutrients; instead, these nutrients eventually enter the vascular system, though they bypass the activity of the liver at first. SEE ALSO BIOAVAILABILITY; EATING HABITS; INSULIN; NUTRITION.

Delores Truesdell

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Disaster Relief Organizations

Natural disasters, as well as some human-caused disasters, lead to human suffering and create needs that the victims cannot alleviate without assistance. Examples of disasters include hurricanes, tornadoes, floods, earthquakes, drought, blizzards, **famine**, war, fire, volcanic eruption, a building collapse, or a transportation wreck. When any such disaster strikes, a variety of international organizations offer relief to the affected country. Each organization has different objectives, expertise, and resources to offer, and several hundred may become involved in a single major disaster. International disaster relief on such a large scale must be properly coordinated to avoid further chaos and confusion both during and after the disaster.

famine: extended period of food shortage

Assessment

In the event of a disaster, the government of the affected country must conduct a **needs assessment** to determine what emergency supplies and personnel are required. These needs should be communicated to those relief organizations that will potentially provide assistance. The process of requesting and receiving supplies is lengthy and includes many events that could delay the arrival of assistance. Requests for assistance must first be reviewed and approved by relief organizations, and then supplies and personnel must be collected and transported to the disaster site. Effective management of relief assistance depends on anticipating and identifying problems, and on delivering specific supplies and personnel at the times and places they are needed.

needs assessment: formal procedure for determining needs

Health Risks

Disasters often pose significant health threats. One of the most serious concerns after a disaster, especially a natural disaster, is sanitation. Disruptions in water supplies and sewage systems can pose serious health risks to victims because they decrease the amount and quality of available drinking water and create difficulties in waste disposal. Drinking water can be contaminated by breaks in sewage lines or the presence of animal cadavers in water sources. These factors can facilitate the spread of disease after a disaster. Providing **potable** drinking water to victims and adopting alternative methods of sanitation must be a priority after a disaster.

potable: safe to drink

Food shortages are often an immediate health consequence of disasters. Existing food stocks may be destroyed or disruptions to distribution systems may prevent the delivery of food. In these situations, food relief programs should include the following elements: (1) assessment of food supplies available after the disaster, (2) determination of the nutritional needs of victims, (3) calculation of daily food needs, and (4) surveillance of victims' nutritional

A woman gets her monthly distribution of food at a disaster-relief center in Baghdad. Following the 2003 war in Iraq, hundreds of relief agencies provided support to affected citizens. [Photograph by Caroline Penn. Corbis. Reproduced by permission.]



malnutrition: chronic lack of sufficient nutrients to maintain health

status. Some populations are particularly susceptible to **malnutrition**, such as children under five years of age and pregnant women. In addition to food, these populations should be given nutritional supplements whenever possible.

After a disaster, victims must be protected from hazardous climatic conditions, such as severe temperatures or precipitation. People should be kept dry, reasonably well clothed, and able to access emergency shelter.

drugs: substances whose administration causes a significant change in the body's function

Disasters can also cause disruptions to the health care infrastructure. Hospitals and health centers may suffer structural damage, or health personnel may be among the casualties, limiting the ability to provide health services to disaster victims. Emergency Health Kits that contain essential medical supplies and **drugs** are often provided to victims as part of the immediate response to disasters. Developed through the collaboration of various relief organizations, these kits are designed to meet the primary health care needs of people without access to medical facilities. Each kit covers the needs of about 10,000 persons for three months, at a cost of about fifty cents per person. The twelve essential drugs in the basic kit include anti-inflammatories, an antacid, a disinfectant, oral **dehydration** salts, an antimalarial, a basic **antibiotic** (effective against the most common **bacteria**), and an ointment for eye infections. These medicines can treat the most common illnesses of disaster victims, such as **anemia**, pain, diarrhea, fever, respiratory tract infections, eye and ear infections, measles, and skin conditions. The basic kit also includes simple medical supplies such as cotton, soap, bandages, thermometers, some medical instruments, health cards and record books, and items to help create a clean water supply.

dehydration: loss of water

antibiotic: substance that kills or prevents the growth of microorganisms

bacteria: single-celled organisms without nuclei, some of which are infectious

anemia: low level of red blood cells in the blood

incidence: number of new cases reported each year

Risk of Disease

Natural disasters do not usually result in infectious disease outbreaks. However, certain circumstances can increase the chance for disease transmission. Immediately after a disaster, most increases in disease **incidence** are caused

INTERNATIONAL DISASTER RELIEF ORGANIZATIONS AND AGENCIES

Organization or Agency Name	Services
Adventist Development and Relief Agency International (ADRA)	Provides immediate disaster relief; supports development programs in community development, construction, and agriculture
Church World Service (CWS)	Provides material aid to refugees and disaster victims; supports development programs in agriculture, energy, soil conservation, reforestation, preventive medicine, sanitation, and potable water supply
Cooperative for Assistance and Relief Everywhere (CARE)	Provides refugee and disaster relief; supports development programs in reforestation, conservation, and agriculture
Direct Relief International (DRI)	Specializes in emergency health care, providing pharmaceuticals, medical supplies, and equipment in famine, refugee, and disaster-affected areas
Disaster Preparedness and Emergency Response Association (DERA)	Assists international communities in disaster preparedness, response, and recovery; serves as a professional association linking disaster relief personnel
Food for the Hungry (FH)	Provides food aid and disaster relief supplies; provides technological support to eliminate hunger
League of Red Cross and Red Crescent Societies (LICROSS)	Coordinates relief activities for disaster victims; provides assistance to refugees; helps countries increase their capacity to respond to humanitarian needs of victims
Lutheran World Federation (LWF)	Provides emergency relief for disaster victims; supports refugee settlement programs and a variety of development assistance activities
OXFAM International (formerly Oxford Committee for Famine Relief)	Provides assistance to people affected by emergencies, disease, famine, earthquakes, war, and civil conflict; supports long-term development programs in impoverished nations
Salvation Army World Service Office (SAWSO)	Supports a variety of programs in disaster relief, community development, food production, public health, and social welfare
United Nations Children's Fund (UNICEF)	Provides disaster and refugee assistance, particularly to children; supports programs in sanitation and water supply; promotes training and education to improve child health care
United Nations Office for the Coordination of Humanitarian Affairs (OCHA)	Responsible for the coordination of UN assistance in humanitarian crises; provides support for international policy development; advocates humanitarian issues
United States Agency for International Development (USAID)	Provides humanitarian, economic, and development assistance to the international community; houses the Office of U.S. Foreign Disaster Assistance

by fecal contamination of water and food supplies. This contamination usually results in intestinal disease. Outbreaks of communicable diseases are directly associated with population density and displacement. If disaster victims live in overcrowded conditions or are forced to leave their homes, the risk of a disease outbreak increases. An increased demand on water and food supplies, elevated risk of contamination, and disruption of sanitation services all contribute to the risk of a disease outbreak.

In the longer term after a disaster, the risk for vector-borne diseases increases. Vector-borne diseases are spread to humans by insects and other arthropods, such as ticks or mosquitoes. Vector-borne diseases are of particular concern following heavy rains and floods. Insecticides may be washed away from buildings and the number of mosquito breeding sites may increase. In addition, wild or domestic animals that have been displaced can introduce infection to humans.

International disaster relief organizations play an important role in the response to disasters. They provide valuable supplies and personnel to victims and help to minimize the social, economic, and health consequences of a disaster. Health concerns, such as potential disease outbreak, malnutrition, and poor sanitation, should be addressed immediately after a disaster to avoid serious health consequences. International relief organizations help victims fulfill unmet needs and play a vital role in effective disaster management. SEE ALSO EMERGENCY NUTRITION NETWORK; FAMINE.

Karen Bryla

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Grantmakers Without Borders. "International Emergency Relief Links." Available from <<http://www.internationaldonors.org>>

Disaster Center. "Disaster Relief Agencies." Available from <<http://www.disastercenter.com/agency.htm>>

Pan American Health Organization. "Disasters and Humanitarian Assistance." Available from <<http://www.paho.org/disasters>>

UNICEF. "Emergency Health Kits." Available from <<http://www.supply.unicef.dk/emergencies/healthkit.htm>>

E

incidence: number of new cases reported each year

Eating Disorders

Eating disorders affect both the mind and the body. Although deviant eating patterns have been reported throughout history, eating disorders were first identified as medical conditions by the British physician William Gull in 1873. The **incidence** of eating disorders increased substantially throughout the twentieth century, and in 1980 the American Psychiatric Association formally classified these conditions as mental illnesses.

Diagnosis

Individuals with eating disorders are obsessed with food, body image, and weight loss. They may have severely limited food choices, employ bizarre eating **rituals**, excessively drink fluids and chew gum, and avoid eating with others. Depending on the severity and duration of their illness, they may display physical symptoms such as weight loss; **amenorrhea**; loss of interest in sex; low **blood pressure**; depressed body temperature; **chronic**, unexplained vomiting; and the growth of soft, fine hair on the body and face.

ritual: ceremony or frequently repeated behavior

amenorrhea: lack of menstruation

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

chronic: over a long period

There are various types of eating disorders, each with its own physical, **psychological**, and **behavioral** manifestations. They are classified into four distinct diagnostic categories by the American Psychiatric Association: **anorexia nervosa**, **bulimia nervosa**, **binge eating disorder**, and eating disorder not otherwise specified.

Anorexia nervosa. Clinically, anorexia nervosa is diagnosed as intentional weight loss of 15 percent or more of normal body weight. The anorexic displays an inordinate fear of weight gain or becoming fat, even though he or she may be extremely thin. Food intake is strictly limited, often to the point of life-threatening starvation. Sufferers may be unaware of or in denial of their weight loss, and may therefore resist treatment.

Peak ages of onset are between 12 and 13 and at age 17. Among women of menstruating age, menstruation ceases due to weight-related declines in female **hormones**.

This illness has two subtypes: the *restricting type*, in which weight loss is achieved solely via reduction in food intake, and the *binge eating/purging type*, in which anorexic behavior is accompanied by recurrent episodes of binge eating or purging.

Bulimia nervosa. Bulimia nervosa is characterized by repeated episodes of bingeing followed by compensatory behaviors to prevent weight gain. Compensatory behaviors include vomiting, diuretic and laxative abuse, fasting, or excessive exercise. Like the anorexic, the typical bulimic has an unusual concern about body weight and weight loss. Unlike the anorexic, he or she is acutely aware of this condition and has a greater sense of guilt and loss of self control.

Bulimia typically develops during the late teens and early twenties. In contrast to the typically emaciated anorexic, most bulimics are of normal body weight, although weight may fluctuate frequently. Physically, the bulimic may have symptoms such as erosion of tooth enamel, swollen salivary glands, potassium depletion, bruised knuckles, and irritation of the esophagus.

To qualify for a clinical diagnosis of bulimia nervosa, binge eating and related compensatory behaviors must take place at least two times a week for a minimum of three months. Sufferers are classified into one of two subtypes: the *purging type*, which employs laxatives, **diuretics**, or self-induced vomiting to compensate for bingeing, or the *nonpurging type*, which relies on behaviors such as excessive exercising or fasting to offset binges.

Binge eating disorder. Binge eating disorder is characterized by eating binges that are not followed by compensatory methods. This condition, which frequently appears in late adolescence or the early twenties, affects between 15 and 50 percent of individuals participating in diet programs and often develops after substantial diet-related weight loss. Of those affected, 50 percent are male.

Binge eating disorder is diagnosed when an individual recurrently (at least twice a week for a six month period) indulges in bingeing behavior. A clinical diagnosis also requires three or more of the following behaviors: (1) eating at an unusually rapid pace, (2) eating until uncomfortably full, (3) eating large quantities of food in the absence of physical hunger, (4) eating alone out

psychological: related to thoughts, feelings, and personal experiences

behavioral: related to behavior, in contrast to medical or other types of interventions

anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purgung)

binge: uncontrolled indulgence

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

hormone: molecules produced by one set of cells that influence the function of another set of cells

diuretic: substance that depletes the body of water