

BODY WEIGHT EVALUATION

Whenever possible, a patient should be weighed on a beam scale with nondetachable weights. The patient should be weighed while fasting, after voiding and without drainage bags and dressings. If it is not possible to remove drainage bags and dressings, weigh them separately to deduct their weight.

Interpretation

Of the three means of evaluating body weight, the “percent usual weight” and the “percent of recent weight change” correlate best with ultimate morbidity and mortality in individual patients. This is largely a result of the fact that many patients have a usual weight that is above their “ideal” weight for height. For the most complete picture, the dietitian may wish to evaluate the patient from the standpoint of all three parameters. For the dehydrated or edematous patient, the measured weight must be intuitively increased or decreased, respectively, before evaluation according to the methods below.

1. Percent Ideal Body Weight (IBW) (1):

$$\% \text{ IBW} = \frac{\text{Actual Weight}}{\text{IBW}} \times 100$$

See Determining Ideal Body Weight Based on Height to Weight: The Hamwi Method (page II-4)

2. Percent Usual Body Weight (UBW) (1):

$$\% \text{ UBW} = \frac{\text{Actual Weight}}{\text{Usual Weight}} \times 100$$

3. Percent Recent Weight Change (1):

$$\% \text{ Recent Weight Change} = \frac{(\text{Usual Weight} - \text{Actual Weight})}{\text{Usual Weight}} \times 100$$

Onset of Weight Loss	Significant Weight Loss	Severe Weight Loss
1 week	1% – 2%	>2%
1 month	5%	>5%
3 months	7.5%	>7.5%
6 months	10%	>10%

Nutritional Parameters for Defining Protein Energy Malnutrition

Code	Weight for Height	Triceps Skinfold (Percentile)	Serum Albumin (g/dL)	Serum Prealbumin (mg/dL)	Other
260 Kwashiorkor	<90% standard	>50th	<3.0		<ul style="list-style-type: none"> • Easily pluckable hair • Peripheral edema • Delayed wound healing
261 Marasmus	<80% standard	<5th	>3.0		
262 Other Severe PEM	Weight loss >10% in 6 months % UBW <74% % IBW <69%	<30th	<2.1	<7.0	
263.0 Moderate PEM	Weight loss 10% in 6 months % UBW <75% to 84% % IBW <70% to 79%	30 – 39th	2.1 – 2.7	7.0 – 12.0	
263.1 Mild PEM	% UBW 85% to 95% % IBW 80% to 90%	40 – 50th	2.8 – 3.5	11.0 – 15.0	

Source: *International Classification of Diseases, Clinical Modification (ICD-9-CM)*. 9th ed. Ann Arbor, Mich: National Center for Health Statistics; 2001.

Reference

1. Blackburn GL, Bistrian BR, Maine BS, Schlamm HT, Smith MF. Nutritional and metabolic assessment of the hospitalized patient. *JPEN*. 1977;1:11.

STATURE DETERMINATION

Method 1: Height

Height should be taken with the subject in stocking feet and standing against a vertical measuring board. (For patients with severe curvature of the spine, other measurements of stature may be more accurate.)

Procedure: Have the subject stand erect with weight equally distributed on both feet and the heels together and touching the vertical board. Where possible the head, shoulder blades, buttocks, and heels should all touch the vertical board. Arms should be hanging free at the sides with palms facing the thighs. Subject should look straight ahead, take a deep breath, and hold position while the horizontal headboard is brought down firmly on top to the head. Measure to the nearest 0.1 cm.

Method 2: Arm Span

Measurement of arm span is roughly equal to height. The span measurement remains constant despite decreasing height with age and is an acceptable alternative method for establishing height.

Procedure: Position the subject with his or her feet against a flat surface, usually a wall. Fully extend the subject's upper extremities (including hands) at shoulder level with palms facing forward. Place a tape measure against the wall to measure the distance between the tip of one middle finger to the tip of the other middle finger (exclude fingernails). Arm span must be done supine between birth and three years of age.

Note: Measurement of arm span may be difficult in elderly persons due to an inability to adequately stretch out their arms, and chest measurements may be altered by lung disease or osteoporosis. Arm span may be used in the elderly to estimate maximum stature at maturity before occurrence of age-related bone loss.

Method 3: Knee Height

Knee height provides a method to measure stature of persons who cannot stand upright. Unlike overall height, knee height changes little with age. The measurement is highly correlated with stature.

The following formulas are used to compute stature from knee height:

Estimation of Stature From Knee Height			Factor*
White male	6 – 18 years	2.22 (Knee Height) + 40.54	±8.42 cm
	18 – 60 years	1.88 (Knee Height) + 71.85	±7.94 cm
	60 – 80 years	2.08 (Knee Height) + 59.01	±15.68 cm
Black male	6 – 18 years	2.18 (Knee Height) + 39.60	±9.16 cm
	18 – 60 years	1.79 (Knee Height) + 73.42	±7.2 cm
	60 – 80 years	1.37 (Knee Height) + 95.79	±16.8 cm
White female	6 – 18 years	2.15 (Knee Height) + 43.21	±7.8 cm
	18 – 60 years	1.87 (Knee Height) + 70.25 – (0.06 age)	±7.2 cm
	60 – 80 years	1.91 (Knee Height) + 75 – (0.17 age)	±17.64 cm
Black female	6 – 18 years	2.02 (Knee Height) + 46.59	±8.78 cm
	18 – 60 years	1.86 (Knee Height) + 68.10 – (0.06 age)	±7.6 cm
	60 – 80 years	1.96 (Knee Height) + 58.72	±16.5 cm

*The stature of an individual will have a 95% chance of falling within the boundaries represented by the formula with the appropriate correction factor.

Adapted from: Chumlea W, Guo S, Steinbaugh M. Prediction of stature from knee height for black and with adults and children with application to mobility-impaired or handicapped person. *J Am Diet Assoc.* 1994;94:1385-1388. From: Grant A, DeHoog S. *Nutrition Assessment Support and Management.* Seattle, Wash: DeHoog/Grant; 1999. Reprinted by permission.

Procedure: The knee length measurement is made with a sliding, broad-blade caliper similar to the apparatus used to measure the length of infants.

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Grant A, DeHoog S. *Nutritional Assessment Support and Management.* 5th ed. Seattle, Wash: Grant/DeHoog; 1999.

BODY MASS INDEX (BMI)

Height	Weight (lb)																					
	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205
5'0"	20	21	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
5'1"	19	20	21	22	23	24	25	26	26	27	28	29	30	31	32	33	34	35	36	37	38	39
5'2"	18	19	20	21	22	23	24	25	26	27	27	28	29	30	31	32	33	34	35	36	37	37
5'3"	18	19	19	20	21	22	23	24	25	26	27	27	28	29	30	31	32	33	34	35	35	36
5'4"	17	18	19	20	21	21	22	23	24	25	26	27	27	28	29	30	31	32	33	33	34	35
5'5"	17	17	18	19	20	21	22	22	23	24	25	26	27	27	28	29	30	31	32	32	33	34
5'6"	16	17	18	19	19	20	21	22	23	23	24	25	26	27	27	28	29	30	31	31	32	33
5'7"	16	16	17	18	19	20	20	21	22	23	23	24	25	26	27	27	28	29	30	31	31	32
5'8"	15	16	17	17	18	19	20	21	21	22	23	24	24	25	26	27	27	28	29	30	30	31
5'9"	15	16	16	17	18	18	19	20	21	21	22	23	24	24	25	26	27	27	28	29	30	30
5'10"	14	15	16	17	17	18	19	19	20	21	22	22	23	24	24	25	26	27	27	28	29	29
5'11"	14	15	15	16	17	17	18	19	20	20	21	22	22	23	24	24	25	26	26	27	28	29
6'0"	14	14	15	16	16	17	18	18	19	20	20	21	22	22	23	24	24	25	26	26	27	28
6'1"	13	14	15	15	16	16	17	18	18	19	20	20	21	22	22	23	24	24	25	26	26	27
6'2"	13	13	14	15	15	16	17	17	18	19	19	20	21	21	22	22	23	24	24	25	26	26
6'3"	12	13	14	14	15	16	16	17	17	18	19	19	20	21	21	22	22	23	24	24	25	26
6'4"	12	13	13	14	15	15	16	16	17	18	18	19	19	20	21	21	22	23	23	24	24	25

The BMI score means the following:

Underweight	Below 18.5
Normal	18.5 – 24.9
Overweight	25.0 – 29.9
Obesity	30.0 – 39.9
Extreme obesity	≥40

Source: National Heart, Lung, and Blood Institute Obesity Education Initiative. Expert Panel. Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults. Available at: <http://www.nhlbi.nih.gov>. Accessed November 8, 1999.

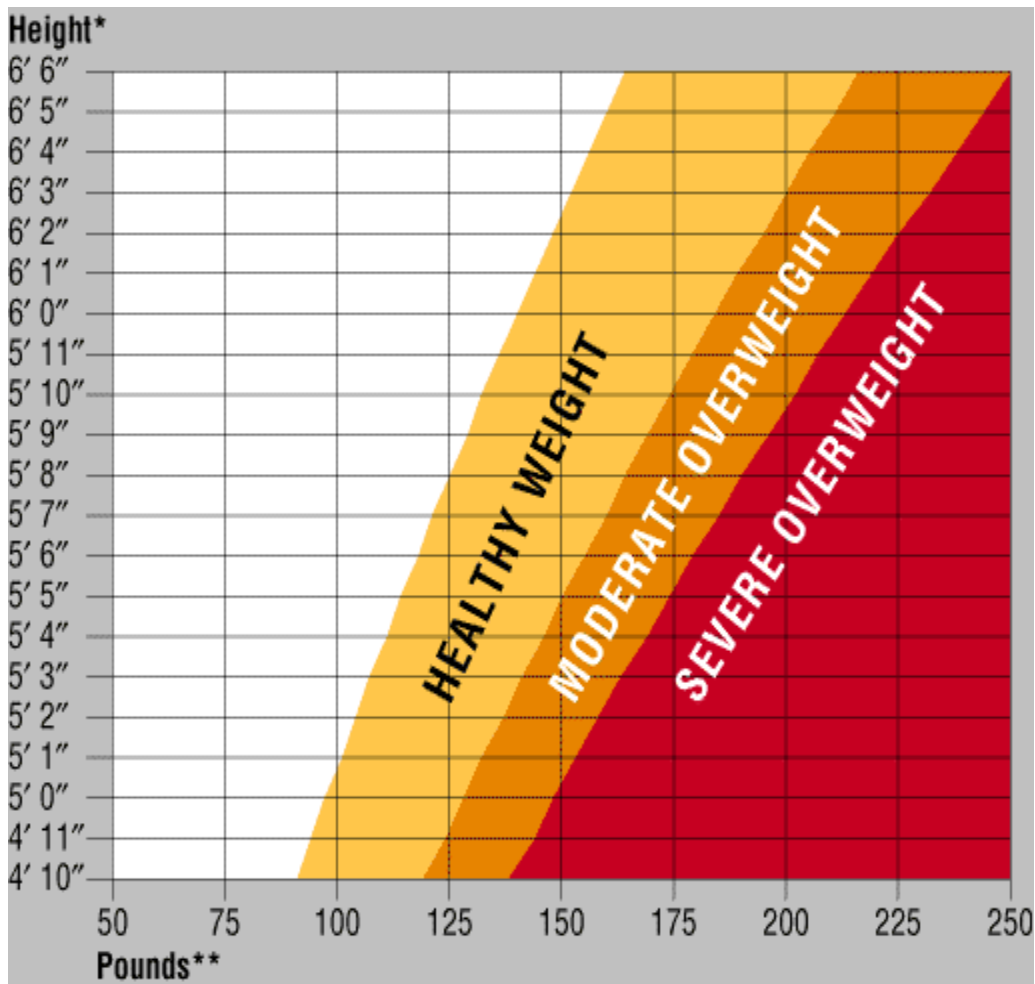
DETERMINING IDEAL BODY WEIGHT (IBW) BASED ON HEIGHT TO WEIGHT: THE HAMWI METHOD

Frame Size	Females	Males
Medium	Allow 100 lb for first 5 ft of height plus 5 lb for each additional inch. Subtract 2.5 lb for each inch less than 5 ft.	Allow 106 lb for first 5 ft of height plus 6 lb for each additional inch. Subtract 2.5 lb for each inch under 5 ft.
Small	Subtract 10%	Subtract 10%
Large	Add 10%	Add 10%

Source: *Nutrition and Your Health: Dietary Guidelines for Americans*. 3rd ed. Washington, DC: US Depts of Agriculture and Health and Human Services; 1990. Home and Garden Bulletin No. 232.
 Hamwi GJ. Changing dietary concepts. In: Danowski TS (ed). *Diabetes Mellitus: Diagnosis and Treatment*, Vol. 1. New York: American Diabetes Association, Inc; 1964:73-78.

The above method of calculating Ideal Body Weight (IBW) is also referred to as the 5 foot rule.

HEALTHY WEIGHT CHART



*Without Shoes
 **Without Clothes

Source: *Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2000*. Available at: <http://www.ars.usda.gov/dgac/dgacguideexp.pdf>. Accessed February 23, 2000.

AVERAGE HEIGHT AND WEIGHT FOR PERSONS AGED 65 YEARS AND OLDER

MEN

Height (in)	Ages 65 - 69	Ages 70 - 74	Ages 75 - 79	Ages 80 - 84	Ages 85 - 89	Ages 90 - 94
61	128 - 156	125 - 153	123 - 151			
62	130 - 158	127 - 155	125 - 153	122 - 148		
63	131 - 161	129 - 157	127 - 155	122 - 150	120 - 146	
64	134 - 164	131 - 161	129 - 157	124 - 152	122 - 148	
65	136 - 166	134 - 164	130 - 160	127 - 155	125 - 153	117 - 143
66	139 - 169	137 - 167	133 - 163	130 - 158	128 - 156	120 - 146
67	140 - 172	140 - 170	136 - 166	132 - 162	130 - 160	122 - 150
68	143 - 175	142 - 174	139 - 169	135 - 165	133 - 163	126 - 154
69	147 - 179	146 - 178	142 - 174	139 - 169	137 - 167	130 - 158
70	150 - 184	148 - 182	146 - 178	143 - 175	140 - 172	134 - 164
71	155 - 189	152 - 186	149 - 183	148 - 180	144 - 176	139 - 169
72	159 - 195	156 - 190	154 - 188	153 - 187	148 - 182	
73	164 - 200	160 - 196	158 - 192			

WOMEN

Height (in)	Ages 65 - 69	Ages 70 - 74	Ages 75 - 79	Ages 80 - 84	Ages 85 - 89	Ages 90 - 94
58	120 - 146	112 - 138	111 - 135			
59	121 - 147	114 - 140	112 - 136	100 - 122	99 - 121	
60	122 - 148	116 - 142	113 - 139	106 - 130	102 - 124	
61	123 - 151	118 - 144	115 - 144	109 - 133	104 - 128	
62	125 - 153	121 - 147	118 - 144	112 - 136	108 - 132	107 - 131
63	127 - 155	123 - 151	121 - 147	115 - 141	112 - 136	107 - 131
64	130 - 158	126 - 154	123 - 151	119 - 145	115 - 141	108 - 132
65	132 - 162	130 - 158	126 - 154	122 - 150	120 - 146	112 - 136
66	136 - 166	132 - 162	128 - 157	126 - 154	124 - 152	116 - 142
67	140 - 170	136 - 166	131 - 161	130 - 158	128 - 156	
68	143 - 175	140 - 170				
69	148 - 180	144 - 176				

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DETERMINATION OF FRAME SIZE

Method 1: Wrist Measurement

$$\text{Frame Size (} r \text{ values)} = \frac{\text{Height (cm)}}{\text{Wrist Circumference (cm)}}$$

<i>r</i> values		Interpretation	Method
Females	Males		
>11.0	>10.4	Small frame	1. Measure individual height in centimeters (cm)
10.1 – 11	9.6 – 10.4	Medium frame	2. Measure the smallest part of the individual's wrist in centimeters.
<10.1	<9.6	Large frame	3. Divide the height by the wrist circumference to derive <i>r</i> value for frame size. Look at table to the left to interpret frame size of individual.

Method 2: Elbow Breadth ^(1,2)

Frame size is influenced by soft tissue and fat but elbow breadth is a good index of skeletal or frame size and is less affected by fat than wrist circumference. It is also closely associated with lean body mass. Elbow breadth is the distance between the epicondyles of the humerus and should be measured with either sliding or spreading calipers. To measure:

1. Extend one arm in front of the body and bend the forearm upward at a 90° angle. Keep the fingers straight and turn the inside of the wrist toward the body.
2. Place the thumb and index finger of the other hand on the two prominent bones (epicondyles of the humerus) on the right side of the elbow. For greatest accuracy, use sliding calipers. (Sliding calipers can be obtained from Lafayette Instrument, PO Box 5729, 3700 Sagamore Pkwy N, Lafayette, IN 47903; telephone: 800/428-7545; fax: 765-423-4111; e-mail: rehab@licmef.com.)
3. Place the blades of the sliding caliper (blades pointing up) or the tips of the spreading caliper on the epicondyles. Exert firm pressure to compress the soft tissues and record in the measurement to the nearest 0.1 cm.
4. Frisancho developed a frame index based on elbow, breadth, height, and age. "Frame Index 2" was derived using data from the National Health and Nutrition Examination Survey III (NHANES) and accounts for age-related changes to height and weight. Plug the value into the following formula:

$$\text{Frame Index 2} = \text{Elbow Breadth (mm)} \div \text{Height (cm)} \times 100$$

5. Use the table below to identify frame size for age.

Frame Size Based on Stature and Age

Age (yr)	<u>Men</u>			<u>Women</u>		
	Small	Medium	Large	Small	Medium	Large
18 – 25	<38.4	38.4 – 41.6	>41.6	< 35.2	35.2 – 38.6	>38.6
25 – 30	<38.6	38.6 – 41.8	>41.8	<35.7	35.7 – 38.7	>38.7
30 – 35	<38.6	38.6 – 42.1	>42.1	<35.7	35.7 – 39.0	>39.0
35 – 40	<39.1	39.1 – 42.4	>42.4	<36.2	36.2 – 39.8	>39.8
40 – 45	<39.3	39.3 – 42.5	>42.5	<36.7	36.7 – 40.2	>40.2
45 – 50	<39.6	39.6 – 43.0	>43.0	<36.7	37.2 – 40.7	>40.7
50 – 55	<39.9	39.9 – 43.3	>43.3	<37.2	37.2 – 41.6	>41.6
55 – 60	<40.2	40.2 – 43.8	>43.8	<37.8	37.8 – 41.9	>41.9
60 – 65	<40.2	40.2 – 43.6	>43.6	<38.2	38.2 – 41.8	>41.8
65 – 70	<40.2	40.2 – 43.6	>43.6	<38.2	38.2 – 41.8	>41.8
70 – 75	<40.2	40.2 – 43.6	>43.6	<38.2	38.2 – 41.8	>41.8

Adapted from: Frisancho AR. *Anthropometric Standards for the Assessment of Growth and Nutritional Status*. Ann Arbor, Mich: University of Michigan Press; 1990. In: Grant A, DeHoog S. *Nutrition Assessment Support and Management*. 5th ed. Seattle, Wash: Grant/DeHoog; 1999. Reprinted by permission.

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ESTIMATION OF IDEAL BODY WEIGHT FOR AMPUTEES

In the case where a patient had an amputation, ideal body weight (IBW) cannot be compared to the standards for normal adults. Although body proportions vary from individual to individual, segmental weights can be used to provide an approximation of IBW.

Percent Total Body Weight by Individual Body Parts

Body Part	Percent
Head	8.0
Trunk	50
Upper arm	2.7
Forearm	1.6
Hand	0.7
Entire arm	5
Thigh	10.1
Calf	4.4
Foot	1.4
Entire leg	16

Determining Adjusted Body Weight for the Amputee

Using the IBW of the patient before the amputation, subtract the percentage of the body weight lost due to amputation. For a method of determining IBW, see Section II: [Suggested Weights for Adults](#).

Example: Determine the adjusted IBW for a woman 5'5" with a below-knee amputation of the right leg.

IBW (female 5'5")	125 lb
Right below the knee (calf 4.4% + foot 1.5% = (-5.9%))	7.5 lb
Adjusted IBW	117.5 lb

Source: Grant A, DeHoog S. *Nutritional Assessment Support and Management*. 5th ed. Seattle, Wash: Grant/DeHoog; 1999.

ESTIMATION OF ENERGY EXPENDITURES

Discussion

Since the early 1900s, various formulas have been employed to estimate energy expenditure. Since the advent of the doubly labeled water (DLW) technique in the 1980s, scientists have begun to more accurately determine total energy expenditure (TEE) in free-living persons (1). Unfortunately, due to its high cost and the limited number of laboratories that perform the DLW technique, this application is not currently accessible in the clinical setting. Most recently, the American Dietetic Association (ADA) explored evidence that reported the accuracy and application of various methods used to measure energy expenditure, particularly indirect calorimetry and predictive formulas for various population groups (2,3). These reports provide evidence that can be used by dietetic professionals to make informed clinical decisions regarding whether to measure or estimate resting energy expenditure (REE) in patients(2). The predictive equations that have been evaluated include: the Harris-Benedict equation (4), Mifflin–St. Jeor equation (5), Owen equations (6,7), and equations used by the World Health Organization and the Dietary Reference Intakes (8). In 2006, the Swinamer equation, Ireton-Jones equations, Penn State equations, and other equations were evaluated for their application in estimating energy expenditure in critically ill patients (3).

The Dietary Reference Intakes for energy, which are based on studies using the DLW technique, are considered the most accurate references for estimating TEE in free-living persons (2,9). These values can serve as a resource for the assessment of patients who are not critically ill or do not have multiple disease processes (2,8). (Refer to Section A: Estimated Energy Requirements (EER) for Male and Female Under 30 Years of Age and Estimated Energy Requirements (EER) for Men and Women 30 Years of Age.) The Mifflin–St. Jeor equation predicts REE with the most consistency and the least percentage of error in the ambulatory population (2). Multiple studies have reported variable accuracy with the Harris-Benedict equation; this equation accurately predicts REE only 45% to 81% of the time in healthy non-obese subjects (2). The accuracy of all predictive equations decreases when applied to the obese population. In studies of obese patients, the Harris-Benedict equation accurately predicted REE only 33% to 64% of the time, while the Mifflin–St. Jeor equation accurately predicted REE 70% of the time (2). Because of the variations reported with the use of the Harris-Benedict formula, evidence provides limited support for its use in estimating the energy expenditure of ambulatory or hospitalized population groups (2,9). Energy expenditure depends on factors including age, gender, height, weight, and physical activity. In the hospital setting where patients generally have multiple complications and the potential for rapid changes in medical status, predictive formulas that include not only determinants of REE, but also modifiers for illness severity, inflammatory state, and respiratory demands may be needed (9,10). Refer to the Ireton-Jones equations and Penn State equations discussed below (3,9,10). The clinician should realize that any method used to estimate energy expenditure only provides an approximation (2). These equations should be used only as a guide or starting point, after which the patient must be closely monitored and interventions must be devised based on individual needs that promote the attainment of nutritional status.

Recommended Formulas to Calculate REE in Critical Care Patients

Indirect calorimetry is the standard for determination of REE in critically ill patients because REE based on measurement is more accurate than estimation using predictive equations (Grade I)* (3). If predictive equations are needed in non-obese critically ill patients, the best prediction accuracy of equations studied (listed in order of accuracy) include the Penn State equation (2003a version) (79%), Swinamer (55%) and Ireton-Jones equation (1992 version), (Grade III) (3,9,11). The Harris-Benedict equation (with or without activity and stress factors), Ireton-Jones equation (1997 version), and Fick equation should not be used to determine REE in critically ill patients, as these equations do not have adequate prediction accuracy (Grade I) (3). In addition, the Mifflin–St. Jeor equation should not be used in critically ill patients, as it was developed for healthy people and has not been well researched in the critically ill population (Grade I) (3). If predictive equations are needed for critically ill, mechanically ventilated individuals who are obese, consider using the Ireton-Jones equation (1992 version) or the Penn State equation (1998 version), as they have the best prediction accuracy of the equations that have been studied (Grade III) (3). Refer to the *Critical Illness Evidence-Based Nutrition Practice Guideline* (2006) in the ADA Evidence Analysis Library for detailed information (3).

*The American Dietetic Association has assigned grades, ranging from Grade I (good/strong) to Grade V (insufficient evidence), to evidence and conclusion statements. The grading system is described in Section III: Clinical Nutrition Management A Reference Guide, page III-1.

The Ireton-Jones equations were developed specifically for critically ill patients and hospitalized burn patients. These formulas are the most widely used formulas for patients in the critical care and hospital setting (9, 10, 12-15). These equations have easily measured variables (height, weight, age, gender, diagnosis, presence of obesity, and ventilatory status) that are used in the equation to estimate REE. For the diagnosis variable, patients are assigned as burn, non-burn trauma, or other. Different than most guidelines and definitions, the Ireton-Jones equation considers obesity to be present if the body mass index (BMI) is greater than 27 kg/m² (12,14). If a patient is mechanically ventilated, the ventilator equation should be used regardless of the presence of obesity. The variables in these equations take into account the health and mobility status of a critical care patient. The common practice of multiplying additional physical activity level (PAL) factors or injury factors is not validated with these formulas.

With the exception of the Penn State Equation, all equations below were developed using actual weight. For the Penn State equation, actual weight was adjusted using the following formula (ideal body weight x 125%) for patients with a BMI of > 30. With the exception of the Penn State Equation, there is no evidence that substituting adjusted or ideal weight in these calculations results in improved accuracy (2,9)

Penn State equations (3):

The 1998 version is recommended for mechanically ventilated, obese, critically ill patients (Grade III) (3):

$$REE = BEE (1.1) + V_E (32) + T_{max} (140) - 5340$$

The 2003a version is recommended for mechanically ventilated, non-obese, critically ill patients (Grade III) (3):

$$REE = BEE (0.85) + V_E (33) + T_{max} (175) - 6433, \text{ where}$$

BEE = basal energy expenditure calculated using the Harris-Benedict equation^a (4)

V_E = minute ventilation (L/min)

T_{max} = maximum temperature (degrees Celsius)

^aHarris-Benedict equation (4) for use in Penn State equation only:

$$\text{kcal/day (male)} = 66 + 13.8 (W) + 5.0(H) - (6.8 \times A)$$

$$\text{kcal/day (female)} = 655 + 9.6 (W) + 1.8 (H) - (4.7 \times A), \text{ where}$$

W = actual weight (kg)

H = height (cm)

A = age (years)

A newer version of the Penn State equations (2003b), in which the Mifflin–St. Jeor equation is used to calculate BEE, is being evaluated (3).

Swinamer Equation (16)

Published in 1990, was based on observations in 112 mechanically ventilated, critically ill trauma, surgical, and medical patients within the first 2-days of admission to critical care unit (Grade III) (16)

$$\text{Energy Expenditure} = 945 (BSA) - 6.4 (\text{age}) + 108 (T) + 24.2 (\text{breaths/min}) + 81.7 (VT) - 4349$$

Equation includes body surface area (BSA) in squared meters (m²), temperature (T) in degrees Celsius, and tidal volume (VT) in liters per minute (L/min).

Ireton-Jones equations (1992 version) (3, 14):

$$IJE (ventilator-dependent) = 1925 - 10 (A) + 5 (W) + 281 (S) + 292 (T) + 851 (B)$$

$$IJE (\text{spontaneous breathing}) = 629 - 11 (A) + 25 (W) - 609 (O), \text{ where}$$

IJE = estimated energy expenditure (kcal/day)

A = age (years)

W = weight (kg)

S = sex (male = 1, female = 0)

T = trauma (present = 1, absent = 0)

B = burns (present = 1, absent = 0)

O = BMI > 27 kg/m² (present = 1, absent = 0)

Mifflin–St. Jeor Equation and Recommended Formulas to Calculate REE in Ambulatory Patients

The Mifflin–St. Jeor equation was designed to estimate REE in the ambulatory population (5, 10). Actual body weight is used in these equations, regardless of BMI (5). It is generally recommended that a PAL factor be multiplied to obtain TEE. It has been recommended that the REE be multiplied by a PAL factor of 1.3 for sedentary individuals; however, this recommendation has not been validated in studies (9). If needed, use a higher activity factor to correct for active individuals engaging in purposeful activity (9). See the following

Estimation of Energy Expenditures

table as a guideline, or refer to PAL described in Dietary Reference Intakes in Section A to determine appropriate PAL estimate (17). Injury factors have not been validated for use with these equations and therefore are not recommended as part of TEE calculations.

The **Mifflin–St. Jeor equation** for men is:

$$\text{REE} = 10(\text{weight}^a \text{ in kg}) + 6.25(\text{height in cm}) - 5(\text{age in years}) + 5$$

The corresponding equation for women is:

$$\text{REE} = 10(\text{weight}^a \text{ in kg}) + 6.25(\text{height in cm}) - 5(\text{age in years}) - 161$$

^aUse total body weight, regardless of BMI.

Physical Activity Level (17)	PAL Factor
Confined to bed	1.2
Out of bed, ambulatory	1.3
Seated work, little or no strenuous leisure activity	1.6-1.7
Standing work or significant amounts of sport or strenuous leisure activity (30 to 60 minutes four or five times per week)	1.8-1.9
Strenuous work or highly active leisure	2.0-2.4

Estimating Energy Expenditure in the Obese Population

Ideally, the REE of an obese patient should be based on lean body mass that is determined by methods such as dual x-ray absorptiometry, underwater weighing, or gold-standard energy expenditure prediction models (eg, DLW technique) (9). However, these methods are not practical in most clinical settings. The common clinical practice of using an adjusted body weight to estimate the metabolically active tissue mass does not improve the accuracy of predicting the metabolic rate in obese patients (10). The Adjusted Body Weight for Obesity formula, a well-known formula developed by Cunningham (18,19), is not considered applicable in current clinical practice and therefore should not be used in any predictive equations (5,9,10,19). The consensus of literature supports the use of actual body weight in predictive formulas for estimating REE in obese patients (19,20). Formulas like the Mifflin–St. Jeor, Ireton-Jones (1992 version), and Penn State (1998 version) equations have utilized obese subjects in the validation of the equations and therefore are an option for predicting REE in obese patients (3,5,10). According to the ADA's Weight Management Practice Guidelines, estimated energy requirements should be based on resting metabolic rate (RMR) (21). If possible, RMR should be measured (eg, indirect calorimetry). If RMR cannot be measured, then the Mifflin–St. Jeor equation using actual body weight is the most accurate formula for estimating RMR for overweight and obese healthy individuals (Grade I) (21).

Estimating Approximate Energy Requirements for Adults

As an alternative to the above calculations, a useful initial approximation of the energy needs of patients in the clinical setting can be obtained as follows (8,22):

Obese or very inactive persons and chronic dieters	10-12 kcal/lb (20 kcal/kg)
Persons older than 55 years, active women, sedentary men	13 kcal/lb (25 kcal/kg)
Active men, very active women	15 kcal/lb (30 kcal/kg)
Thin or very active men	20 kcal/lb (40 kcal/kg)

Estimating Energy Requirements for Spinal Cord Injury

People with spinal cord injury tend to have reduced metabolic activity due to denervated muscle. Measured energy expenditure is at least 10% below predicted; therefore, caloric needs of spinal cord injured patients should be based on measured energy expenditure (Grade III) (23). If indirect calorimetry is not available during the acute phase (0 - 4 weeks post-injury using prediction equations based on critical care level using admission weight and multiplying by an injury/stress factor of 1.2 has been suggested (23). During the rehabilitation phase, one study reports initial caloric needs can be estimated using 22.7 kcal/kg body weight for individuals with tetraplegia and 27.9 kcal/kg for those with paraplegia (23). When estimating caloric needs of individuals with spinal cord injury, acuteness of injury, level of injury, gender, and physical activity level should be taken into consideration (Grade III) (23).

Measuring REE by Indirect Calorimetry

Indirect calorimetry is an indirect measurement of REE based on quantification of an individual's respiratory gas exchange (ratio of oxygen consumed to carbon dioxide produced). From respiratory gas exchange measurements, a respiratory quotient can be obtained that can provide additional information about individual substrate utilization (10). Many stress factors and kilocalorie ranges proposed for estimating energy expenditure for specific disease states are based on indirect calorimetry studies; however, the accuracy of these formulas for estimating expenditure for the individual patient can vary (9,10). Factors that affect energy expenditure and impact the outcome of indirect calorimetry results include: changes in medications that act as a stimulant or a sedative, changes in the degree or type of ventilator support, and day-to-day variations in the metabolic stress level (10). These factors should be considered when monitoring and interpreting measured REE. Indirect calorimetry remains a viable option for estimating energy requirements in the critical care setting and can be useful in the prevention of overfeeding the critical care patient. Precise guidelines and more in-depth considerations for the use of indirect calorimetry have been published (2,10-12).

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ESTIMATION OF PROTEIN REQUIREMENTS

The following methods can be used to estimate protein requirements based on life stage. Use of actual body weight or when weight cannot be obtained, ideal body weight (IBW), is suggested for all equations because protein requirements relate to lean body mass. In the underweight, malnourished patient, use of actual body weight has been suggested in equations using anabolic protein levels in order to avoid the consequences of overfeeding in these patients. A nitrogen balance test may be employed to evaluate adequacy of protein intake in either obese or undernourished patients.

1. Grams per kilogram

Maintenance: Recommended Dietary Allowances (RDA): 0.8 to 1.0 g/kg ideal weight (1)

Anabolism:

Critical illness and hypermetabolism is associated with increased protein turnover, protein catabolism, and negative nitrogen balance (2). Protein requirements double in critical illness to approximately 15% to 20% of total calories (2). Current practice dictates that energy requirements be provided to meet energy demands as determined by appropriate energy equations or indirect calorimetry and protein intakes between 1.1 g to 1.5 g/kg (2,3). Higher requirements may be required in acute trauma and burn patients (3). See below for current recommendations.

Critical Illness/Moderate Stress: 1.1 to 1.5 g/kg (2,3)

Trauma/Burn: 1.5 g/kg to 2.0 g/kg (3). Refer to Section III: Burns

Spinal Cord Injury: The acute phase of spinal cord injury results in an obligatory negative nitrogen balance that may persist for 7 weeks or more, as nitrogen excretion increases with changes in body weight and loss of lean body mass (4). Efforts to achieve positive nitrogen balance with aggressive nutrition support are generally unsuccessful and may result in overfeeding (4). Although a protein intake of 2.4 grams/kg IBW/day may lessen the negative nitrogen balance, 2 g protein/kg IBW/day may be more appropriate given potential concerns of substrate overload (Grade III) (4). Acute phase hypoalbuminemia may not be indicative of malnutrition, but a rising albumin level within 3 weeks of injury generally indicates adequate nutritional intake (4). For a person with spinal cord injury, 0.8 - 1.0 g protein/kg body weight/day may be required for maintenance, with an increase to 1.0 - 1.5 g protein/kg body weight/day if pressure ulcers or infection are present (Grade III)(4).

Refer to Criteria and Dietary Reference Intake Values for Protein by Life Stage Group in Section 1A or Section III for disease-specific information.

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LABORATORY INDICES OF NUTRITIONAL STATUS

Laboratory values can be useful in assessing nutritional status or identifying those at high risk that may require nutrition intervention. However, caution is necessary when interpreting laboratory values, and results from single laboratory values should be interpreted carefully. The laboratory tests listed below are commonly used to evaluate either a direct or indirect relationship to a patient's nutritional status. The negative acute-phase hepatic proteins albumin, pre-albumin, transferrin and retinol-binding protein are now considered better indicators of inflammatory metabolism, morbidity, mortality and severity of illness than nutritional status (1-4). These proteins can decrease by as much as 25% as a result of inflammatory metabolism caused by acute or chronic disease (1). In addition, these proteins are not directly linked to nutrition deprivation as once thought (1-4). Because of their ability to predict severity of illness, they can be used to indirectly identify the sickest patients who most likely will require nutritional interventions and medical nutrition therapy (1,2,4). It has currently been suggested that diagnostic classifications of malnutrition be revised to accommodate the interface between uncomplicated malnutrition and that associated with disease and trauma (1).

Test	Purpose/Definition	Normal Range	Discussion
Protein Status			
Albumin	Indicator of inflammatory metabolism, morbidity, mortality, or severity of illness (1-4)	3.5 – 5.0 g/dL	Should not be used as an indicator of nutritional status Use as an indicator of inflammatory metabolism, morbidity, mortality, or severity of illness (1-4) Elevated levels occur in dehydration. Low in uncomplicated malnutrition (without existing acute or chronic disease) (1)
Pre-albumin	Indicator of inflammatory metabolism, morbidity, mortality, or severity of illness (1-4)	19 – 43 mg/dL	Should not be used as an indicator of nutritional status Use as an indicator of inflammatory metabolism, morbidity, mortality, or severity of illness (1-4) More sensitive to dietary change than albumin post fasting, (4,5). Low in uncomplicated malnutrition (without existing acute or chronic disease) (1)
Protein, total	Total protein is of little value as a sensitive index for estimating protein nutritional status	Serum value 6.4 – 8.3 g/dL	Decreased values occur with: nephrosis severe burns malnutrition overhydration hepatic insufficiency Increased values occur with: multiple myeloma dehydration
Transferrin	Indicator of inflammatory metabolism, morbidity, mortality, or severity of illness (1-4)	200 – 400 mg/dL	Should not be used as an indicator of nutritional status Use as an indicator of inflammatory metabolism, morbidity, mortality, or severity of illness (1-4) Decreases with anemia and protein-energy malnutrition (uncomplicated by acute or chronic disease) Increases with iron deficiency, infection, oral contraceptives, and pregnancy
Urea nitrogen	Urea is the principal end product of protein catabolism	10 – 20 mg/dL Values may be slightly higher in the elderly	Decreased values occur with: liver impairment decreased protein intake overhydration malabsorption high-carbohydrate, low-protein diets Increased values occur with: renal insufficiency GI bleeding dehydration lower urinary tract infection diabetes mellitus obstruction starvation congestive heart failure excessive protein intake or protein catabolism
Hematologic Status			
Red blood cells (RBCs)	Measures the number of RBCs in whole blood	M: 4.5 – 6.0 million/mm ³ F: 4.0 – 5.5 million/mm ³	Decreased values occur with: anemia chronic infection leukemia Increased values occur with: dehydration

Laboratory Indices of Nutritional Status

Test	Purpose/Definition	Normal Range	Discussion
Hemoglobin (Hgb)	Part of the red blood cells that carries oxygen and carbon dioxide in the blood	M: 13 – 18 g/100 dL F: 12 – 16 g/100 dL	Men's Hgb may drop 1 – 2 g/100 mL with age. Women have no documented change. Although Hgb declines with age, other signs should be reviewed, eg, pale skin, pale conjunctiva.
Hematocrit (HCT)	Measures the percent of RBCs in the total blood volume	M: 42% – 52% F: 37% – 47%	Values may decrease slightly in the elderly
Mean corpuscular hemoglobin concentration (MCHC)	Measures the concentration of Hgb per unit of red blood cells	32% – 36%	Values <30 indicate advanced iron deficiency anemia
Mean corpuscular volume (MCV)	Measures the average size of the RBC	80 – 95 mm ³	Increased values indicate pernicious anemia. Decreased values indicate iron deficient anemia.
Ferritin	Provides an index of iron stores in iron deficiency and iron overload	M: 12 – 300 µg/L F: 10 – 150 µg/L	Significantly higher in men and post menopausal women. Decreased values occur with iron or protein depletion. Increased values occur with iron excess.
Prothrombin time (PT)	Measures velocity of blood clotting and is an indirect measure of vitamin K status	Adults: 11 – 12.5 seconds 85% – 100% of control	Increased values occur with: vitamin K deficiency (common in elderly and hospitalized) liver disease fat malabsorption drug therapy (antibodies, anticoagulants, aspirin) PT >25 seconds is associated with major bleeding

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CLASSIFICATION OF SOME ANEMIAS

Test	B12 Deficiency	Folate Deficiency	Iron Deficiency	Anemia of Chronic Disease
RBC count	D	D	D	D
Hemoglobin	D	D	D	Slight D
Hematocrit	D	D	D	D
MCV	I	I	D	N
MCH	I	I	D	N
MCHC	N	N	D	N
Reticulocyte count	N or D	N or D	N or D	N or D
RDW	N or I	N or I	I	N
Serum ferritin	I	I	D	N or I
TIBC	N	N	N or I	N or D
Transferrin	N	N	N or I	N or D
Transferrin saturation (%)	N	N	D	N or D
Serum iron	N	N	D	D
Serum folate	N or I	D	N	N
Red cell folate	D	D	N	N
Vitamin B12	D	N	N	N
Red blood cells	Normochromic, macrocytic	Normochromic, macrocytic	Hypochromic, microcytic	Hypochromic, microcytic (both mild)
Other	Hypersegmented neutrophils, macro-ovalocytes	Hypersegmented neutrophils, macro-ovalocytes	Anisocytosis	Poikilocytosis (slight), anisocytosis (moderate)

I = increased; N = normal; D = decreased; TIBC = total iron-binding capacity

Source: Grant A, DeHoog S. *Nutrition Assessment Support and Management*. 5th ed. Seattle, Wash: Grant/DeHoog; 1999:183. Reprinted by permission.

DIAGNOSTIC CRITERIA FOR DIABETES MELLITUS

The diagnostic criteria for diabetes are issued by the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus (1). This system of classification of diabetes is based on the cause of the disease, as opposed to the therapy used to treat the hyperglycemia.

Diagnosis of Diabetes

The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus advocates use of the following laboratory criteria for nonpregnant adults (1):

1. Symptoms of diabetes plus casual plasma glucose concentration greater than or equal to 200 mg/dL (11.1 mmol/L). Casual is defined as any time of the day without regard to the time since the last meal. The classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss.
2. Fasting plasma glucose (FPG) concentration greater than or equal to 126 mg/dL (7.0 mmol/L). Fasting is defined as no energy intake for at least 8 hours.
3. Plasma glucose concentration 2 hours after glucose ingestion greater than or equal to 200 mg/dL during an oral glucose tolerance test (OGTT). The test should be performed, as described by the World Health Organization (WHO), using a glucose load containing the equivalent of 75 g of anhydrous glucose dissolved in water.

In the absence of unequivocal hyperglycemia with acute metabolic decompensation, these criteria should be confirmed by repeated testing on a different day. The OGTT is not recommended for routine clinical use (1).

Impaired Fasting Glucose (IFG) and Impaired Glucose Tolerance (IGT)

The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus endorses the following criteria for the diagnosis of diabetes mellitus (1). The Expert Committee recognizes an intermediate group of patients whose glucose levels, although do not meet the criteria for diabetes, are too high to be considered normal. This group is now referred to as “pre-diabetes” indicating the relatively high risk for development of diabetes in these patients (1):

	“Normal”	“Pre-diabetes”	“Diabetes”
Fasting plasma glucose	≤100 mg/dL	Impaired Fasting Glucose (IFG) ≥100 and <126 mg/dL (IFG)	≥126 mg/dL
Glucose tolerance, at 2 hours after glucose load (during OGTT)	<140 mg/dL	Impaired Glucose Tolerance (IGT) ≥140 and <200 mg/dL (IGT)	>200 mg/dL

Screening and Diagnosis Scheme for Gestational Diabetes Mellitus (GDM) (2,3)

Plasma Glucose	50-g Screening Test (mg/dL)	100-g Diagnostic Test* (mg/dL)
Fasting	--	95
1 h postprandial	130-140	180
2 h postprandial	--	155
3 h postprandial	--	140

Note: High risk women (e.g., marked obesity, history of GDM, glycosuria, or strong family history of diabetes) should undergo glucose testing during the initial prenatal care visit, if found to not have GDM should be retested at 24 and 28 weeks gestation. Screening should be performed between the 24th and 28th weeks of gestation in women with average risk meeting one or more of the following criteria: ≥25 years of age; a body mass index (BMI) ≥25 kg/m²; family history of diabetes in first-degree relatives; history of abnormal glucose tolerance, and/or member of an ethnic/racial group with a high prevalence of diabetes (eg, Hispanic-American, Native American, Asian-American, African-American, or Pacific Islander).

*The 100-g diagnostic test is performed on patients who have a positive screening test. The diagnosis of GDM requires any two of the four plasma glucose values obtained during the test to meet or exceed the values shown above. The test should be done in the morning after an overnight fast of between 8 and 14 hours and after at least 3 days of unrestricted diet (> 150 g Carbohydrate per day) and unlimited physical activity.

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MAJOR NUTRIENTS: FUNCTIONS AND SOURCES

Fat-Soluble Vitamins	Important Sources	Physiological Roles
Vitamin A (retinol, beta carotene)	Milk, butter, fortified margarine, whole milk Cheese, liver, egg yolk (retinol) Green leafy and stem vegetables, yellow fruits and vegetables (carotene), eg, spinach, asparagus, broccoli, carrots, apricots, and cantaloupe	Maintains normal vision in dim light, healthy skin, and mucous membranes Essential for normal skeletal and tooth development
Vitamin D (calciferol)	Exposure to sunlight, fortified foods, fish liver oils	Maintains blood calcium and phosphorus levels Required for proper bone development
Vitamin E (tocopherol)	Vegetable oils Whole grains, wheat germ Leafy vegetables Egg yolk Legumes, nuts (especially almonds, peanuts, pecans, walnuts), sunflower seeds	Protects the integrity of normal cell membranes Assists in prevention of hemolysis of red blood cells Protects vitamin A, acting as an antioxidant
Vitamin K	Lettuce, spinach (green leafy vegetables), kale, cauliflower, cabbage Egg yolk Soybean oil Liver	Produces prothrombin in normal blood clotting
Water-Soluble Vitamins	Important Sources	Physiologic Roles
Ascorbic acid (vitamin C)	Citrus fruits, strawberries, cantaloupe, tomatoes, sweet peppers, cabbage, potatoes, kale, parsley, turnip greens, broccoli	Maintains integrity of capillaries Promotes healing of wounds and fractures Aids tooth and bone formation Increases iron absorption Protects folic acid Helps form collagen for healthy connective tissue
Thiamin (vitamin B1)	Pork, liver, chicken, fish, beef Whole grains, wheat germ, dried yeast, enriched cereal products Nuts and lentils	Metabolizes carbohydrates for energy Provides function of nerve cell membranes
Riboflavin (vitamin B2)	Milk Liver, meat, fish, eggs Enriched cereal products Green leafy vegetables	Metabolizes carbohydrates, proteins, and fats for energy Closely related to the metabolism of protein
Niacin	Liver, poultry, meat, fish, eggs Whole grains, enriched cereal products Peanuts, peanut butter	Metabolizes carbohydrate for energy
Pyridoxine (vitamin B6)	Pork, organ meats, meat, poultry, fish, legumes, seeds Whole grains	Metabolizes protein Converts tryptophan to niacin Synthesizes hemoglobin Maintains integrity of central nervous system

Major Nutrients: Functions and Sources

Water-Soluble Vitamins	Important Sources	Physiologic Roles
Vitamin B12 (cyanocobalamin)	Animal foods only: liver, meat, salt-water fish, oysters, eggs Milk	Essential for red blood cell maturation and normal function of all body cells (especially nervous system, gastrointestinal tract and bone marrow)
Folate	Green leafy vegetables Liver, beef, fish, dry beans, lentils Whole grains	Essential for DNA synthesis and synthesis and maturation of red blood cells
Pantothenic acid	Animal sources (esp. organ meats, egg yolk, and meat) Whole grains Legumes Yeast	Responsible for metabolism of carbohydrates, proteins, and fats for energy; formation of some hormones, hemoglobin, and nerve-regulating substances
Biotin	Organ meats, egg, yolk, legumes, nuts	Synthesizes fatty acids Helps in metabolism of carbohydrates for energy
Minerals	Important Sources	Physiologic Roles
Calcium	Milk Hard cheeses, eg, cheddar, Swiss, mozzarella, and provolone Yogurt, ice cream, cottage cheese Turnip and mustard greens, collards, kale, broccoli, cabbage	Maintains strength of bones and teeth Involved with transmission of nerve impulses, muscle contractions and relaxation, blood clotting, structure and function of cell membranes, and absorption of vitamin B12
Phosphorus	Milk and milk products Meat, poultry, fish and eggs Whole grain cereals and flours Nuts and legumes	Essential for structure of bones and teeth; release of stored energy; structure of RNA and DNA; cell permeability; and metabolism of carbohydrates, fats, and proteins
Magnesium	Whole grain breads and cereals Soybeans, nuts, dry beans and peas, green leafy vegetables	Fundamental to the production of energy, calcium, and phosphorus metabolism in bone; maintenance of the function and structural integrity of heart muscle as well as other muscles and nerves
Sodium	Use of salt at the table and in cooking Processed foods Milk Eggs, meat, poultry, fish Smoked meats Olives, pickles, soy sauce	Maintains normal osmotic pressure water balance, normal irritability of nerve cells and contraction of muscles, and permeability of the cell membrane
Potassium	Meats, poultry, fish, (especially veal and salmon) Fruits and vegetables (especially bananas, potatoes, tomatoes, and citrus fruits) Whole grain cereals	Maintains normal osmotic pressure and fluid balance Required to store energy within the cell Key to transmission of nerve impulse and contraction of muscle fibers, especially the heart muscle
Chloride	Use of salt at the table and in cooking	Regulates osmotic pressure, water balance, and acid-base balance of extracellular fluid Is a component of hydrochloric acid in the gastric juice

Trace Elements	Important Sources	Physiologic Roles
Iron	Liver, meat, fish and poultry Whole grain and enriched cereals Legumes Green leafy vegetables Eggs Dried fruit Foods cooked in iron pots and skillets (especially foods with a high acid content)	Essential to the formation of hemoglobin in blood and myoglobin in muscles, which supply oxygen to cells
Zinc	Animal products (especially liver and oysters) Beef, lamb, pork Whole grain cereals Legumes Peanuts Peanut butter	Essential in wound healing, synthesis of proteins, mobilization of vitamin A from liver, normal cellular immune functions, and normal growth of genital organs
Copper	Organ meats Shellfish (especially oysters and crabs) Whole grain cereals Hickory and brazil nuts, sesame and sunflower seeds Legumes (soybeans, kidney, navy, lima beans)	Essential for formation of red blood cells and the utilization of iron, production of energy, cell protection against oxidative damage, and synthesis of connective tissue
Iodine	Iodized salt used at the table and in cooking	Part of thyroid hormones Influences physical and mental growth, functioning of nervous and muscle tissues, circulatory activity, and metabolism of all nutrients
Fluoride	Fluoridated water Seafood	Increases deposit of calcium, which strengthens the bone and reduces the acid in the mouth, therefore decreasing tooth decay
Chromium Manganese Molybdenum Selenium Nickel Silicon Vanadium	Present in very small amounts in plant foods (ie, whole grains, dried beans and peas, nuts, seeds, fresh fruits and vegetables) Animal foods (meat, fish, poultry, eggs)	Essential as components of enzymes and hormones

PHYSICAL SIGNS OF NUTRITIONAL DEFICIENCIES

Body Part	Signs	Deficiencies
Hair	Color change	Protein-energy malnutrition
	Easy pluckability, sparseness Alopecia Brittle Dryness	Biotin, zinc, vitamins A and E
Skin	Acneiform lesions	Vitamin A
	Follicular keratosis (scalelike plaques)	Vitamin A or essential fatty acids
	Xerosis (dry skin)	Vitamin A
	Ecchymoses; petechiae (hemorrhagic spots)	Vitamins C and K
	Thickening and hyperpigmentation of pressure points Scrotal dermatosis	Niacin Niacin and riboflavin
Eyes	Pale conjunctiva (pale coloring of eyelid lining and whites of the eyes)	Iron, folate, or vitamin B ₁₂ Vitamin A
	Bitot's spots (foamy spots on the whites of the eyes)	Vitamin A
	Conjunctival xerosis (inner lids and whites appear dull, rough)	Riboflavin and niacin
	Angular palpebritis (corners of eyes are cracked, red)	
Mouth	Decreased production of salivary fluids	Vitamin A
	Angular stomatitis (cracked, red, flaky at corner of mouth)	Vitamin B ₁₂
	Bleeding gums	Vitamin C
	Cheilosis (vertical cracks of lips)	Riboflavin
Tongue	Atrophic papillae (smooth, pale, slick tongue)	Folate, niacin, riboflavin, iron, or vitamin B ₁₂
	Glossitis (red, painful tongue)	Folate, niacin, and vitamin B ₁₂
	Magenta tongue (purplish, red tongue)	Riboflavin
Nails	Koilonychia (concave, spoon-shaped)	Iron
Extremities	Genu valgum or varum (knocked knees or bowed legs)	Vitamin D or calcium
	Loss of deep tendon reflexes of lower extremities	Thiamin and vitamin B ₁₂

FOOD AND DRUG INTERACTIONS^a

Drug Classification	Effect of Food on Drug	Effect of Drug on Nutritional Status	Patient Guidelines
Analgesic Acetaminophen (Tylenol) Ibuprofen (Motrin) Aspirin/salicylate	Food delays but does not ↓ absorption None	GI bleeding is possible Decreased platelet levels of vitamin C Decreased serum folate due to competing for serum protein binding sites Fecal iron loss; potassium depletion	If medication (any analgesic) upsets stomach, take with meals Vitamin C supplementation is recommended for individuals receiving salicylates for treatment of rheumatoid arthritis May take with low-mineral carbohydrate snack
Antacid Magnesium trisilicate (Trisogel) Calcium carbonate (Tums) Sodium bicarbonate	None	May ↓ iron absorption ↑ thirst; ↑ weight (edema)	Take after meals with water Evaluate iron status regularly Take iron supplements separately 1 hour before or 2 hours after eating
Anticonvulsant Diphenylhydantoin (Dilantin)	Administer separately from tube feeding due to possible effects of bioavailability	Possible megaloblastic anemia with long-term therapy (responds to 25 μg/day of folate) Increased turnover of vitamin D Blocks conversion of vitamin D by liver; osteomalacia may result (responds to vitamin D) Increased vitamin C requirements Reduction in vitamin K-dependent coagulation factors Reduced serum B ₁₂ status Can ↓ taste acuity Hyperglycemia has been reported Folate need ↑ with long-term therapy; however, ↑ folate will ↓ absorption	Take with food or milk (drug may cause gastric irritation) Stop tube feeding 1 hour before and 1 hour after drug intake (1) Liberal intake of dairy products is advised Vitamin D or folate supplement may be needed Take Ca or Mg supplement or antacids 2 hours before or after drug If patient has loss of seizure control, may need to ↓ folic acid supplement
Antibiotic/Anti-Infective Erythromycin Penicillin or Ampicillin Tetracycline (Achromycin)	Delayed absorption when taken with food Absorption impaired by concurrent intake of food and antacids containing	Anorexia; oral candidiasis; abdominal stress Can promote negative nitrogen balance	Take on empty stomach with full glass of water Allow 1 hour to elapse between penicillin dose and consumption of fruit juice or other acidic beverage Take on empty stomach with full glass of water to avoid nausea. Avoid milk products, iron-fortified cereals, and iron supplements within 2 hours of dosage

^aGI indicates gastrointestinal; ↑, increase; and ↓, decrease

Drug Classification	Effect of Food on Drug	Effect of Drug on Nutritional Status	Patient Guidelines
Antibiotic/Anti-Infective (cont) Ciprofloxacin (Cipro) Sulfasalazine		Patients taking sulfasalazine may require a supplement of 1 mg/day of folic acid to prevent vitamin deficiency associated with competition of the drug for absorption of folate Possible ↓ vitamin K and vitamin B absorption	Take multivitamins with minerals, Ca, Fe, Mg separately by 2 hours Stop tube feeding 2 hours before and 2 hours after drug intake
Antifungal Griseofulvin (Fulvicin)	Fulvicin absorption improves with a fatty meal or whole milk	Taste loss; oral candidiasis; dry mouth; stomach pain	Take with whole milk or meal
Antihyperlipidemic Clofibrate (Atromid-S) Colestipol (Cholestid; Probuco) Cholestyramine (Questran, Cuemid) Atorvastatin (Lipitor) Lovastatin, (Mevacor) Simvastatin (Zocor)	Consuming high-fiber foods at same time medication is taken ↓ absorption of drug Grapefruit juice may increase drug availability and absorption (2-5)	Nausea Reported decreased absorption of vitamins A, D, K, B ₁₂ , folate, and Fe Constipation common	Take with food or milk Follow a low-cholesterol and low-fat diet Increase intake of water and high-fiber foods Take with meals Take vitamin/mineral supplements 1 hour before or 4 hours after medication intake Mevacor: Do not consume with high-fiber foods Avoid grapefruit juice (2-5).
Antihypertensive Propranolol beta blockers (Inderal, Lopressor) Calcium channel blockers (Nifedipine, Felodipine, Nicardipine, Nimodipine, Isradipine, Nisoldipine) and Phenylalkylamine beta blocker (Verapamil)	Food may increase, decrease, or delay absorption (depending on which beta blocker is used) Grapefruit juice may increase drug availability and absorption (2-5)	Dry mouth; diarrhea; nausea; vomiting; constipation May prevent the appearance of certain premonitory signs and symptoms of acute hypoglycemia in type 1 diabetes	Take with food Follow a sodium-restricted diet Avoid natural licorice Avoid grapefruit juice (2-5).

^aGI indicates gastrointestinal; ↑, increase; and ↓, decrease

Drug Classification	Effect of Food on Drug	Effect of Drug on Nutritional Status	Patient Guidelines
Bronchodilator Theophylline (Theo-24, Theo-Dur, Theolair, Slo-bid)	Drug effect is increased by caffeine; toxicity can result When plasma levels are measured, coffee, tea, cola, chocolate, and acetaminophen and xanthine contribute to high values; may ↑ risk of cardiovascular and central nervous system side effects Drug effect may be decreased by ingestion of charcoal-broiled meats High-protein/low-carbohydrate diet is associated with decreased drug level	May occasionally act as a GI irritant Anorexia Bitter aftertaste Raises glucose with high dosage	Avoid large amounts of caffeine and chocolate Take with food to help reduce GI irritation Avoid major changes in carbohydrate and protein composition of diet Avoid excessive intake of charbroiled meats
Cardiovascular Digoxin (Lanoxin) Arrhythmia Specific: Amiodarone (Cordarone) Disopyramide (Norpace)	Food delays but does not inhibit absorption except for bran, which may reduce absorption Grapefruit juice may increase drug availability and absorption (2-5)	Digitalis may exacerbate metabolic effects of hyperkalemia, especially with respect to myocardial activity May cause GI irritation Anorexia; weight loss Diarrhea	Take 2 hours after meals to lessen gastric irritation Take medication between meals if meals are high in bran; bran decreases effects and level of medication Diet should provide liberal potassium, Mg, and Ca intake Avoid natural licorice (imported) ^b and low Na intake Avoid grapefruit juice (2-5)

^aGI indicates gastrointestinal; ↑, increase; and ↓, decrease

Drug Classification	Effect of Food on Drug	Effect of Drug on Nutritional Status	Patient Guidelines
<p>Diuretic Thiazides (Diuril, Hydrodiuril) Furosemide (Lasix) Triamterene with hydrochlorothiazide (Dyazide, Maxzide)</p>	<p>Food increases absorption Mg supplement will ↓ absorption of drug</p>	<p>Natriuresis may be accompanied by loss of potassium Also increases K, Mg, Zn, and B₆ excretion Will ↓ utilization of folate Hypokalemia is uncommon, but hyperkalemia may occur</p>	<p>Do not take with magnesium supplement Take with meal or milk Limit intake of foods high in sodium; sodium-restricted diet may be preferred Increase intake of foods high in potassium and folate Limit use of natural licorice (imported)^b Avoid use of salt substitutes Increase potassium intake only when necessary and then cautiously</p>
<p>GI Stimulant Cisapride (Propulsid)</p>	<p>Grapefruit juice may increase drug availability and absorption (2,3).</p>		<p>Avoid grapefruit juice (2,3).</p>
<p>Laxative Bisacodyl (Dulcolax) Bisacodyl (Dulcolax)</p>	<p>Milk can raise pH of stomach sufficiently to dissolve enteric coating prematurely Milk can raise pH of stomach sufficiently to dissolve enteric coating prematurely</p>	<p>Misuse may cause hypokalemia and weight loss Misuse may cause hypokalemia and weight loss</p>	<p>Take on empty stomach with 8 oz of water or juice Drink plenty of fluids Take on empty stomach with 8 oz of water or juice Drink plenty of fluids</p>
<p>Thyroid Preparation Synthroid</p>		<p>Goitrogenic substances naturally present in some foods can interfere with iodine uptake by the thyroid</p>	<p>Take iron supplement separately by 4 hours Take on empty stomach If hypothyroidism is induced by goitrogenic foods, one should encourage thorough cooking to inactivate the goitrogens in some vegetables</p>
<p>Haloperidol (Haldol)</p>	<p>May cause additive hypotension with alcohol Coffee or tea may precipitate liquid form of drug</p>	<p>Appetite ↓; weight loss; anorexia Dry mouth Constipation</p>	<p>Take Fe supplement separately by 4 hours Avoid consumption of coffee, tea, or fruit juice 1 hour before or 2 hours after taking liquid form Take with food or milk</p>

^aGI indicates gastrointestinal; ↑, increase; and ↓, decrease

^bNatural licorice contains a corticosteroid pressor substance (carbenoxolone), which can interfere with the effect of antihypertensive drugs (beta blockers/hydralazine /thiazides/spironolactone). Advise patients receiving antihypertensive therapy to eat no more than an occasional piece of natural licorice. See Section II: Herb and Drug Interaction.

Drug Classification	Effect of Food on Drug	Effect of Drug on Nutritional Status	Patient Guidelines
Miscellaneous			
Cimetidine (Tagamet)	Food delays drug absorption and allows maintenance of an effective blood concentration between doses	Aplastic anemia; ↓ absorption of vitamin B ₁₂	Take with or directly after meals Advise concerning taste changes
Protease Inhibitor (Fortorase)	Grapefruit juice may increase drug availability and absorption (2,3).		Avoid grapefruit juice (2,3).
Benzodiazepines Midazolam, and Triazolam (Halcion, Clomipramine, Anafranil)	Grapefruit juice may increase drug availability and absorption (2,3).		Avoid grapefruit juice (2,3).
Vitamin Supplements Vitamin A	Adequate fat, protein, and vitamin E needed for absorption ↑ calories for carbohydrate intake; ↑ thiamin requirement	Toxic in excess doses	Avoid excessive intake of raw fish
Thiamin (B ₁)	Foods high in thiaminase may ↓ thiamin activity	Large doses may ↑ blood glucose and cause jaundice and GI disturbances; 3 – 9 g/day produces toxicity	Take with food or milk to ↓ GI distress For capsules, do not mix contents with jam or jelly
Niacin (B ₃)			
Pyridoxine (B ₆)			
Vitamin C			
Vitamin D			
Vitamin E		Large doses may ↑ red blood cell hemolysis and destroy dietary vitamin B ₁₂ when taken with food May be relevant to kidney stone formation Toxic in excess doses	Take vitamin B-12 supplement separately by 1 hour Take with iron supplement to ↑ iron absorption
		Large doses may induce vitamin K deficiency	

^aGI indicates gastrointestinal; ↑, increase; and ↓, decrease

Drug Classification	Effect of Food on Drug	Effect of Drug on Nutritional Status	Patient Guidelines
Mineral Supplements Fluoride Potassium (K-Dur, K-Lor, K-Lyte)	Decreased absorption when taken with dairy products	>20 mg/day will produce severe skeletal fluorosis Ca, vitamin C, or protein deficiency will ↑ fluorosis	Do not take with high-fat, low-sugar (rich) foods Keep Ca supplement and albumin hydroxide separate of fluoride by 2 hours Do not take with dairy products

^aGI indicates gastrointestinal; ↑, increase; and ↓, decrease

Also find reference to the following drugs:

Anticoagulants	See Section III: Anticoagulant Therapy
Corticosteroids	See Section III: Corticosteroid Therapy
Calcium supplements	See Section IF: Nutrition Management of Calcium Intake
Chemotherapeutic agents	See Section III: Cancer
Monamine oxidase inhibitors	See Section IH: Tyramine Restricted Diet
Oral glucose lowering medications	See Section III: Diabetes: Oral Glucose Lowering Medications and Insulin

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HERB AND DRUG INTERACTIONS

Herb Classifications	Common Indications	Possible Side Effects	Herb-Drug Interactions	Patient Guidelines
<p>German chamomile <i>Matricaria recutita</i></p> <p>(Note: Various types are available, such as English chamomile, with varying properties.)</p>	<p>Internal:</p> <ul style="list-style-type: none"> *Cough/bronchitis (2) *Fever and colds (2) *Inflammation or spasms of the gastrointestinal tract (2) *Inflammation of the mouth and pharynx (2) *Tendency for infection (2) <p>Topical:</p> <p>Mild inflammation of the skin (2)</p> <p><i>Contraindications:</i> Pregnancy and lactation (3)</p>	<p>Allergy (rare) (1)</p> <p>Patients with severe allergies to ragweed should be warned about possible cross-reactivity to chamomile and other members of the aster family (eg, echinacea, feverfew, and milk thistle) (2).</p>	<p>Avoid use with coumarin anticoagulants (2). Chamomile may exacerbate the anticoagulant effects of warfarin (4).</p> <p>Avoid use with alcohol and benzodiazepines (2).</p>	<p>Avoid taking with other sedatives, such as benzodiazepines and alcohol (1).</p> <p>Recommended daily dosage for internal use: 3 g (2) as an infusion; 3 g in 150 mL water 3 times daily for gastrointestinal complaints (8); 1 to 4 mL of liquid extract or 1 cup of tea administered three to four times daily (2).</p>
<p>Echinacea <i>Echinacea purpurea</i>, <i>Echinacea angustifolia</i>, <i>Echinacea pallida</i></p>	<p>Internal:</p> <ul style="list-style-type: none"> *Prevention and treatment of colds, cough/bronchitis, and urinary tract infections *Inflammation of the mouth and pharynx *Stimulates immune system (2) <p>Topical:</p> <p>Promotes wound healing (1-3)</p> <p><i>Contraindications:</i> Multiple sclerosis, leukosis, collagen disease, AIDS, tuberculosis, and pregnancy</p>	<p>Possible suppression of immunity with habitual use (1-2)</p> <p>Parenteral doses may cause fever, nausea, and vomiting (2). Patients with diabetes should avoid parenteral administration (2).</p>	<p>Immunostimulating effects of echinacea offset the immunosuppressive effects of corticosteroids and cyclosporine (2,3).</p>	<p>Dosage is dependent on variation type. Safe dosages for short-term use (<8 weeks) (1,2,4) are ½ to 1 tsp liquid (expressed juice of the herb stabilized in 22% alcohol) or one 88.5-mg capsule of dried juice TID (3) or 900 mg daily (2).</p>
<p>Feverfew <i>Tanacetum parthenium</i></p>	<p>Prevention and treatment of migraines and migraine-associated nausea and vomiting (2)</p> <p>Antiarthritic (1)</p> <p><i>Contraindications:</i> Pregnancy and lactation</p>	<p>Potential sensitization via skin contact with drug (2)</p> <p>Inflammation of mouth and tongue (3)</p>	<p>May interact with thrombolytics, anticoagulants, and drugs that decrease platelet aggregation (eg, aspirin) (2).</p>	<p>Recommended daily dosage: 200 to 250 mg orally, standard content of 0.2% parthenolide (3). A 4- to 6-week course of continual use of the herbal drug is suggested to improve migraines.</p> <p>A 4- to 6-week course of feverfew is suggested to improve migraines.</p>

Herb Classifications	Common Indications	Possible Side Effects	Herb-Drug Interactions	Patient Guidelines
Garlic <i>Allium sativum</i>	*Antiatherosclerosis (lipid-lowering anti-thrombotic, fibrinolytic, antihypertensive) (1-2) <i>Contraindications:</i> Lactation; prolongs bleeding time, and should be discontinued 1-2 weeks prior surgery (3)	Stomach upset, headache, myalgia, fatigue, and vertigo (2) Sulfuric odor, contact irritation, and dermatitis (2)	May increase the effect of antihypertensive drugs and anticoagulant drugs, such as aspirin, NSAIDs, or warfarin (2,5)	Recommended daily dosage: a commercial preparation of 600 to 900 mg (containing 3 mg of allicin or a total allicin potential of 5,000 µg) in an enteric-coated form QD (2) or one clove of raw garlic (equal to 4 g) QD or BID (2).
Ginger <i>Zingiber officinale</i>	*Loss of appetite, nausea, travel sickness, and dyspeptic complaints (1,2) <i>Contraindications:</i> Germany's Commission E contraindicates the use of ginger for morning sickness associated with pregnancy (2); gallstone conditions; and persons at risk for hemorrhage (2).	Heartburn (1) Doses >6 g/day may lead to ulcer formation (2). Allergic reaction (rare) (1)	May exacerbate the anticoagulant effects of warfarin (2,3) May decrease effectiveness of antacids, H2 blockers, and proton pump inhibitors May interfere with diabetic and blood pressure medicines (3)	Use only briefly during pregnancy. May prolong bleeding, so do not use after surgery. Patients receiving anticoagulant drugs or patients with a history of gallstones should not take ginger (2,3,4). Usual dose for antiemetic is 1 to 2 g freshly ground ginger taken with liquid and in two divided doses (2)
Ginkgo <i>Ginkgo biloba</i>	*Symptomatic relief of organic brain dysfunction and intermittent claudication (dementia, peripheral occlusive arterial disease [POAD]) (1,2); improves memory *Vertigo (vascular origin) (2) *Tinnitus (vascular origin) (2)	Gastrointestinal tract disturbance, headache, and (rarely) contact dermatitis (1-3); blood pressure irregularities (2); blood glucose level changes (3) Patients with known risk factors for intracranial hemorrhage (eg, systemic arterial hypertension, diabetes amyloid senile plaques) should avoid use of ginkgo (2).	May exacerbate the effects of antithrombotic agents (eg, anticoagulants, antiplatelets, aspirin, or acetaminophen) as a result of a potent inhibitory effect on platelet-activating factor (2,4) May cause hypomania if taken with fluoxetine May interact with medicines that lower seizure threshold and thiazide diuretics (3)	Ginkgo is available in a capsule, tablet, or liquid form. Absorption is unaffected by food intake (1). Recommended daily dosage for cerebrovascular insufficiency (eg, dementia, POAD, and equilibrium disorders) is 120 to 240 mg of standardized dried extract in 2 or 3 oral doses (2,6). A 6- to 8-week course is advised to determine effectiveness of therapy.

Herb Classifications	Common Indications	Possible Side Effects	Herb-Drug Interactions	Patient Guidelines
<p>Ginseng <i>Panax ginseng</i> <i>Panax quinquefolius</i></p>	<p>*Stimulates the central nervous system, reduces fatigue, and improves concentration (1-3)</p> <p>Anticancer effects (1,2); antioxidant effects (2); antiplatelet effects (2); antiviral effects (2); hypolipidemic/cardiac effects (2); and hypoglycemic effects (2)</p> <p><i>Caution in use with:</i> Cardiac disorders, including hypertension (6), and diabetes (2,4)</p> <p><i>Contraindications:</i> Pregnancy and lactation (2).</p>	<p>Tachycardia and hypertension (1,2)</p> <p>Insomnia, epistaxis, headache, nervousness, and vomiting (2)</p> <p>Reports of mastalgia and postmenopausal vaginal bleeding (2)</p> <p>Overdose can cause hypertension, insomnia, hypertonia, and edema (2).</p>	<p>Avoid concomitant use with warfarin, NSAIDs, and antiplatelet agents (2,5) due to anticoagulant effects.</p> <p>Caution should be taken with diabetic agents/insulin due to hypoglycemic effects (2).</p> <p>Patients taking steroids, MAOIs, or loop diuretics should not use ginseng (2,4).</p>	<p>Recommended daily dosage (usually capsule form) for cognitive function is 400 mg (2); for hypoglycemic effects, 100 to 200 mg (2); for antiviral effects, 100 to 200 mg (2); for physical and psychological performance, 100 mg twice a day (2).</p> <p>Other recommendations: 100 mg QD or BID of 4% to 7% ginsengosides (3)</p> <p>Limit continuous use to less than 3 months (3).</p>
<p>Green tea <i>Camellia sinensis</i></p>	<p>Prevents cancers of the pancreas, colon, small intestine, stomach, breast, and lung (2)</p> <p>Dental caries (2)</p> <p>Diarrhea (2)</p>	<p>Excess consumption (>5 cups/day) can cause gastrointestinal tract irritation (related to hyperacidity) and excitability or anxiety (related to caffeine) (2).</p> <p>Pregnant women should not exceed a dosage of 300 mg/day (2).</p> <p>Microcytic anemia has been reported in infants fed 250 mL of green tea daily (2).</p>	<p>Resorption of alkaline medications can be delayed because of chemical bonding with tannins (2).</p> <p>May increase risk of bleeding with anticoagulant drugs</p> <p>May interact with verapamil by increasing plasma caffeine levels (3)</p>	<p>Available as an infusion or capsule form for internal use.</p> <p>Recommended daily dosage is 300 to 400 mg of polyphenols or 3 cups of green tea (which contains 240 to 320 mg of polyphenols) (2).</p> <p>Avoid concomitant use with grapefruit juice (3).</p>
<p>English hawthorn <i>Crataegus laevigata</i></p>	<p>*Decreased cardiac output, senile heart, chronic cor pulmonale, and mild forms of bradycardial arrhythmias (2)</p> <p><i>Contraindications:</i> Acute angina (because herb action is too slow) (1,2); avoid during first trimester of pregnancy; children younger than 12 years should avoid this product</p>	<p>Hawthorn supplements should be prescribed and monitored by a physician (2). During treatment, heart rate and blood pressure should be monitored on a regular basis (2).</p>	<p>Use with antiarrhythmics is discouraged due to similar modes of action (2).</p> <p>English hawthorn may potentiate the effects of cardiac glycosides. Therefore, if initiated in patients taking digoxin, digitoxin, or g-strophanthin, the glycoside dosage should be adjusted (2).</p>	<p>Recommended daily dosage is 5 g of drug or 160 to 900 mg of hawthorn extract (standardized to 20% procyanidins or 2.2% flavonoid content) administered in divided doses three times daily (2,3).</p> <p>Treatment duration is a minimum of 6 weeks (2).</p>

Herb Classifications	Common Indications	Possible Side Effects	Herb-Drug Interactions	Patient Guidelines
English hawthorn <i>Crataegus laevigata</i> (Continued)			Can cause a hypertensive effect when used in combination with beta-blockers (2) Should be avoided with cisapride and other drugs in a similar drug class as cisapride (2)	
Kava kava <i>Piper methysticum</i>	*Suppresses anxiety and the central nervous system (2) *May relieve mild anxiety and sleeplessness/restlessness (2,3) <i>Contraindications:</i> Pregnancy and lactation; patients with endogenous depression (2,7)	In rare cases, kava kava may cause dry patchy skin and a temporary yellow discoloration of skin, hair, and nails (1). Overdose can result in disorders of complex movement (without a disturbance of consciousness), followed by tiredness and tendency to sleep (2).	May potentiate the effectiveness of substances that affect the central nervous system (eg, alcohol, barbiturates, and psychopharmacologic agents) (2) Kava kava is reported to antagonize the effect of dopamine. Patients with Parkinson disease who take levodopa should avoid kava kava (2).	Recommended dosage is 150 to 300 mg of root extract taken twice daily, with a daily dose of preparations equivalent to 50 to 240 mg kava pyrones (2). The herb should be taken with food or liquid due to its lipid solubility (2). Avoid concomitant use of kava kava with alcohol (3)
Licorice <i>Glycyrrhiza glabra</i>	*Soothing stomach irritations/gastritis (2) *Cough remedy and expectorant/bronchitis (2) <i>Contraindications:</i> Natural licorice (except deglycyrrhizinated licorice) is not recommended for people with high blood pressure, heart disease, diabetes, cholestatic liver disorders, liver cirrhosis, hypertonia, hypokalemia, or severe kidney insufficiency (6); or for pregnant or lactating women (2,3);	Large amounts may lead to potassium loss, sodium retention, edema, high blood pressure, and cardiac complaints (2,5).	Avoid with thiazide drugs, as licorice may counteract the effects of thiazide medications (2). Increases potassium losses, which may increase toxicity to digitalis glycosides (2,4) May interfere with anti-arrhythmic agents (eg, procainamide, quinidine) (2). Prolongs half-life of cortisol, which may lead to hypokalemia, high blood pressure, and edema (2)	Recommended daily dosage is 5 to 15 g (1 to 2 tsp) of dried root, containing 200 to 600 mg of glycyrrhizin (2). Should not be used more than 4 to 6 weeks, otherwise the risk of side effects and overdose increases (2,8) Avoid concomitant use with grapefruit juice (3).

Herb Classifications	Common Indications	Possible Side Effects	Herb-Drug Interactions	Patient Guidelines
Milk thistle <i>Silybum marianum</i>	*Dyspeptic complaints (2)*Used as a tonic, as a stimulant, and for relief of functional disorders of the liver and gallbladder (2)	No known side effects if properly administered (2)	Concomitant use with butyrophenones or phenothiazines results in reduced lipid peroxidation (2) Antagonistic effect with yohimbine and phentolamine (2)	Recommended daily dosage is a 140 mg to 420 mg capsule (standardized to 70% silymarin) BID or TID (1,2); or 400 mg of concentrated extract (which equals 140 mg of silymarin).
Saw palmetto <i>Serenoa repens</i>	*Prostate complaints (relieves the difficulties caused by an enlarged prostate without reducing the enlargement) (2) *Irritable bladder (2) Inhibits male hormones; has some effects on estrogen; may be anti-inflammatory (3) <i>Contraindications:</i> Pregnancy and lactation (due to potential hormonal effects) (2)	Rare cases of gastrointestinal tract upset (1,2)	May exert estrogen, androgen, and alpha-adrenergic blocking effects; therefore, the concomitant use of hormones, hormone-like drugs, or adrenergic drugs may need to be adjusted (2) No significant adverse effects have been reported in clinical trials (2). Might increase risk of bleeding if taken with anticoagulant drugs (3)	Prostate enlargement requires diagnosis and follow-up by a physician (5). Recommended daily dosage is 160 mg BID or 320 mg one time per day of an extract standardized to contain 85% to 95% fatty acids and steroids (2,4).
Valerian <i>Valerian officinalis</i>	*Nervousness and insomnia (1,2) Relieves pain, reduces spasms (6), and stimulates appetite (6) <i>Contraindications:</i> Pregnancy and lactation	Heart palpitations and insomnia occur rarely with long-term use (1,2).	Avoid use with alcohol (2). Potentiates the effect of central nervous system depressants and not recommended for use with sedatives or antidepressants (2). May exacerbate the side effects (drowsiness and fatigue) of drugs used to treat allergies or anxiety (eg, antihistamines) (5)	Recommended daily dosage is 400 to 900 mg of standardized valerian root 30 minutes before bedtime to treat insomnia or 220 mg in extract three times daily to treat restlessness (2).

*Indications for use have been approved by the Commission E, Germany's regulatory authority on herbal and botanical products, which is currently recognized as the best expert consensus on medicinal herbs (2).

NSAIDs = nonsteroidal anti-inflammatory drugs; MAOI = monoamine oxidase inhibitor; SSRI = selective serotonin reuptake inhibitor; TID = three times a day; BID = two times a day; QD = every day; a.m. = morning; p.m. = evening.

Herb and Drug Interactions

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