LA FUNCION DE LOS: *MINERALES*
en el Ejercicio y Deporte

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CONTENIDO DE LA PRESENTACIÓN

- ❑ Conceptos básicos
- ❑ Origen/Formación
- ❑ Funciones
- ❑ Clasificación
- ❑ Deficiencias
- ❑ Requisitos vitamínicos (RDA)
- ❑ Dietary Reference Intakes (DRI)
- ❑ Suplementación
- ❑ Toxicidad
- ❑ Mitos y realidades
- ❑ Recomendaciones – *Atleta en general*
- ❑ Discusión detalada de las vitaminas y su vínculo con el ejercicio
- ❑ Preguntas

MINERALES

CONCEPTO

Elementos (iones y metales) inorgánicos que se encuentran en cantidades muy pequeñas (4% de la masa corporal) en el tejido animal y que proporcionan fuerza y rigidez a ciertos tejidos del cuerpo e intervienen en muchas funciones vitales

MINERALES

ORIGEN/FORMACIÓN

- **En la naturaleza:**
  - ***Los minerales se encuentran en el agua de los ríos, lagos y oceanos, en la capa de la tierra y debajo de la superficie de la tierra***
- **En las plantas y árboles:**
  - ***Las raíces de las plantas y árboles absorben los minerales y los incorpora en los nutrientes que producen (hidratos de carbono, grasas y proteínas)***

MINERALES

ORIGEN/FORMACIÓN

- **En los animales:**
  - ***Los minerales se convierten en parte de la estructura del cuerpo de los animales (y ser humanos) al éstos consumir agua, alimentos producidos por las plantas y carne animal***

MINERALES

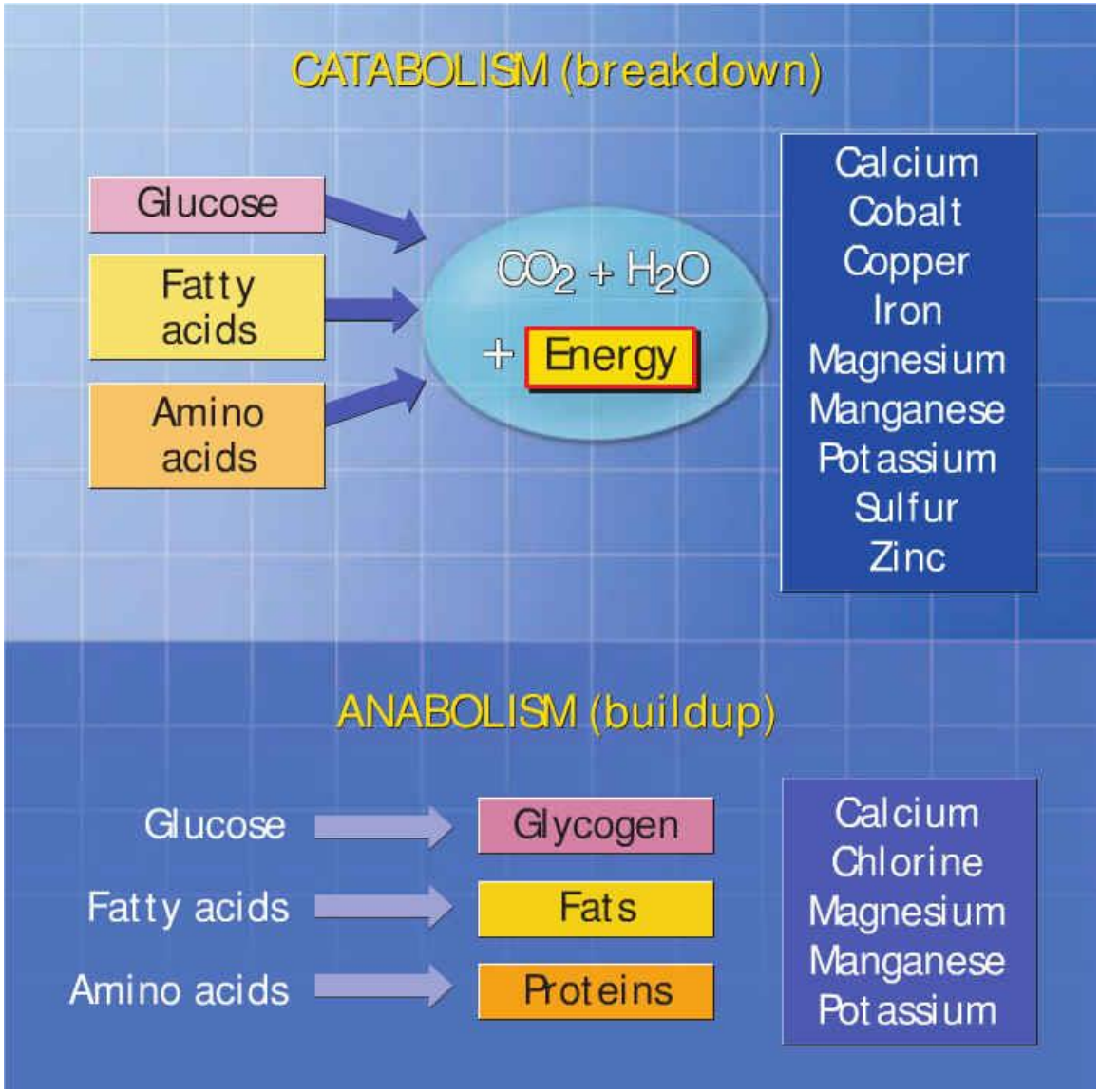
FUNCIONES: General

- **Regulación de la excitabilidad del sistema nervioso y la contracción muscular**
- **Forma parte de la estructura de varios compuestos esenciales del cuerpo (hormonas, enzimas, vitaminas, hemoglobina y otros), que ayudan a regular las reacciones químicas dentro de las células**
- **Ayudan a mantener la reacción alcalina, ácida o neutra de los tejidos y líquidos corporales**

MINERALES

FUNCIONES: General

- **Aceleran el proceso de las reacciones biológicas que ocurren dentro de las células**
- **Ayudan a mantener un balance constante de agua en los compartimientos extracelular (intravascular o intercelular) e intracelular, que posee el cuerpo**
- **Son esenciales para el crecimiento de los tejidos del cuerpo, como los huesos y dientes**



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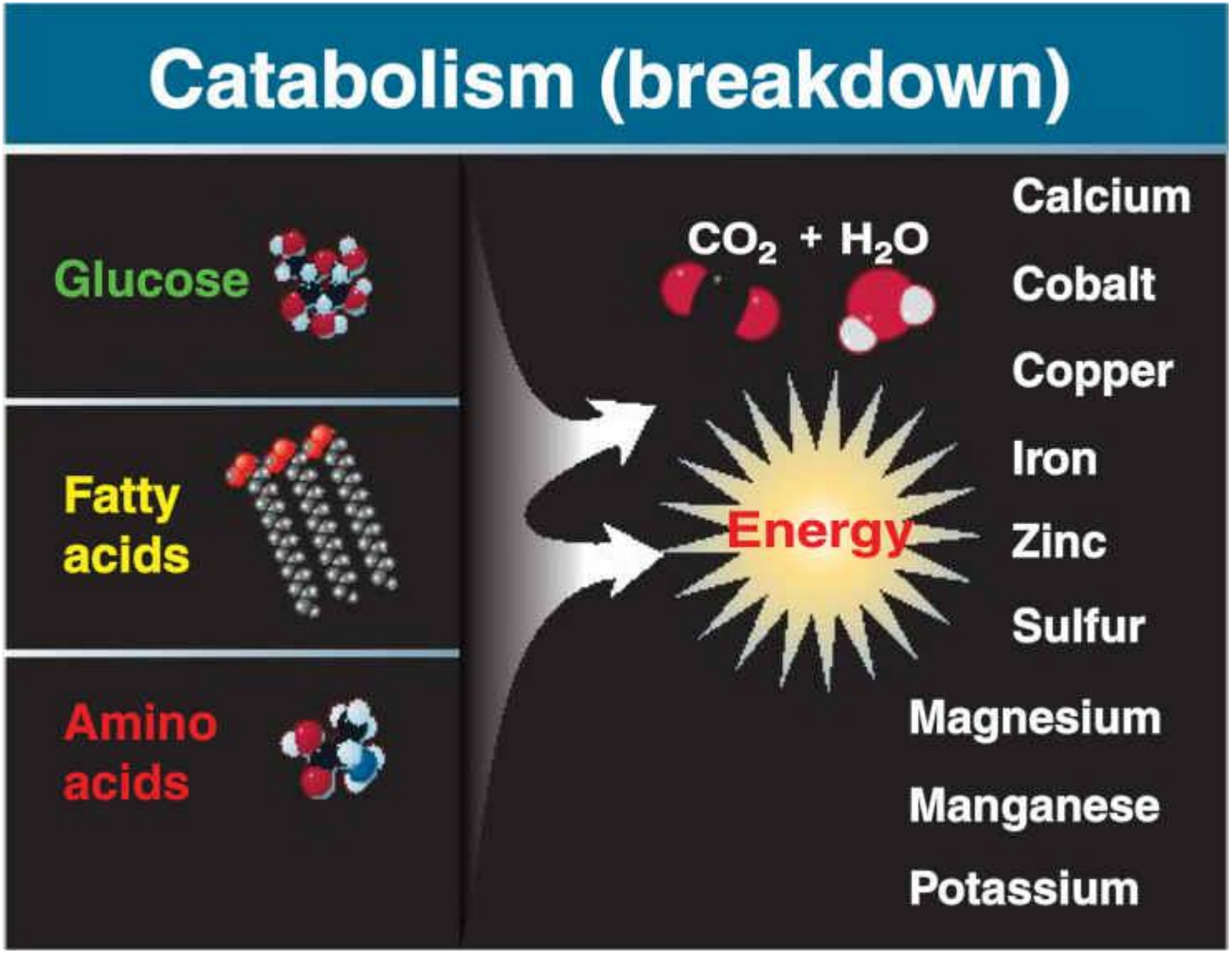

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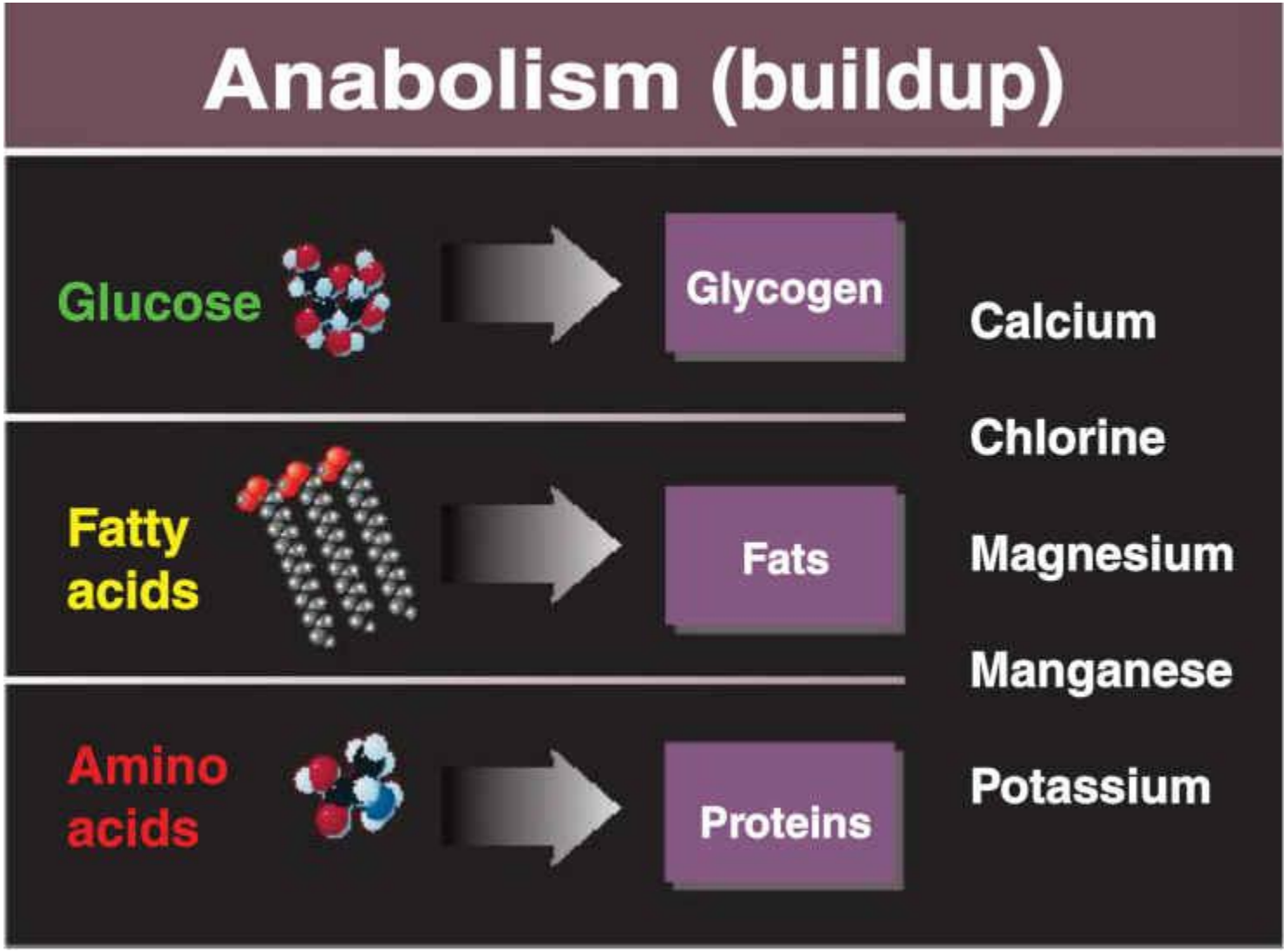

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MINERALES

CLASIFICACIÓN: Básica

- **Macronutrientes (Minerales Principales)**
- **Micronutrientes u Oligoelementos (Minerales Menores)**

MINERALES

CLASIFICACIÓN: Macronutrientes

- **Elementos macronutrientes (o macroformadores) esenciales para la nutrición humana:**
  - ***Son elementos que están presentes en cantidades relativamente altas en el tejido animal***
  - ***Requieren ser consumidos a través de los alimentos en niveles mayores de 100 miligramos por día***
  - ***Se consideran macronutrientes:***

    Calcio, fósforo, potasio, azufre, cloro, sodio y magnesio

MINERALES

CLASIFICACIÓN: Micronutrientes

- **Elementos micronutrientes (o microformadores) esenciales para la nutrición humana:**
  - ***Son elementos que se hallan en mínimas cantidades en el organismo***
  - ***Se consideran micronutrientes:***

    Hierro, cinc, selenio, manganeso, cobre, yodo, molibdeno, cobalto, cromio, flúor, silicio, vanadio, niquel y arsénico

Recommended Daily Allowance (RDA)—the average daily intake level that is sufficient to meet the nutrient requirement of 97–98% of healthy individuals by age and sex.

Adequate Intake (AI)—used when an RDA cannot be determined. The AI is an estimate of intake by healthy individuals.

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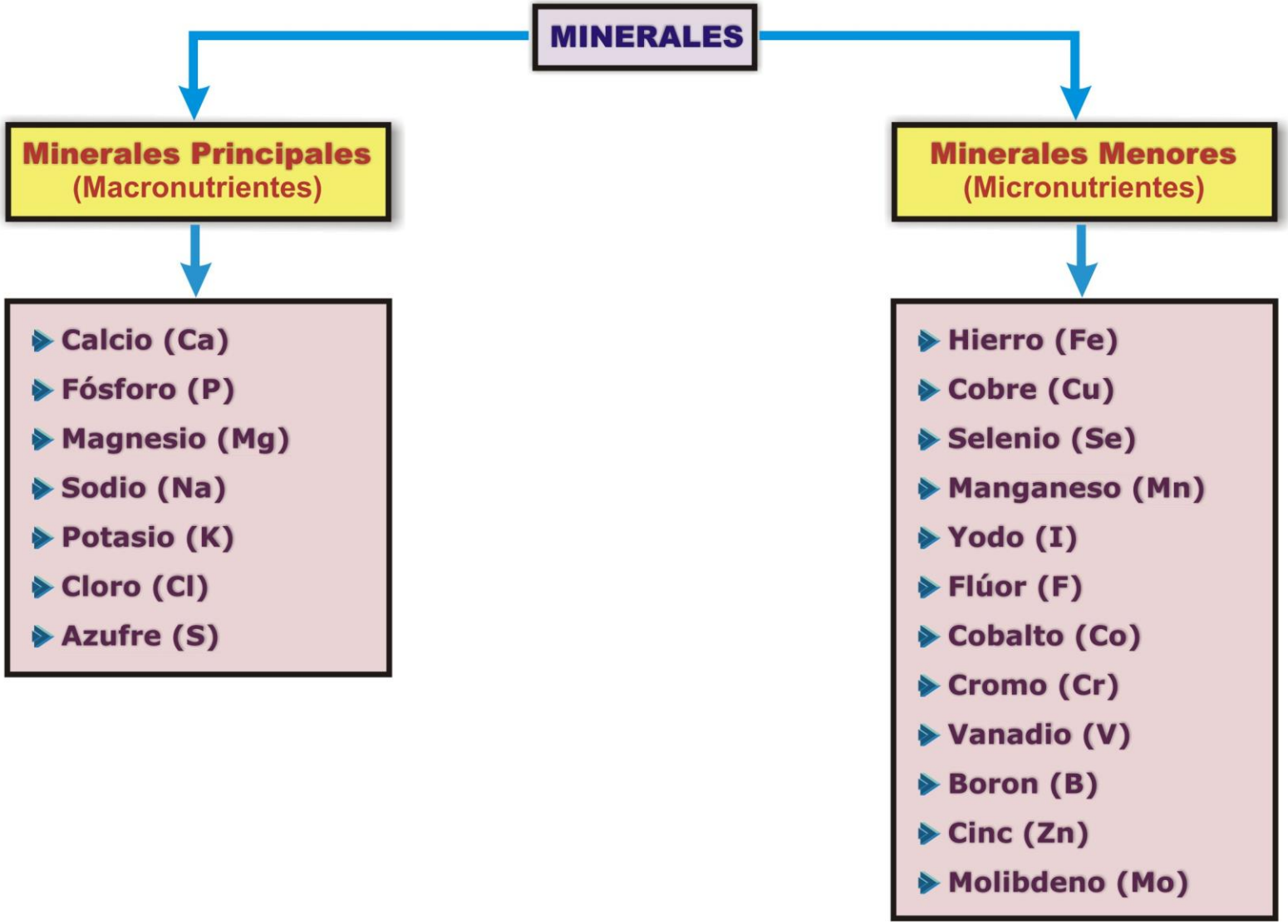

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Table 8-5. Minerals: Summary of Functions, Deficiency Symptoms, and Food Sources

Mineral	Food Sources	Major Functions	Deficiency Symptoms	RDA or AI (Adult per Day)	Toxicity Symptoms or Ingestion Above UL
Macrominerals					
Calcium	Milk products, tofu, small fish with bones, legumes	Bone and teeth mineralization, muscle contraction, nerve impulse transmission, blood clotting	Osteoporosis in adults, abnormal bone growth in children	AI: 1000 mg	Risk of kidney stones, kidney dysfunction, difficulties with absorption of other minerals
Phosphorous	Meat, fish, poultry, milk	Bone and teeth mineralization, major ion of intracellular fluid, acid–base balance, phospholipids in cell membranes, part of metabolic components	Bone pain, muscle weakness	RDA: 700 mg	Calcification of nonskeletal tissue, kidney stones, kidney problems
Magnesium	Nuts, whole grain, legumes, seafood, dark green vegetables	Bone mineralization, teeth maintenance, muscle contraction, nerve impulse transmission, proper immune function	Muscle weakness, confusion, poor heart function	RDA: Men: 400 mg; Women: 310 mg	From nonfood sources: diarrhea, dehydration

RDA, recommended dietary allowance; AI, adequate intake; UL, upper level.

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Macrominerals					
Sulfur	Meat, fish, poultry, milk, nuts, eggs	Part of sulfur-containing amino acids in protein, part of insulin, part of some B vitamins (biotin, thiamin)	None known	None	Toxicity occurs only if sulfur-containing amino acids are eaten in excess; in animals, this depresses normal growth
Sodium	Table salt, soy sauce, processed foods	Major ion of extracellular fluid, maintenance of fluid compartments, nerve impulse transmission	Muscle cramps, loss of appetite, mental apathy	AI: 1500 mg	Edema, hypertension
Potassium	Meats, milk, fruits, vegetables, legumes, grains	Major ion of intracellular fluid, maintains fluid compartments, nerve impulse transmission, muscle contraction	Muscle weakness, paralysis, confusion	AI: 4700 mg	Muscle weakness, vomiting, slow heart rate apparent in kidney failure

RDA, recommended dietary allowance; AI, adequate intake; UL, upper level.

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Macrominerals					
Chloride	Table salt, soy sauce, processed foods	Major ion of extracellular fluid, maintains fluid compartments, part of stomach hydrochloric acid	Adults under normal conditions: none; convulsions in infants	AI: 2300 mg	Vomiting, linked to high blood pressure in susceptible individuals when combined with sodium

RDA, recommended dietary allowance; AI, adequate intake; UL, upper level.

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Table 8-5. Minerals: Summary of Functions, Deficiency Symptoms, and Food Sources

Mineral	Food Sources	Major Functions	Deficiency Symptoms	RDA or AI (Adult per Day)	Toxicity Symptoms or Ingestion Above UL
Trace Minerals					
Iron	Part of hemoglobin and myoglobin, aids immune function	Red meats, fish, poultry, shellfish, dried fruits, legumes, eggs	Anemia, low blood iron, payable red blood cells, low hemoglobin values, impaired immune function	RDA: Men: 8 mg; Women: 18 mg (19–50 yr), 8 mg (51 yr +)	Gastrointestinal distress; in children consuming iron supplements, iron overload results in nausea, vomiting, diarrhea, rapid heart rate, dizziness, shock, and confusion
Iodine	Part of thyroid hormones that regulate growth, development, and metabolic rate	Iodized salt, seafood, bread, dairy products	Underactive thyroid gland; goiter; deficiency in pregnancy causes mental and physical retardation in fetus	RDA: 150 µg	Goiter, underactive thyroid gland
Fluoride	Needed for formation of bones and teeth, makes teeth resistant to decay	Fluoridated water, tooth paste, seafood	Increased risk of tooth decay	AI: Men: 3.8 mg; Women: 3.1 mg	Pitting and discoloration of teeth

RDA, recommended dietary allowance; AI, adequate intake; UL, upper level.

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Trace Minerals					
Zinc	Part of many enzymes, involved in DNA and proteins, immune reactions, taste perception, wound healing, reproduction, normal development of fetus	Red meats, shellfish, whole grains	Growth retardation, delayed sexual development, impaired immune function, hair loss, appetite and taste loss	RDA: Men: 11 mg; Women: 8 mg	Iron and copper deficiency, impaired immunity, low HDL
Selenium	Aids antioxidant system, needed for thyroid hormone regulation	Seafood, meat, whole grains, vegetables	Predisposes to heart tissue becoming fibrous, muscle pain, muscle weakness	RDA: 55 µg	Brittle and loss of hair and nails, fatigue, irritability, nervous system disorders
Copper	Needed for absorption and use of iron and formation of hemoglobin, part of enzymes	Seafood, nuts, whole grains, legumes	Anemia, low white blood cell count, bone abnormalities	RDA: 900 µg	Nervous system disorders, liver damage

RDA, recommended dietary allowance; AI, adequate intake; UL, upper level.

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Trace Minerals					
Manganese	Cofactor of several enzymes, including enzymes of carbohydrate metabolism	Nuts, whole grains, tea, leafy vegetables	Rare in humans	AI: Men: 2.3 mg; Women: 1.8 mg	Nervous system disorders
Molybdenum	Cofactor for some enzymes	Legumes, cereals, organ meats	None known	RDA: 45 µg	None known

RDA, recommended dietary allowance; AI, adequate intake; UL, upper level.

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MINERALES

CLASIFICACIÓN: Otra

- **Elementos no Esenciales**
- **Elementos sin Función Metabólica**

MINERALES

CLASIFICACIÓN: No Esenciales

- **Elementos no esenciales para la nutrición humana:**
  - ***Estos son elementos que no se han establecidos como imprescindibles para el organismo, aunque hay evidencia que participan en algunas reacciones biológicas***
  - ***Se incluyen en esta categoría:***

    Bario, estaño, bromo, estroncio y cadmio

MINERALES

CLASIFICACIÓN: Sin Función

- **Elementos del cuerpo sin función metabólica:**
  - ***Estos son elementos que pueden hallarse en el tejido animal en forma de contaminantes ambientales, pero hasta ahora no se sabe si desempeñan algún papel esencial en la nutrición***
  - ***Algunos de estos elementos son:***

    Oro, plata, aluminio, mercurio, bismuto, galio, plomo, antimonio, boro, litio (puede ser importante para patalogía bipolares) y otros 20 elementos más

MINERALES

SUPLEMENTACIÓN: Indicaciones

- **Dieta de pobre calidad:**
  - **Restricción en la ingesta calórica:**
    - **Posibles deficiencias de minerales:**
      - **Magnesio**
- **El ejercicio aumenta la pérdida de minerales a través del:**
  - **Sudor**
  - **Orina (después del ejercicio)**

MINERALES

SUPLEMENTACIÓN: Indicaciones

- **Sudor:**
  - **Principales electrólitos que posee:**
    - **Sodio**
    - **Cloruro**
  - **Otros minerales en pequeñas cantidades:**
    - **Potasio**
    - **Magnesio**
    - **Calcio**
    - **Hierro**
    - **Cobre**
    - **Cinc**

LESS MAY EVEN BE MORE BENEFICIAL

The Centers for Disease Control and Prevention (www.cdc.gov) state that nearly 70% of adult Americans should follow a low-salt diet that cuts the recommended daily sodium intake of 2300 mg to 1500 mg, about the amount found in two-thirds of a teaspoon of salt. The three groups at special risk for sodium sensitivity include (1) people with existing hypertension (30.5% of the adult population), (2) those age 40 and older without hypertension (34.4%), and (3) African Americans age 20 to 39 without hypertension (4.2%). In addition, reducing sodium intake may have health benefits beyond lowering blood pressure; it may improve flow-mediated dilation, the measure of a blood vessel's healthy ability to relax. As of 2010, the federal *Dietary Guidelines for Americans* has now extended this 1500-mg recommendation to all Americans regardless of health status.

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SOME SODIUM CULPRITS

Burger King's Country Pork Sandwich (3310 mg)
Canadian bacon, 3.5 oz (2500 mg)
Wendy's Hot & Spicy Boneless Wings (2490 mg)
Jack in the Box Deli Trio Grilled Sandwich (2460 mg)
Subway's Footlong Black Forest Ham Sub (2400 mg)
McDonald's Big Breakfast with Hotcakes and Large Size Biscuit (2260 mg)
Taco Bell's Chicken Grilled Stuffed Burrito (2180 mg)
Corned beef, 3.5 oz (1740 mg)
Seasoned rice mixes (1000 mg)
Canned soups (400–900 mg)
Ham, bacon, sausages, and luncheon meats (423 mg)
Store-bought salad dressing (300–600 mg)

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TABLE 2.10 **Electrolyte Concentrations in Blood Serum and Sweat, and Carbohydrate and Electrolyte Concentrations of Some Common Beverages**

	Na^+ ($mEq \cdot L^{-1}$)	K^+ ($mEq \cdot L^{-1}$)	Ca^{2+} ($mEq \cdot L^{-1}$)	Mg^{2+} ($mEq \cdot L^{-1}$)	Cl^- ($mEq \cdot L^{-1}$)	Osmolality ($mOsm \cdot L^{-1}$)	CHO ($g \cdot L^{-1}$)
Blood serum	140	4.5	2.5	1.5–2.1	110	300	—
Sweat	60–80	4.5	1.5	3.3	40–90	170–220	—
Coca Cola	3.0	—	—	—	1.0	650	107
Gatorade	23.0	3.0	—	—	14.0	280	62
Fruit juice	0.5	58.0	—	—	—	690	118
Pepsi Cola	1.7	Trace	—	—	Trace	568	81
Water	Trace	Trace	—	—	Trace	10–20	—

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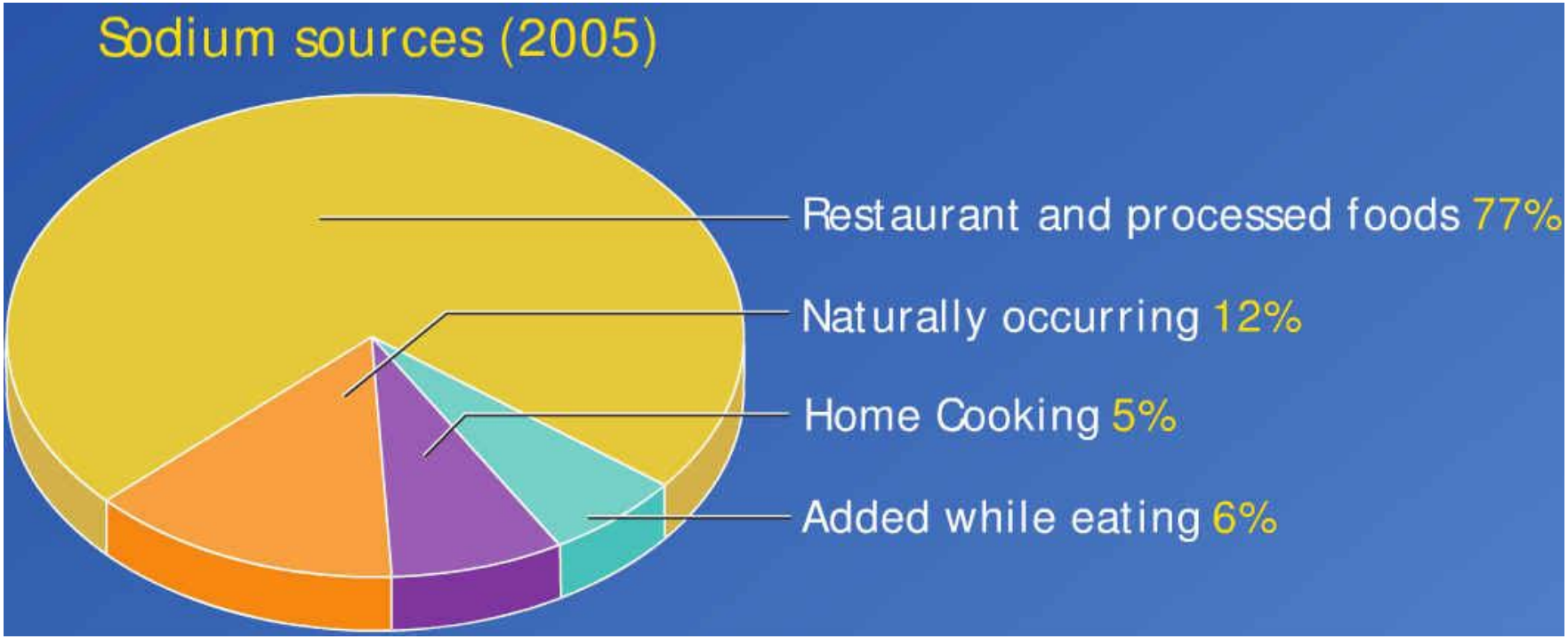

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TABLE 1 • Dietary Approaches to Stop Hypertension (DASH)

Food Group	Example of One Serving	Servings
Vegetables	1/2 cup of cooked or raw chopped vegetables; 1 cup of raw leafy vegetables; or 6 oz of juice	8 to 12 daily
Fruit	1 medium apple, pear, orange, or banana; 1/2 grapefruit; 1/3 cantaloupe; 1/2 cup of fresh frozen or canned fruit; 1/4 cup of dried fruit; or 6 oz of juice	8 to 12 daily
Grains	1 slice of bread; 1/2 cup of cold, dry cereal; 1/2 cup cooked rice or pasta	6 to 12 daily
Dairy	1 cup of no-fat or low-fat milk or 1 1/2 oz of low-fat or part-skim cheese	2 to 4 daily
Nuts, seeds, and beans	1/3 cup (1 1/2 oz) of nuts; 2 T of seeds; or 1/2 cup of cooked beans	4 to 7 weekly
Meat, poultry, or fish	3 oz serving (roughly the size of a deck of cards)	1 to 2 daily
Oil or other fats	1 tsp vegetable oil, butter, salad dressings, soft margarine	2 to 4 daily

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TABLE 2 • Sample DASH Diet (2100 kCal)

Food	Amount	Food	Amount
Breakfast		*Dinner*	
Orange juice	6 oz	Herbed baked cod	3 oz
1% low-fat milk	8 oz (used with corn flakes)	Scallion rice	1 cup [equals 2 servings of grain]
Corn flakes (1 tsp sugar)	1 cup (dry) [equals 2 servings of grains]	Steamed broccoli	1/2 cup
		Stewed tomatoes	1/2 cup
Banana	1 medium	Spinach salad (raw spinach)	1/2 cup
Whole-wheat bread	1 slice		
Soft margarine	1 tsp	Cherry tomatoes	2
Lunch		Cucumber	2 slices
Low-fat chicken salad	3/4 cup	Light Italian salad dressing	1 Tbsp [equals 1/2 fat serving]
Pita bread	1/2 large		
Raw vegetable medley		Whole-wheat dinner roll	1
Carrot and celery sticks	3–4 sticks each		
Radishes	2	Soft margarine	1 tsp
Lettuce	2 leaves	Melon balls	1/2 cup
Part-skim mozzarella	1 1/2 slices (1.5 oz)	*Snack*	
1% low-fat milk	8 oz	Dried apricots	1 oz (1/4 cup)
Fruit cocktail	1/2 cup	Mixed nuts, unsalted	1.5 oz (1/3 cup)
		Mini-pretzels, unsalted	1 oz (3/4 cup)
		Diet ginger ale	12 oz [does not count as a serving of any food]

Svetkey LP, et al. Effects of dietary patterns on blood pressure: subgroup analysis of the Dietary Approaches to Stop Hypertension (DASH) randomized clinical trial. Arch Intern Med 1999;159:285.

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MINERALES

CONSIDERACIONES ESPECIALES: Atleta Femenina

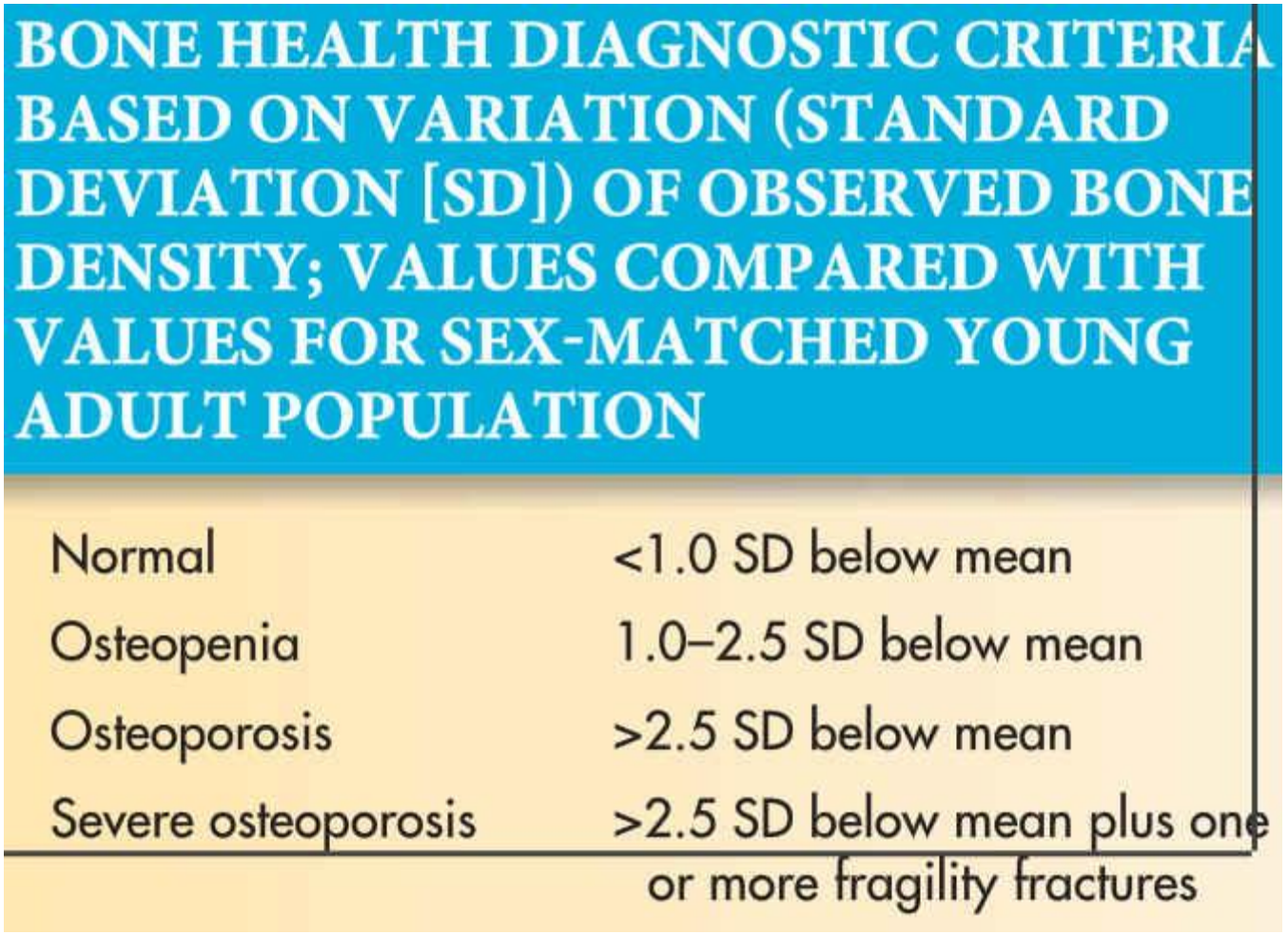
Deficiencias Nutricionales

- **Calcio**
- **Hierro**

MINERALES

SUPLEMENTACIÓN: Calcio

- **Edades: 19 - 25 años:**
  - **Deficiente consumo de calcio (< 800 mg/día)**



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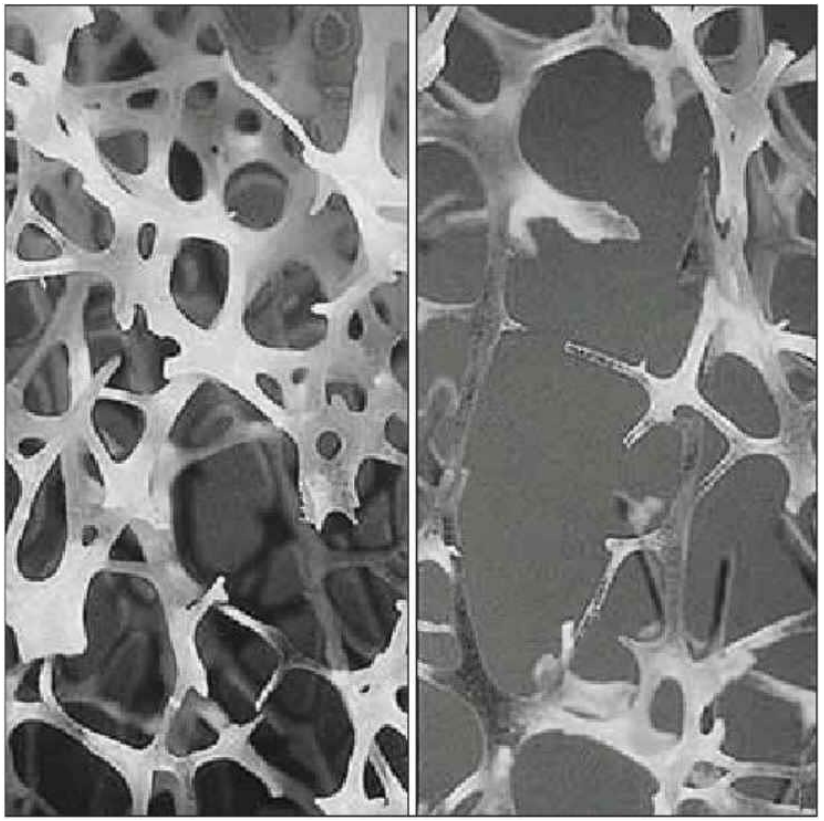

FIGURE 2.6. Micrograph of normal bone (*left*) and osteoporotic bone (*right*). Osteoporotic bone shows the following characteristics: loss of mineral matter, brittleness, cortex thinning (concomitant medullary diameter increase), increased porosity, imbalance between bone formation and resorption, disrupted bone architecture and cross-sectional geometry, microfracture accumulation, loss of mechanical integrity, and less tolerance to bending stress and thus more susceptibility to fracture.

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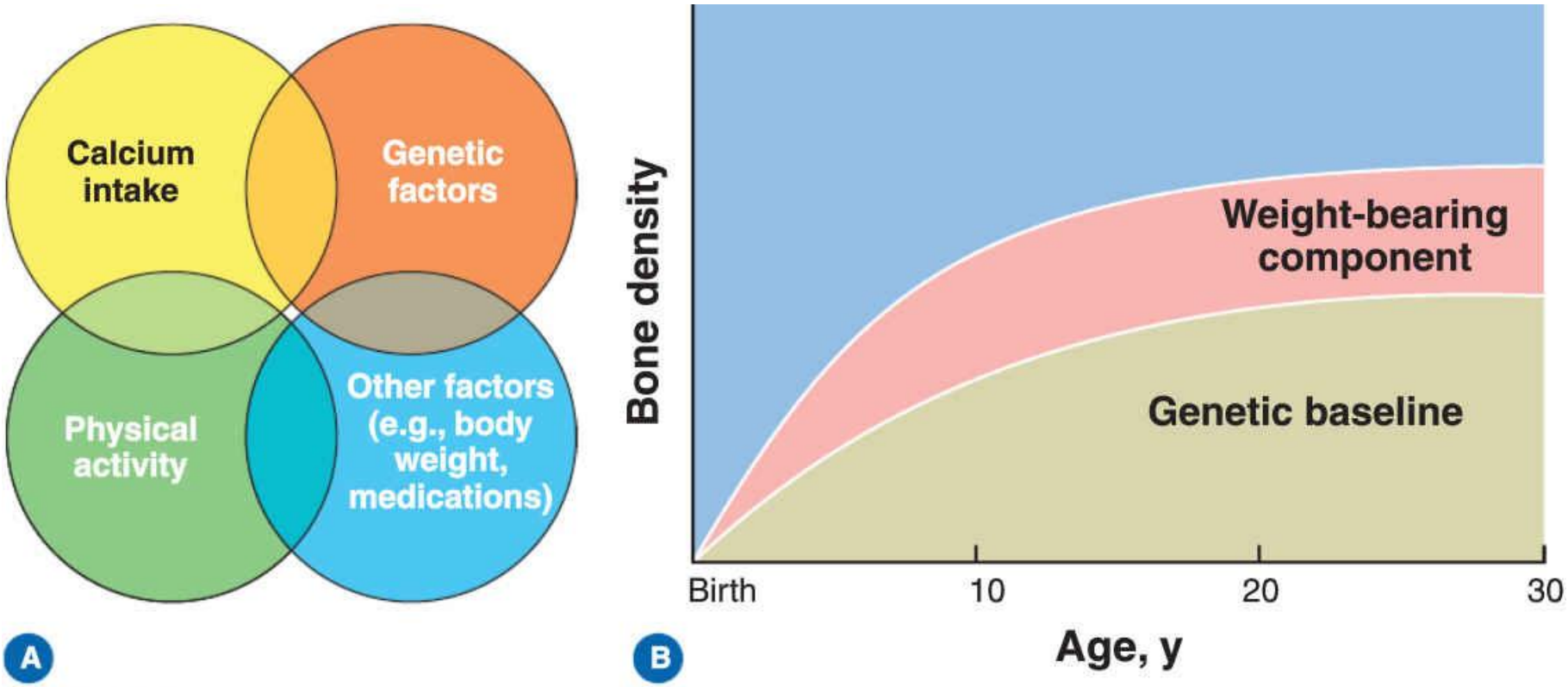

FIGURE 2.7. **A.** The variation in bone mass within the population is likely a function of how the different factors that affect bone mass interact with each other. (Modified from Specker BL. Should there be dietary guidelines for calcium intake? *Am J Clin Nutr* 2000;71:663.) **B.** Weight-bearing exercise augments skeletal mass during growth above the genetic baseline. The degree of augmentation depends largely on the amount of mechanical loading to which a particular bone is subjected. (Modified from Turner CH. Site-specific effects of exercise: importance of interstitial fluid pressure. *Bone* 1999;24:161.)

COMPLIANCE REMAINS CRITICAL TO PROVIDE BONE-PROTECTIVE BENEFITS OF EXTRA CALCIUM

Regular intake of calcium is crucial in providing bone-protective benefits. Several studies have cast doubts on the benefits of supplemental calcium for bone health. On further analysis of the data, it turned out that nearly 60% of the subjects failed to regularly take the supplements. For the 40% who consistently took calcium, a 30 to 40% reduction occurred in fracture risk. In essence, use of supplemental calcium does reduce fracture risk for aging women, but it must be taken regularly.

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Exercise Is Helpful

Regular dynamic weight-bearing exercise helps to build bone mass and bone strength and slow the rate of skeletal aging. Children and adults, regardless of age, who maintain an active lifestyle show greater bone mass and bone density with substantial improvements in mechanical strength of bone than sedentary counterparts.[40,58,61,92,121,123,159]

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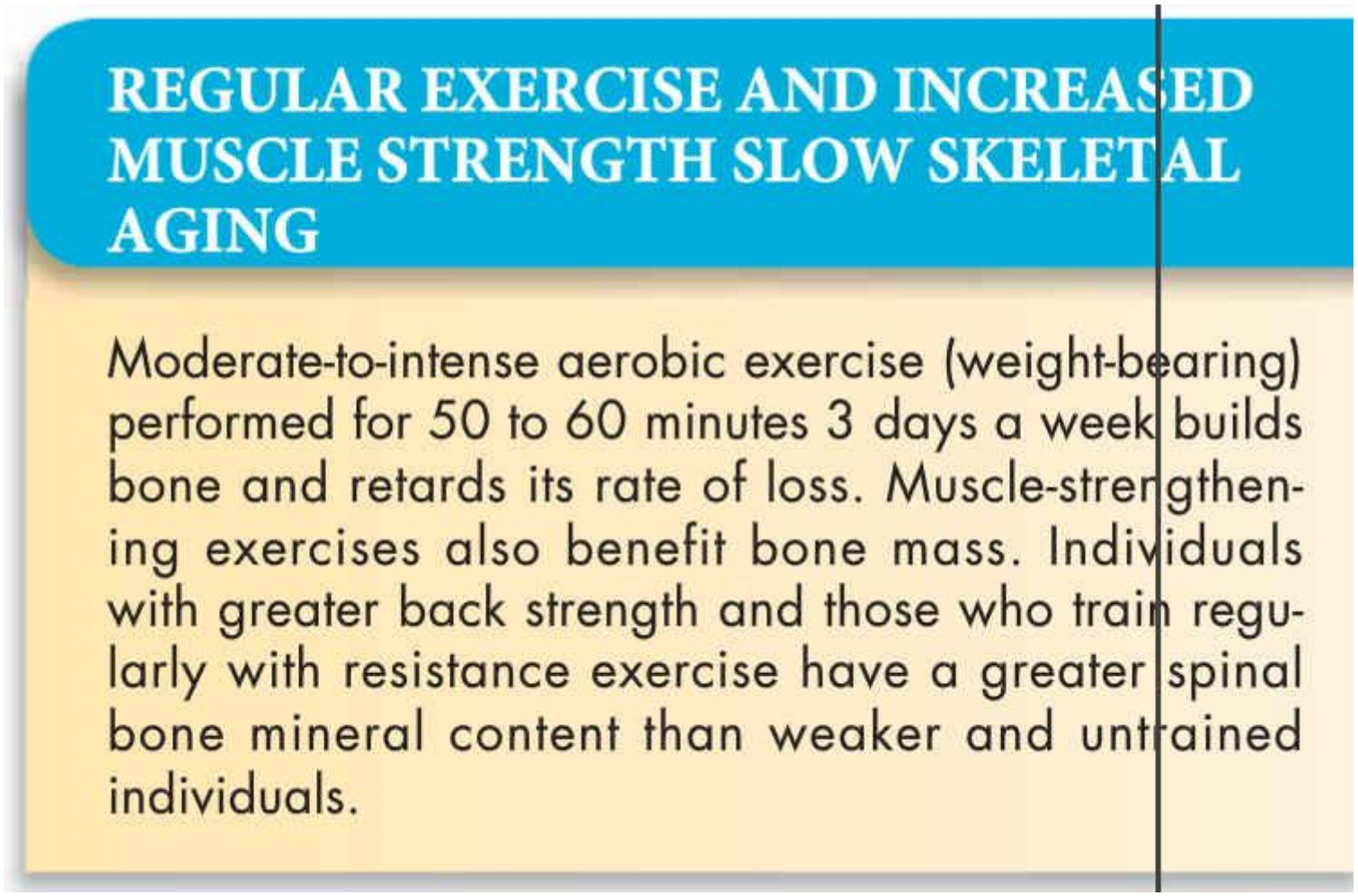

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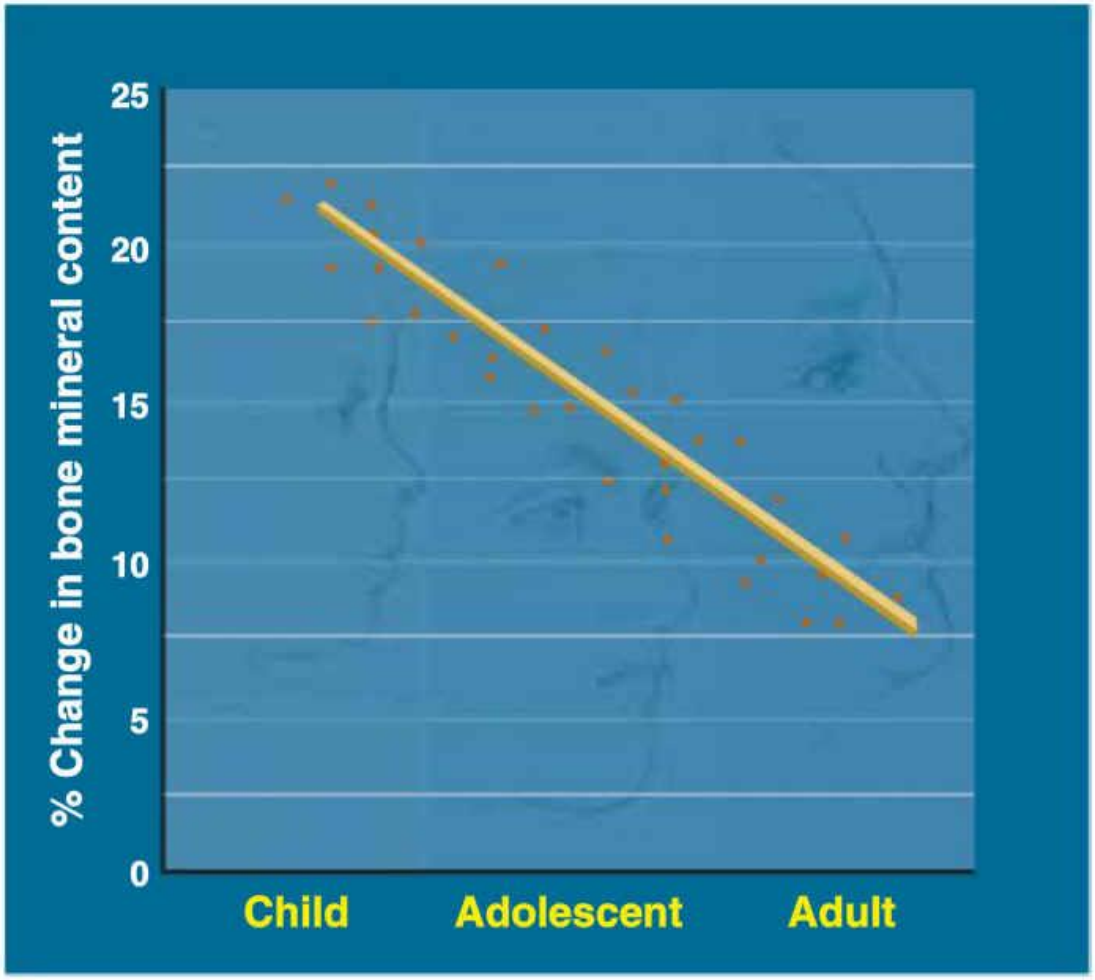

FIGURE 2.8. Generalized curve for the association between age and the effects of regular bouts of intermittent, dynamic exercise on bone mass accretion.

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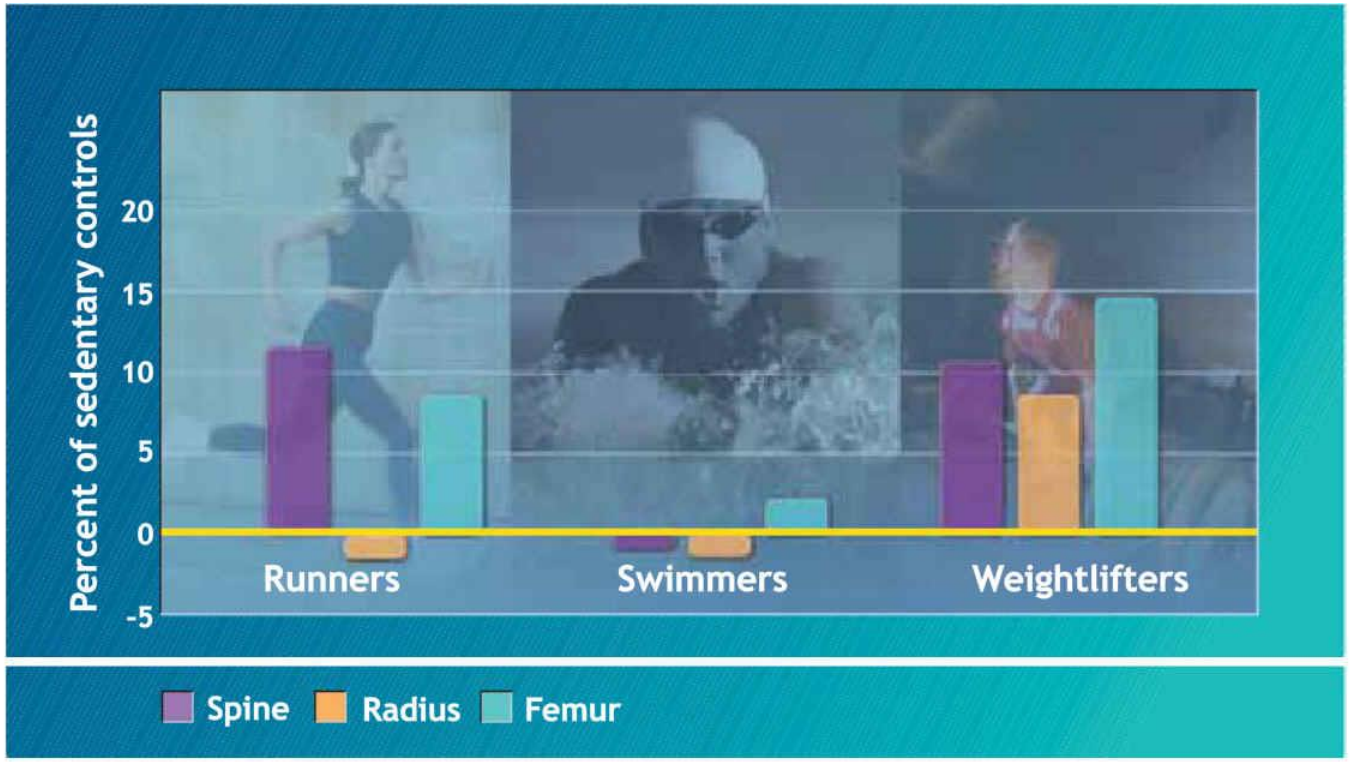

FIGURE 2.9. Bone mineral density expressed as a percentage of sedentary control values at three skeletal sites for weightlifters, swimmers, and runners. (From Drinkwater BL. Physical activity, fitness, and osteoporosis. In: Bouchard C, et al., eds. *Physical Activity, Fitness, and Health*. Champaign, IL: Human Kinetics, 1994.)

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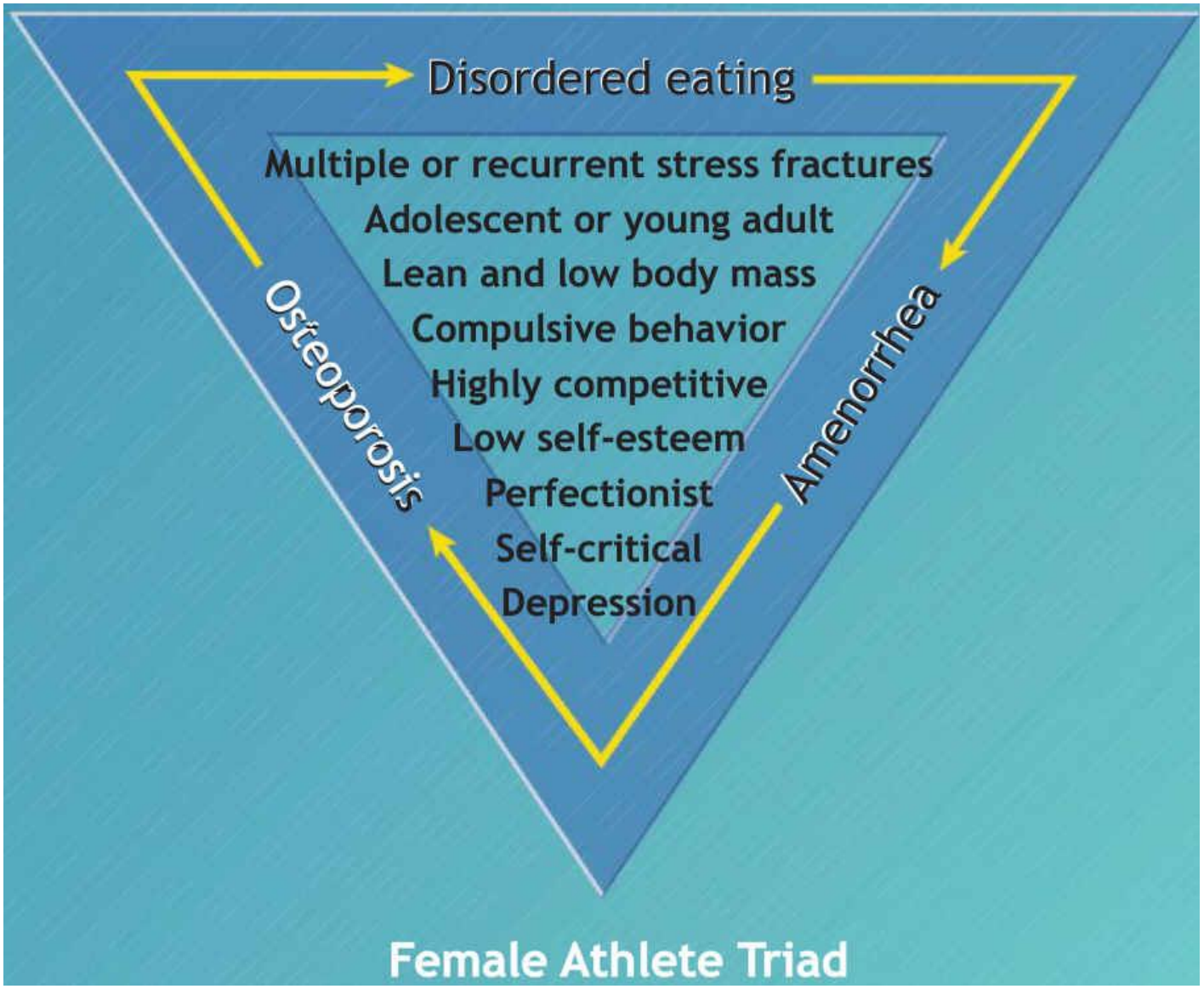

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SIX PRINCIPLES FOR PROMOTING BONE HEALTH THROUGH EXERCISE

1. **Specificity:** Exercise provides a local osteogenic effect.
2. **Overload:** Progressively increasing exercise intensity promotes continued improvement.
3. **Initial values:** Individuals with the smallest total bone mass have the greatest potential for improvement.
4. **Diminishing returns:** As one approaches the biologic ceiling for bone density, further gains require greater effort.
5. **More not necessarily better:** Bone cells become desensitized in response to prolonged mechanical-loading sessions.
6. **Reversibility:** Discontinuing exercise overload reverses the positive osteogenic effects of exercise.

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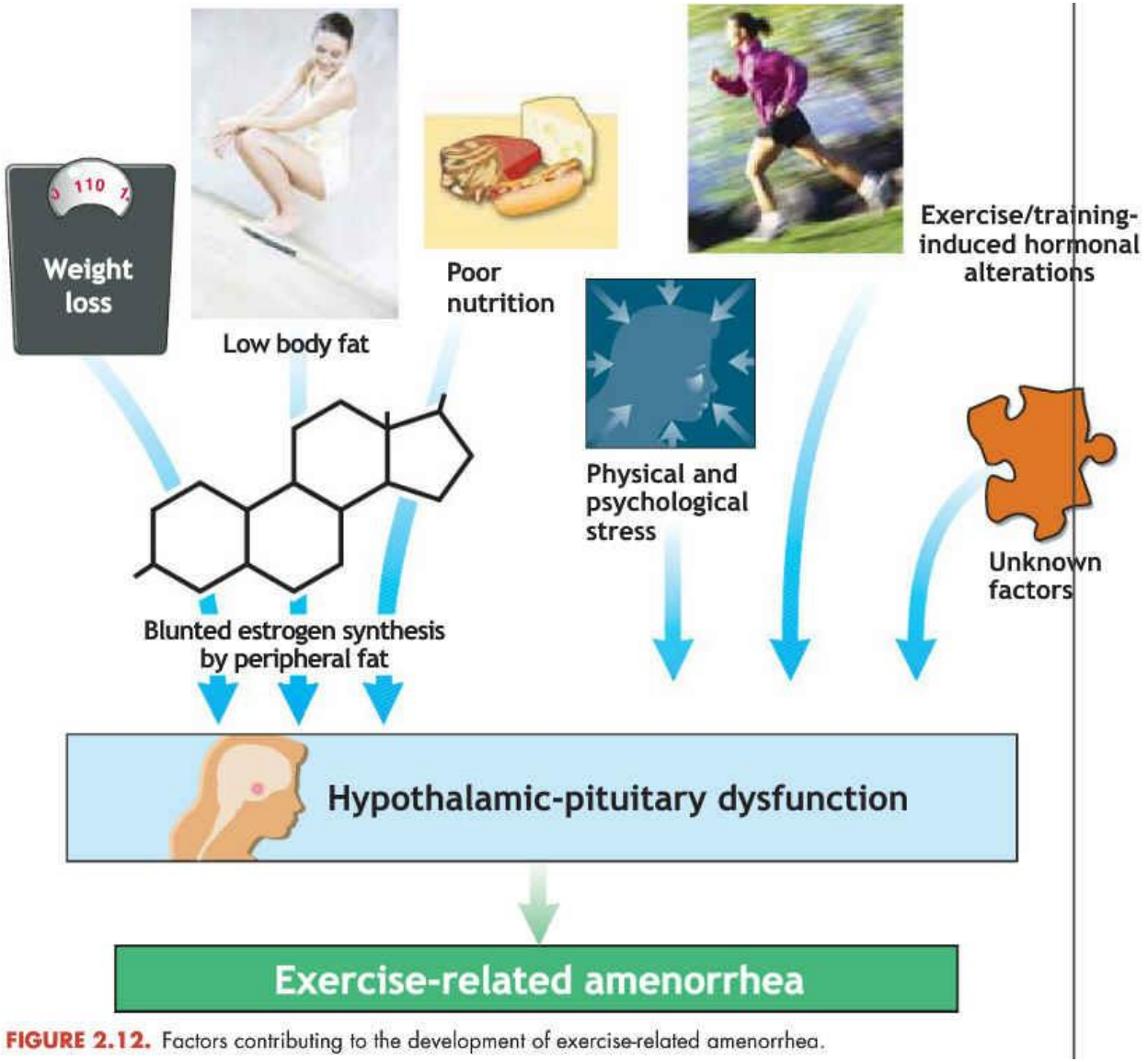

FIGURE 2.12. Factors contributing to the development of exercise-related amenorrhea.

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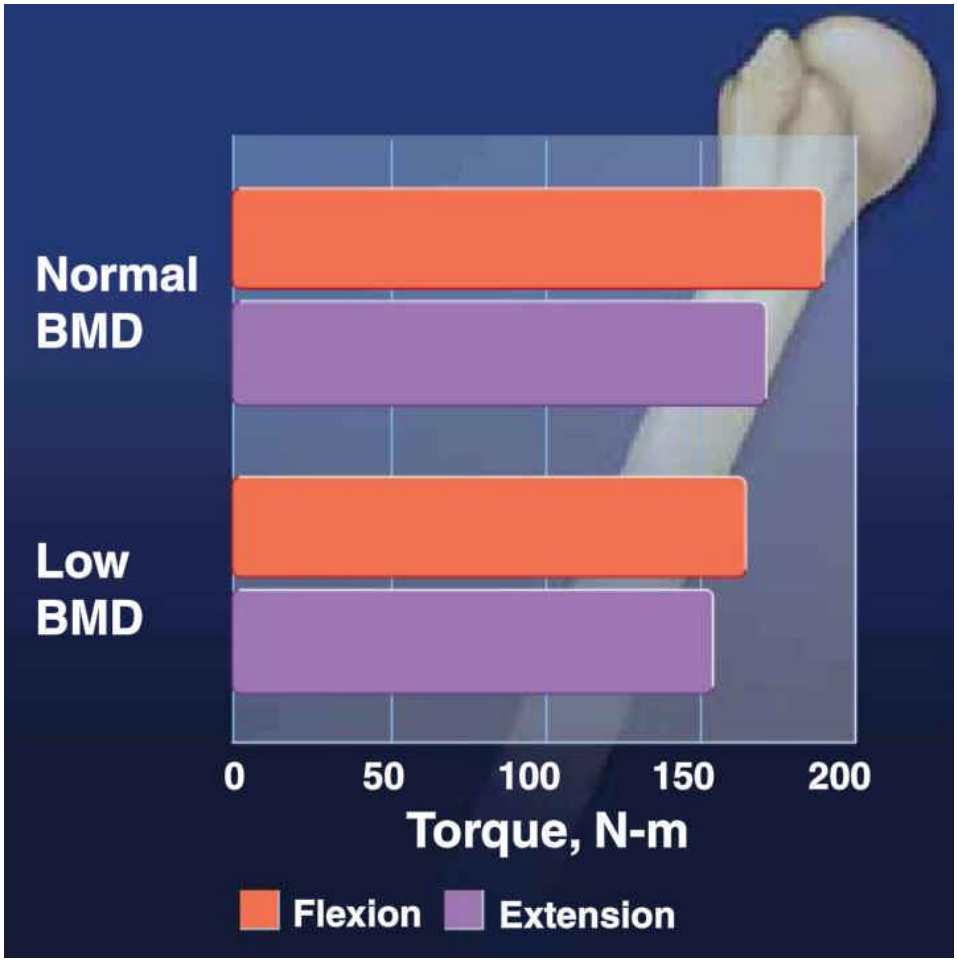

FIGURE 2.13. Comparison of chest press extension and flexion strength in age- and weight-matched postmenopausal women with normal and low bone mineral density (BMD). Women with low BMD scored significantly lower on each measure of muscular strength than the reference group. (From Stock JL, et al. Dynamic muscle strength is decreased in postmenopausal women with low bone density. *J Bone Miner Res* 1987;2:338; Janey C, et al. Maximum muscular strength differs in postmenopausal women with and without osteoporosis. *Med Sci Sports Exerc* 1987;19:S61.)

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TABLE 2.9 Recommended Dietary Allowances for Iron

	Age (years)	Iron (mg)
Children	1–10	10
Males	11–18	12
	191	10
Females	11–50	15
	51+	10
	Pregnant	30[a]
	Lactating	15[a]

[a]*Generally, this increased requirement cannot be met by ordinary diets; therefore, the use of 30 to 60 mg of supplemental iron is recommended.*

Food and Nutrition Board, National Academy of Sciences-National Research Council, Washington, DC. Recommended dietary allowances, revised 2001.

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FACTORS THAT INCREASE AND DECREASE IRON ABSORPTION

Increase Iron Absorption

1. Stomach acid
2. Dietary iron in heme form
3. High body demand for red blood cells (blood loss, high altitude exposure, exercise training, pregnancy)
4. Presence of meat protein factor (MPF), a substance in meat, poultry, and fish that aids in nonheme iron absorption
5. Vitamin C in small intestine

Decrease Iron Absorption

1. Phytic acid (in dietary fiber)
2. Oaxlic acid
3. Polyphenols (in tea or coffee)
4. Excess of other minerals (Zn, Mg, Ca), particularly taken as supplements
5. Reduced stomach acid
6. Antacid use

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MINERALES

SUPLEMENTACIÓN: Hierro

Indicaciones

- **Deportistas que se abstienen de los productos de carnes (Ej: vegetarianos)**
- **Atletas que participan en deportes que deben controlar el peso (consumen muy pocas calorías)**
- **Atletas femeninas que participan en eventos de tolerancia aeróbica (Ej: maratonistas, triatletas)**

MINERALES

SUPLEMENTACIÓN: Hierro

INDICACIONES:
Mujeres Adultas

- **Los requisitos de hierro aumentan por:**
  - ***Embarazo***
  - ***Lactación***
  - ***Entrenamiento con resistencias***

MINERALES

SUPLEMENTACIÓN: Hierro - *Dosis*

Suplemento Multi-Vitamínico/Mineral

- **Dosis: 10 - 15 miligramos:**
  - ***Esta dosis se encuentra en:***
    - **Suplemento vitamínico/mineral común**
    - **Algunos cereales fortificados**

MINERALES

SUPLEMENTACIÓN: Hierro - *Precausión*

Recomendaciones

- **Asegurar una absorción efectiva del hierro:**
  - ***Consumo moderado de carnes rojas (hierro hemático), particularmente si se consumen suplementos de calcio***
  - ***Evitar el café y el té***

ANEMIA INDUCIDA POR EL EJERCICIO

Intense physical training theoretically creates an augmented iron demand from three sources:

1. Small loss of iron in sweat[207]
2. Loss of hemoglobin in urine from red blood cell destruction with increased temperature, spleen activity, and circulation rates and from jarring of the kidneys and mechanical trauma from feet pounding on the running surface (called *foot-strike hemolysis*)[96]
3. Gastrointestinal bleeding with distance running unrelated to age, gender, or performance time[26,156]

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ANEMIA INDUCIDA POR EL EJERCICIO

Real Anemia or Pseudoanemia?

Apparent suboptimal hemoglobin concentrations and hematocrits occur more frequently among endurance athletes, thus supporting the possibility of an exercise-induced anemia. However, reductions in hemoglobin concentration remain transient, occurring in the early phase of training and then returning toward pretraining values. FIGURE 2.15 illustrates the general response for hematologic variables for high school female cross-country runners during a competitive season. The decrease in hemoglobin concentration generally parallels the disproportionately large expansion in plasma volume with both endurance and resistance training (see Fig. 13.5).[42,67,171] Several days of exercise training increase plasma volume by 20%, while total red blood cell volume remains unchanged. Consequently, *total* hemoglobin (an important factor in endurance performance) remains the same or increases slightly with training, while hemoglobin *concentration* decreases in the expanding plasma volume. Despite this hemoglobin dilution, aerobic capacity and exercise performance improve with training.

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Functional Anemia

A relatively high prevalence of nonanemic iron depletion exists among athletes in diverse sports as well as in recreationally active women and men.[48,71,175] Low values for hemoglobin within the "normal" range often reflect **functional anemia** or **marginal iron deficiency.** Depleted iron stores and reduced iron-dependent protein production (e.g., oxidative enzymes) with a relatively normal hemoglobin concentration characterize this condition. Ergogenic effects of iron supplementation on aerobic exercise performance and training responsiveness occur for these iron-deficient athletes.[23,24,61,63] Physically ac-

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Importance of Iron Source

The small intestine absorbs about 10 to 15% of the total ingested iron, depending on iron status, the form of iron ingested, and the meal's composition. For example, the small intestine usually absorbs 2 to 5% of iron from plants (trivalent ferric or **nonheme** elemental iron), whereas iron absorption from animal (divalent ferrous or **heme**) sources increases to 10 to 35%. The presence of heme iron, which represents

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MINERALES

- Macrominerals exist in your body in quantities of approximately 35 to 1,050 grams, whereas microminerals are found in your body only in quantities of less than a few grams.
- The majority of iron within the body is found in hemoglobin and myoglobin molecules, which transport oxygen within the blood and muscle fibers, respectively.
- Individuals with iron-deficient anemia do benefit from iron supplementation, but supplementation in nonanemic individuals does not increase physical performance.
- Calcium deficiency can contribute to osteoporosis. Thus, recommendations to combat osteoporosis include sufficient calcium ingestion as well as exercise throughout the lifespan to minimize the loss of skeletal mass with aging.

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MINERALES

SUMMARY

1. Approximately 4% of the body mass consists of 22 elements called minerals. Minerals become distributed in all body tissues and fluids.
2. Minerals occur freely in nature, in the waters of rivers, lakes, and oceans and in soil. The root system of plants absorbs minerals; they eventually become incorporated into the tissues of animals that consume plants.
3. Minerals function primarily in metabolism as constituents of enzymes. Minerals provide structure in the formation of bones and teeth and synthesize the biologic macronutrients glycogen, fat, and protein.
4. A balanced diet generally provides adequate mineral intake, except in some geographic locations lacking specific minerals (e.g., iodine).
5. Osteoporosis has reached almost epidemic proportions among older individuals, particularly women. Adequate calcium intake and regular weight-bearing exercise and/or resistance training provide an effective defense against bone loss at any age.

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MINERALES

SUMMARY *(continued)*

6. Paradoxically, women who train intensely but cannot match energy intake to energy output reduce body weight and body fat to the point that may adversely affect menstruation. These women often show advanced bone loss at an early age. Restoration of normal menstruation does not totally restore bone mass.
7. The association between muscular strength and bone density raises the likelihood of using strength testing of postmenopausal women as a clinically useful tool to screen for osteoporosis.
8. About 40% of American women of child-bearing age suffer from dietary iron insufficiency that could lead to iron deficiency anemia. This condition negatively affects aerobic exercise performance and the ability to perform intense training.
9. For women on vegetarian-type diets, the relatively low bioavailability of nonheme iron increases the risk for developing iron insufficiency. Vitamin C (in food or supplement form) and moderate physical activity increase intestinal absorption of nonheme iron.
10. Regular physical activity generally does not create a significant drain on the body's iron reserves. If it does, women with the greatest iron requirement and lowest iron intake could increase their risk for anemia. Assessment of the body's iron status should evaluate hematologic characteristics and iron reserves.
11. The DASH eating plan lowers blood pressure in some individuals to the same extent as pharmacologic therapy and often more than other lifestyle changes.

¿PREGUNTAS?