Chapter 10 Energy Balance, Weight Control, and Eating Disorders

Overview

Chapter 10 begins with a discussion of energy balance and the components of energy expenditure - basal metabolic rate, physical activity, thermic effect of food, and thermogenesis. Various methods for measuring energy expenditure, including direct and indirect calorimetry, are presented. Next, students will learn about the differences between hunger and appetite as well as the many factors that influence hunger, appetite, and satiety. Methods for estimating body composition are reviewed, including BMI, underwater weighing, air displacement, DEXA, and skinfold thickness. Genetic and environment factors that affect body weight and composition are described. Sensible weight-loss treatments are compared to fad diets. Medical interventions for weight control, such as very-low-calorie diets, weight-loss medications, and gastroplasty are reviewed. The chapter concludes with a discussion of the diagnosis, characteristics, treatment, and prevention of eating disorders, including anorexia nervosa, bulimia nervosa, and binge-eating disorder.

Learning Outcomes

1. Describe energy balance and its relationship to energy intake and expenditure.
2. Evaluate the different techniques used to measure energy expenditure by the body.
3. Explain internal and external regulation of hunger, appetite, and satiety.
4. Describe the methods used for assessing body composition and determining whether body weight and composition are healthy.
5. Explain the impact of genetics and environment on body weight and composition.
6. Outline the key components of programs designed to treat overweight, obesity, and underweight.
7. Discuss the characteristics of fad diets.
8. Evaluate weight loss programs to determine whether they are safe and likely to result in long-term weight loss.
9. Identify common characteristics and health risks of different eating disorders.

Teaching Strategies, Activities, Demonstrations, and Assignments

1. Assign students the **Take Action** activity, “How to Spot a Fad Diet.”
2. Assign students the **Take Action** activity, "Changing for the Better." They should complete the calculations and the interpretation and application sections. They should turn this assignment in to be graded.
2. Have students read a popular diet book or current magazine article describing a weight-loss plan. They can use Table 10-7 as a guide for making their choice. Have them read the book and do the following:
   A. Write a report evaluating the book/article, using the principles of a sound weight-loss program and characteristics of fad diets listed in the chapter as guides. Have them address weaknesses and strengths of the diet approach, faddist tendencies, and violations of sound weight-loss principles.
   B. Evaluate the diet described by the book, using the Dietary Guidelines for Americans 2015-2020 for comparison.
   C. These reports could be used as a basis for making oral reports on various diets.
3. Have students revise their own dietary record that they kept to do their nutritional assessment earlier in the semester to make it nutritionally adequate and to provide 1,200 kcal/d/women and 1,500 kcal/d/men. Some will need to add and others eliminate or decrease foods to reach these kilocalories. Have them use the Dietary Guidelines for Americans 2015-2020 to determine nutritional adequacy of the diet they have created.
4. Have students select three food products for which claims are made like "low calories," "light," "reduced calories," or "dietetic," and compare that product to a similar one for which no claim is made for energy and nutrient content. For example, comparing reduced-calorie mayonnaise to regular.
5. Have students bring an advertisement for a weight-reduction aid to class. Select from these and have the class evaluate, in writing or as a class discussion, the rationale, effectiveness, cost, and potential hazards.

6. Have students get menus from area restaurants and fast-food establishments. Put these menus on an overhead transparency. Use the overheads for class discussion. Ask students to choose foods and meals from these menus that would be appropriate for weight control.

7. Use a class period to allow students to go to a campus facility to have their body fat assessed using skinfold thicknesses. If there are no campus resources, ask someone from a local fitness center to do it, or do it yourself with the help of another faculty member of the opposite gender (so the female and male could assess same-gender students). Most exercise physiology books have formulas and instructions for doing skinfold measurements.

8. Ask a resource from the community to lecture in your class about various weight control issues:
   A. Ask a physician to discuss treatment for morbid obesity.
   B. Ask leaders from TOPS or Weight Watchers to discuss their approaches and programs.
   C. Have someone who has had gastric bypass speak to the class about their experience.

9. Divide students into groups. Have each group compile three lists. The first list should contain healthful eating tips; for example, trim fat from meat before cooking. The second list should contain helpful dieting tips, for example, cut vegetables, dried fruit, and pretzels are good snack choices when traveling in a car. The third list should contain dieting traps and ways to prevent being "trapped." An example would be the restaurant ordering trap. The prevention tip would be to think of what would be healthful food choices before entering the restaurant. And, once in the restaurant, be the first to order if you are with others so their choices will not influence yours. Use the lists as a springboard for discussing behavior modification. Collect the lists, consolidate information, have someone type resulting lists, and either photocopy for students or make a copy available for interested students to photocopy.

10. Ask students to wear pedometers for five days to track the number of miles they walk. Have them calculate the number of calories burned based on the distance walked. (Students can use their diet analysis software if you prefer.)

11. Ask a professional from your community who treats eating disorders to give a guest presentation in the class. It might be preferable to have someone from the campus counseling center do this presentation so students can become familiar with a campus resource for treating eating disorders.

12. Ask an individual who is recovering from an eating disorder to give a presentation in class about his or her history and condition, and give opportunities for students to ask questions. Ask the guest speaker to discuss how he/she developed the disorder, triggers or cues to binging, his/her life characteristics, and what prompted him/her to get treatment.

13. Have students investigate resources in the university or the community for individual and/or group services to help students with eating disorders.

14. Prepare a "case study" description of anorexia nervosa or bulimia (or use one of the available films) and have students analyze the "case" to identify:
    A. Initiation or triggering factors
    B. Signs and symptoms
    C. Presence of "typical" characteristics
    D. Warning signs
    E. Prognosis with treatment

15. Have students bring to class examples from the media related to body image. Discuss what the media is telling us about our bodies/images. What influence do these messages have on an individual who is at risk to develop an eating disorder?

16. Prepare a case study of a person with health conditions that have been previously discussed in earlier chapters and with a weight imbalance. Provide students with the information typically found in a nutrition assessment (ABCDEH) for this person. Have them assess weight status and any medical conditions or concerns. Then have them modify their lifestyle choices (meal plan, activity, sleep, stress) giving specific examples using behavior modification.

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Lecture Outline

10.1 Energy Balance

A. General

1. Energy balance: relationship between energy intake and energy expenditure
2. Energy equilibrium: calories consumed = energy expended
3. Positive energy balance: calories consumed > energy expended, leads to growth, weight gain, recovery from illness or injury
   a. Desired during pregnancy, infancy, childhood, and adolescence
   b. Weight gain is not a natural part of aging; it stems from a pattern of excess food intake coupled with limited physical activity and slower metabolism
4. Negative energy balance: calories consumed < energy expended, leads to weight loss
   a. Loss of muscle and adipose tissue
   b. Desired when body fatness exceeds health levels
   c. Not desirable during growth stages of the life cycle

B. Energy Intake

1. Bomb calorimeter: directly measures calories in food by measuring heat produced when burning a food item
2. Calorie content is more commonly calculated by multiplying grams of carbohydrate, fat, protein, and alcohol by physiological fuel values

C. Energy Expenditure

1. Basal Metabolism
   a. Basal metabolic rate (BMR): minimum amount of energy expended in a fasting state (12 hours or more) to keep a resting, awake body alive in a warm, quiet environment
      i. Women: approximately 0.9 kcal/kg/hr
      ii. Men: approximately 1.0 kcal/kg/hr
   b. 60 - 70% of total energy expenditure for a sedentary person
   c. Maintains activity of lungs, heart, liver, brain, kidneys, etc.
   d. Resting metabolic rate (RMR): measured when person is not fasting or completely rested; 6% higher than BMR
   e. BMR varies 25 - 30% among individuals
   f. Factors that increase BMR
      i. Greater muscle mass (greatest influence)
      ii. Larger body surface area
      iii. Male gender
      iv. Body temperature
      v. Higher than normal secretions of thyroid hormones
      vi. Aspects of nervous system activity (e.g., stress hormones)
      vii. Growth stages of life cycle
      viii. Caffeine and tobacco use
      ix. Recent exercise
   g. Factors that decrease BMR
      i. Lower than normal secretions of thyroid hormones (hypothyroidism)
      ii. Restricted calorie intake: BMR declines 10 - 20% when calorie intake declines
      iii. Less body surface area and muscle mass
      iv. Aging after age 30 years

2. Energy for Physical Activity
   a. Increases energy expenditure 25 - 40% above BMR
   b. Lack of physical activity is a major cause for obesity
3. Thermic Effect of Food (TEF)
   a. Energy used to digest, absorb, transport, store, and metabolize nutrients in the diet
   b. 5 - 10% of total energy expenditure; varies somewhat among individuals
   c. Food composition influences TEF
      i. TEF for protein rich meals is 20 to 30%
      ii. TEF for carbohydrate rich meals is 5 to 10%
      iii. TEF for fat rich meal is 0 to 3%
      iv. Large meal > many small meals
4. Adaptive Thermogenesis
   a. Heat produced when body expends energy for non-voluntary physical activity (e.g., shivering, fidgeting, maintaining muscle tone, holding body upright)
   b. Triggered by extreme cold, overfeeding, trauma, and starvation
   c. Also known as
      i. Thermoregulation
      ii. Non-exercise activity thermogenesis (NEAT)
   d. Brown adipose tissue: specialized fat tissue that participates in thermogenesis
      i. Contains a large number of capillaries and mitochondria
      ii. Mostly found in infants (as much as 5% of body weight) and hibernating animals

10.2 Measuring Energy Expenditure

A. Direct calorimetry
1. Estimates energy expenditure by measuring amount of heat released by the body
   a. About 60% of energy the body uses leaves as heat
2. Heat release is measured by placing person in insulated chamber surrounded by layer of water
   a. Change in temperature determines amount of energy person expended

B. Indirect calorimetry
1. Based on predictable relationship between energy use and O_2 consumption and CO_2 production, as measured in expired air
2. Measured in laboratory or with a handheld device (mobile)

C. Doubly labeled water
1. Additional approach to indirect calorimetry
2. Subject consumes doubly labeled water (^2H_2O and $H_2{}^{18}O$)
3. Blood and urine samples are analyzed to examine excretion of ^2H (excreted only as water) and ^{18}O (excreted as CO_2 in expired air)
4. Compare hydrogen losses to oxygen losses to measure carbon dioxide output
5. Accurate, but expensive

D. Estimated Energy Requirements (EERs) developed by Food and Nutrition Board to estimate energy needs based on weight (kg), height (m), gender, age (years), and physical activity level (see tables)
1. Adult men: EER = 662 - (9.53 x AGE) + PA x ([15.91 x WT] + [539.6 x HT])
2. Adult women: EER = 354 - (6.91 x AGE) + PA x [(9.36 x WT[+ [726 x HT[)

10.3 Eating Behavior Regulation

A. Hunger: physiological drive to find and eat food controlled by internal body mechanisms (e.g., organs, hormones, hormone-like factors, nervous system)
B. Appetite: psychological drive to eat affected mostly by external factors (e.g., social customs, time of day, mood, tastes, sight)
C. External signals cause cephalic responses by the body: release of saliva, digestive hormones, and insulin that encourage eating and prepare the body for the meal
D. Although hunger and appetite work together, they don't always coincide; where food is ample, appetite is the main trigger for eating
E. Satiety: satisfaction after eating; cessation in drive to eat
   1. Regulated by hypothalamus, which communicates with the endocrine and nervous systems and integrates internal cues (e.g., blood glucose levels, hormone secretions, and sympathetic nervous system activity)
   2. Damage to satiety center (e.g., from cancer or surgery) may lead to obesity or weight loss
   3. If internal signals stimulate the satiety center, we stop eating; if they stimulate feeding centers, we eat more.
   4. Satiety process
      a. Sensory aspects of food
      b. Knowledge that a meal has been eaten
      c. Release of histamine in response to chewing
      d. Gastrointestinal distension
      e. Secretion of hormones (e.g., cholecystokinin, glucagon-like peptide-1, and peptide YY_{3-36}) during digestion
      f. Nutrient receptors in the small intestine
      g. Apolipoprotein on chylomicrons
      h. Metabolism of nutrients
         i. Carbohydrates increase serotonin production
         ii. Protein decreases secretion of ghrelin
      i. Nutrient use in the liver
      j. Long-term satiety is promoted by body composition and the amount of body fat.
      k. Body fat: adipose cells secrete leptin, which signal satiety, although leptin seems more important for promoting energy conservation
   5. Signals to eat
      a. Several hours after eating, concentrations of macronutrients fall, and the body starts to use energy from stores, causing feelings of satiety to diminish
      b. Endorphins and hormones (cortisol and ghrelin) stimulate appetite and increase food intake

10.4 Estimating Body Weight and Composition

A. Weight-for-Height tables
   1. Metropolitan Life Insurance Company tables (latest in 1983) considered gender and frame size
   2. Better for estimating health and longevity of populations than for determining individual health status
   3. Recent shift of focus from weight to total body fat, location of body fat, and weight-related medical problems

B. Body Mass Index
   1. Current weight-for-height standard that applies to men and women
   2. Most closely related to body fat content
   3. Kg/m^2 or $(lb \times 703)/in^2$
   4. BMI categories
      a. Underweight: <18.5
      b. Healthy: 18.5 to < 25

c. Overweight: 25 to < 30
   i. Health risks may be seen
   ii. Not necessarily a marker of overfat
d. Obese: ≥30

5. BMI categories may not apply to all populations
   a. Children
   b. Teens
   c. Older adults
   d. Pregnant and lactating women

C. Measuring Body Fat Content

1. Desirable body fat content
   a. Men: 8 - 24%
   b. Women: 21 - 35%; women require more fat for normal reproductive function
2. Proper measurement of body fat requires body weight and body volume
   a. Underwater weighing: determines body volume by comparing measurements of body weight underwater and in air, then calculates body density and % body fat
   b. Air displacement (BodPod): determines body volume by measuring the space the body takes up in a small chamber, then calculates body density and % body fat
   c. Body density = body weight / body volume
   d. % body fat = (495 / body density) - 450
3. Skinfold thickness: use calipers to measure subcutaneous fat at multiple sites; determine percent body fat using a mathematical formula
4. Bioelectrical impedance: estimates percent body fat by measuring flow of a small electrical current through the body
   a. Based on the principle that body fat resists the flow of electricity because it is low in water and electrolytes
   b. The degree of resistance to electrical flow is used to estimate body fatness
   c. Greater electrical resistance equals more adipose tissue
5. Dual energy X-ray absorptiometry: estimates body fat, fat-free soft tissue, and bone minerals using low-dose X rays
   a. Most accurate method
   b. Measures body fat by releasing small doses of radiation through the body to assess body fat and bone density
   c. Expensive, not widely available

D. Assessing Body Fat Distribution

1. Upper-body (android) obesity
   a. Related to cardiovascular disease, hypertension, and type 2 diabetes
   b. Seen in:
      i. Males (high blood testosterone)
      ii. Diets with high glycemic load
      iii. High levels of alcohol intake
      iv. Smokers
   c. Classification based on waist circumference measurements
      i. Women: > 35” (88 cm)
      ii. Men: > 40” (102 cm)
2. Lower-body (gynoid) obesity
   a. Encouraged by estrogen and progesterone
   b. After menopause, upper-body fat distribution becomes more common among women

10.5 Factors Affecting Body Weight and Composition

A. Role of Genetics
1. Identical twin studies show similar weight-gain patterns for twins, even when reared apart
2. Children with no obese parents have 10% chance of becoming obese
3. If child has 1 obese parent, risk increases to 40%
4. If both parents are obese, risk soars to 80%
5. Genes account for up to 40 - 70% of weight differences between people
   a. Body type
   b. Metabolic rate
   c. Hunger and satiety
   d. Height
6. Thrifty metabolism: frugal energy expenditure; tendency to store fat more readily
7. Set-point theory: body closely regulates genetically predetermined body weight or body fat content that is closely regulated
   a. May be job of hypothalamus monitoring amount of body fat and keeping it constant over time
   b. When energy intake is reduced, thyroid hormone secretions fall, slowing metabolism
   c. When weight is lost, body becomes more efficient at storing fat
   d. May also help prevent weight gain

B. Role of Environment
1. Body weight similarities among family members may be more from learned behaviors
   a. Couples and friends may behave similarly toward food
2. Obesity has increased at epidemic proportions, but gene pool has not changed much
3. Environmental influences on eating
   a. Time of eating
   b. Taste preferences
   c. Amount of food consumed
   d. Food availability
   e. Food marketing
   f. Social networks
   g. Culture
   h. Education
   i. Lifestyle
   j. Health concerns
   k. Income

C. Genetic and Environmental Synergy
1. Both nature and nurture interact to determine body weight and composition
2. Person with genetic predisposition for leanness can gain fat with continuous overeating and sedentary lifestyle
3. Person with genetic predisposition for obesity can avoid excess fat storage with adequate physical activity and healthy eating

D. Diseases and Disorders
1. Diseases that limit fat stores
   a. Cancer
   b. AIDS
   c. Hyperthyroidism
   d. Marfan syndrome

e. Anorexia nervosa

2. Diseases that promote obesity
   a. Brain tumors
   b. Ovarian cysts
   c. Hypothyroidism
   d. Congenital syndromes (e.g., Prader-Willi syndrome)

10.6 Treatment of Overweight and Obesity

A. General

1. Requires long-term lifestyle changes including active lifestyles and dietary modifications
2. Weight cycling occurs when temporary fixes are employed
3. Negative consequences of weight cycling
   a. Upper-body fat deposition
   b. Diminished self-esteem
   c. Decline in HDL
   d. Decline in immune function
4. Success of weight-loss programs is determined by weight maintenance after weight loss
   a. Only 5% of people in commercial diet programs lose weight and remain close to that weight
   b. 1/3 of lost weight is typically regained within 3-5 years
5. Currently, only surgical weight-loss treatments show success in maintaining weight loss in most people
6. A sound weight loss program should include control of energy intake, regular physical activity, and control of problem behaviors

B. Control of Energy Intake

1. Adipose tissue = 3500 kcal/lb; calorie deficit of 500 kcal/d results in ~1 lb weight loss/week
   a. 1200 kcal/d for women, more if active
   b. 1500 kcal/d for men, more if active
2. Low-fat approach
3. Low-carbohydrate or low-GL approaches
4. High (plant) protein approach
5. Low-energy-density (low-fat, high-fiber, high water content) approaches are most successful in long-term studies
   a. Limits energy intake
   b. Promotes satiety
6. Healthy eating should become a habit, not a temporary solution
7. Decrease portion sizes; measure portions
8. Use Nutrition Facts panel to choose foods with low energy density
9. Choose mostly calorie-free beverages
10. Self-monitoring of food intake followed by nutrient analysis

C. Regular Physical Activity

1. Expending 100 to 300 extra kcal/day above normal activity can lead to a steady weight loss
2. Boosts self-esteem
3. Increases bone mass
4. See Table 10-5 for approximate energy costs of various activities
5. Duration and regular performance are more important than intensity
6. Enjoyment of activity
7. Some resistance exercise should be included to increase lean body mass

8. Technological advances promote sedentary lifestyle
9. Make activity part of daily routine
10. Pedometer can be a good motivator

D. Control of Problem Behaviors
1. Chain-breaking: break the link between activities that occur together
2. Stimulus control: alter environment to minimize stimuli for eating or maximize stimuli for healthy eating or exercise
3. Cognitive restructuring: change frame of mind regarding eating
4. Contingency management: be prepared for/aware of situations that trigger overeating or hinder physical activity
5. Self-monitoring: track foods, physical activity, and body weight to understand habits and reveal patterns
6. Examples of behavior modification techniques
   a. Shopping
      i. Shop after eating; buy nutrient-dense foods
      ii. Shop from a list; limit purchases of problem foods
      iii. Avoid ready-to-eat foods
   b. Plans
      i. Plan to limit food intake
      ii. Plan meals, snacks, and physical activity
      iii. Eat meals and snacks at scheduled times; don't skip meals
      iv. Exercise with a partner
      v. Participate in fitness class
   c. Activities
      i. Store food out of sight to discourage impulsive eating
      ii. Eat only in dining area
      iii. Keep serving dishes off the table
      iv. Use smaller serving dishes, glasses, and utensils
      v. Keep exercise equipment handy and visible
   d. Holidays and parties
      i. Drink fewer alcoholic beverages
      ii. Plan eating behavior before parties
      iii. Eat low-calorie snack before parties
      iv. Practice polite ways to decline food
      v. Engage in physical activity (e.g., dancing, swimming) at parties
   e. Eating behavior
      i. Put down fork between bites; chew thoroughly
      ii. Leave some food on plate
      iii. Concentrate on eating rather than multitasking
      iv. Avoid deprivation
      v. Limit eating out to once or twice per week
   f. Portion control
      i. Substitute smaller portions or lower-energy-density choices
      ii. Share entrée; order smaller portion
      iii. Use to-go container
      iv. Measure; learn to estimate portion sizes
      v. Learn to recognize feelings of fullness
   g. Reward and social support
      i. Plan specific nonfood rewards for specific behavior

ii. Solicit help from family/friends
iii. Use self-monitoring records as basis for rewards

h. Self-monitoring
i. Keep diet diary (note the time and place of eating, the type and amount of food eaten, who is present, and how you feel) and use it to identify problem areas.
ii. Keep physical activity diary(note which exercise is done, when, and how long) and use it to identify when more physical activity can be included.
iii. Check body weight regularly

i. Cognitive restructuring
i. Avoid setting unreasonable goals
ii. Think about progress, not shortcomings
iii. Avoid imperatives (e.g., always, never)
iv. Counter negative thoughts with positive restatements
v. Don't be discouraged by occasional setbacks; plan to overcome setbacks
vi. Eating a particular food doesn't make a person "bad" and shouldn't lead to feelings of guilt. Change responses such as "I ate a cookie, so I'm a failure" to "I ate a cookie and enjoyed it. Next time, I'll have a piece of fruit."
vii. Seek professional help before weight, dietary intake, or sedentary behavior gets out of control.

E. Weight Loss Maintenance
1. Low-fat (25% of total kcal), high-carbohydrate (56% of total kcal; mainly fruits, vegetables, and whole grains) diet
2. Eating breakfast (whole-grain cereal, fat-free milk, fruit) helps the body burn more fat throughout the day and less tendency to overeat due to hunger
3. Self-monitor by regularly weighing yourself and keeping a food journal
4. Regular exercise program

F. Expert Perspective from the Field: Tailoring a Healthy Eating Plan to Fit your Lifestyle
1. Find a weight loss diet that suits your lifestyle to control weight and eat a healthy diet
2. Consider eating pattern and lifestyle to choose a program and achieve changes that are important to you

10.7 Fad Diets

A. Red flags
1. Recommendations that promise a quick fix
2. Dire warnings of danger from a single product or regimen
3. Claims that sound to good to be true
4. Simplistic conclusions drawn from a complex study
5. Recommendations based on a single study
6. Dramatic statements refuted by reputable scientific organizations
7. Lists of "good" and "bad" foods
8. Recommendations made to help sell a product; often use testimonials
9. Recommendations based on studies published without peer preview
10. Recommendations from studies that ignore differences among individuals or groups

B. Guarantee failure; not designed for maintenance because habits are not changed
C. See Table 10-7 for a summary of popular diet approaches to weight control
1. Moderate energy restriction
2. Restricted carbohydrate

a. Lead to reduced glycogen synthesis, which limits water stores
b. Very low carbohydrate intake forces liver to produce glucose via gluconeogenesis (mostly from body proteins)
c. Amount lost and improvements to health are no greater than moderate fat, higher carbohydrate, high protein diets, as only short-term results are seen
d. May increase L D L levels

3. Low fat
a. Very-low-fat diets may restrict fat intake to 5 - 10% of total kcal
b. Not harmful for healthy adults, but difficult to follow
c. Contain mainly grains, fruits, and vegetables

4. Novelty diets
a. Built on gimmicks
b. Emphasize one food or food group; exclude others
c. Actually limit food intake due to monotony
d. Difficult to maintain
e. Not based on scientific evidence
f. Quack fad diets
i. Promote costly products or services
g. Legitimate health discoveries will be reported by reputable journals and authorities

D. Clinical Perspective: Professional Help for Weight Control

1. Qualified professionals
a. Family physician
b. Registered dietitian
c. Exercise physiologists

2. Drug Treatment for Weight Loss
a. Only successful in combination with reduced energy intake and increased physical activity
b. Candidates have BMI > 30 or BMI > 27 with comorbid conditions and no contraindications
c. Examples
i. Medications that enhance norepinephrine and serotonin activity in the brain by reducing reuptake by nerve cells; prolongs sense of satiety
ii. Amphetamine-like medications that prolong epinephrine and norepinephrine activity in the brain; show only short-term effectiveness (e.g., phenteramine)
iii. Medications that inhibit lipase enzyme action in the small intestine, reducing fat digestion by about 30% (e.g., orlistat); requires control of fat intake and use of multivitamin and mineral supplement to compensate for nutrient losses in feces
iv. Off-label use of medications that have weight loss as a side effect (e.g., antidepressants, such as bupropion)

3. Treatment of Severe Obesity
a. Severe (morbid) obesity: at least 100 lb over (or 2X) healthy body weight
b. Very-low-calorie diets (VLCDs) or modified fasts (e.g., Optifast)
i. Provide 400 - 800 kcal/d, often in liquid form
ii. Most often used by those with poorly-controlled, obesity-related diseases
iii. Usually induce ketosis, which decreases hunger
iv. Main reasons for weight loss are calorie restriction and absence of food choices
v. Loss of 3- 4 lb/week
vi. Careful monitoring by physician is crucial to avoid heart problems and gallstones
vii. Maintenance is difficult, depends on behavioral changes and physical activity
c. Gastroplasty (see Figure 10-18)

i. Candidates are morbidly obese, have been obese > 5 years, previous attempts at non-surgical weight loss, no history of alcoholism or major psychiatric disorders
ii. Gastric bypass surgery: reduces stomach capacity to 30 ml, bypasses part of upper small intestine to promote malabsorption of nutrients
iii. Vertical-banded gastroplasty: staples stomach to create a small pouch; bands stomach outlet
iv. Gastric banding: band placed around upper portion of stomach to create small pouch; adjust band by injecting with saline solution
v. Requires major lifestyle changes
vi. Frequent, small meals
vii. Elimination of sugars to prevent dumping syndrome (severe diarrhea that occurs with consuming concentrated sources of sugar)
viii. Costly
ix. 75% of those undergoing gastroplasty lose half or more of excess body weight; long-term maintenance leads to dramatic health improvements (e.g., reduced blood pressure and elimination of type 2 diabetes)
x. Risks (bleeding, blood clots, hernias, infections, 2% death date, nutrient deficiencies)
xi. May require future surgery to remove excess skin

4. Treatment of Underweight
   a. BMI < 18.5
   b. Health risks of underweight
      i. Loss of menstrual function
      ii. Low bone mass
      iii. Complications with pregnancy and surgery
      iv. Slow recovery after illness
      v. Stunted growth and development
      vi. Increased death rates, especially combined with cigarette smoking
   c. Causes
      i. Excessive physical activity
      ii. Severe calorie restriction
      iii. Health conditions (e.g., cancer, infectious disease, digestive tract disorders, mental stress or depression)
      iv. Genetic background
   d. Weight gain requires 500 extra kcal/d
      i. Replace low-energy-density foods with high-energy-density foods
      ii. Gradually increase portion sizes
      iii. Eat regular meals
      iv. Reduce excessive physical activity
      v. Build lean mass through resistance training

10.8 Eating Disorders

A. General

1. Disordered eating: mild and short-term changes in eating patterns that occur in response to a stressful event, illness, or desire to modify the diet for health and/or appearance, may lead to changes to body weight and nutritional problems, rarely requires professional attention
2. Eating disorder: severe distortion of the eating process that can develop into a life-threatening condition if left untreated
   a. Includes obesity, anorexia nervosa, bulimia nervosa, binge-eating disorder

B. Prevalence and Susceptibility

1. Statistics
   a. 6 to 10 times more common in females than males
   b. Up to 5% of women in North America develop some form of anorexia nervosa or bulimia nervosa during their lifetimes
2. May be more susceptible because of:
   a. Genetics
   b. Psychology
      i. Frequently coincide with psychological disorders (e.g., depression, substance abuse, anxiety disorders)
   c. Physiology
3. Eating disorders may start with simple diet, but because of stress, lack of appropriate coping mechanisms, dysfunctional family relationships, or drug abuse, dieting gets out of control
4. Eating disorders require professional intervention that goes beyond nutritional therapy
5. Without treatment, serious health complications can occur including heart conditions, kidney failure, and death

C. Anorexia Nervosa
1. General
   a. Extreme weight loss
   b. Distorted body image
   c. Irrational morbid fear of obesity and weight gain
   d. ~1 in 200 adolescent girls in North America eventually develops AN
      i. May be due to tendency to blame weight gain associated with puberty on themselves
   e. Only 10% of cases occur in men, and those are usually related to participation in sports that require weight classes
   f. Typical characteristics (see Table 10-8)
      i. Rigid dieting, causing dramatic weight loss, generally to less than 85% of what would be expected for one's age (or B M I of 17.5 or less)
      ii. False body perception—thinking "I'm too fat," even when extremely underweight; relentless pursuit of control
      iii. Rituals involving food, excessive exercise, and other aspects of life
      iv. Maintenance of rigid control in lifestyle; security found in control and order
      v. Feeling of panic after a small weight gain; intense fear of gaining weight
      vi. Feelings of purity, power, and superiority through maintenance of strict discipline and self-denial
      vii. Preoccupation with food, its preparation, and observing another person eat
      viii. Helplessness in the presence of food
      ix. Typically lack of menstrual periods after what should be the age of puberty
      x. Some binge eat and purge
2. Physical Effects of Anorexia Nervosa
   a. Skin and bones appearance; 15% below expected body weight or BMI <17.5
   b. Lowered body temperature
   c. Slower metabolic rate
   d. Decreased heart rate, easy fatigue, fainting, overwhelming need for sleep, heart damage
   e. Iron deficiency anemia
   f. Rough, dry, scaly, cold skin
   g. Low WBC count
   h. Abnormal feeling of fullness or bloating after eating
   i. Loss of hair
   j. Appearance of lanugo: downy hairs that trap heat next to skin

k. Constipation
l. Low blood potassium
m. Loss of menstrual periods
n. Changes in neurotransmitter function in the brain
o. Tooth loss
p. Muscle tears and stress fractures

3. Treatment of Anorexia Nervosa
   a. General
      i. Early intervention is crucial for recovery and survival
      ii. Treatment requires a multidisciplinary team of physicians, registered dietitians, psychologists, and other health professionals
      iii. May require outpatient therapy, day hospitalization, or total hospitalization
      iv. Hospitalization is needed if weight falls below 75%
      v. Prevention is key
      vi. Average recovery time is 7 years
   b. Nutrition Therapy
      i. Goal is to minimize or stop weight loss
      ii. Must raise metabolic rate to normal
      iii. Restore food habits
      iv. May need to take in 3000 to 4000 kcal daily
      v. Slow weight gain of 2 to 3 pounds weekly
      vi. Supplement with multivitamin and calcium
      vii. Promote healthy attitude towards food
      viii. Teach eating based on hunger and satiety cues
   c. Psychological and related therapy
      i. Teach patient to accept healthy body weight
      ii. Regain control of life
      iii. Cope with tough situations
      iv. Family therapy

D. Bulimia Nervosa
1. General
   a. Episodes of binge eating followed by attempts to purge excess calories by vomiting; misusing laxatives, diuretics, or enemas; or excessive exercise
   b. Uses food to cope with critical situations
   c. Recognize that behavior is abnormal
   d. 50% have major depression
   e. Statistics
      i. 4% of adolescent and college-age women
      ii. 10% of cases occur in men
      iii. Many cases are undiagnosed
      iv. Body weight is usually at or slightly above normal
      v. 1/3 of individuals with anorexia nervosa cross over to bulimia nervosa; cross over from bulimia nervosa to anorexia nervosa is less likely
   f. Typical characteristics (see Table 10-8)
      i. Secretive binge eating; generally not overeating in front of others
      ii. Eating when depressed or under stress

iii. Bingeing on a large amount of food, followed by fasting, laxative or diuretic abuse, self-induced vomiting, or excessive exercise (at least weekly for 3 months)
iv. Shame, embarrassment, deceit, and depression; low self-esteem and guilt (especially after a binge)
v. Fluctuating weight (±10 lb or 5 kg) resulting from alternate bingeing and fasting
vi. Loss of control; fear of not being able to stop eating
vii. Perfectionism, "people pleaser"; food as the only comfort/escape in an otherwise carefully controlled and regulated life
viii. Erosion of teeth; swollen glands from vomiting
ix. Purchase of syrup of ipecac, a compound sold in pharmacies that induces vomiting

g. AN patients frequently crossover into BN behaviors, particularly if parents are overly critical, but BN is less likely to cross over into AN, except in cases of alcohol abuse

2. Binge-Purge Cycle
a. Often have elaborate food rules (e.g., avoid all sweets)
b. Can be triggered by hunger, stress, boredom, loneliness, depression
c. Often followed by strict dieting, leading to intense hunger
d. Binge is self-propelling
e. Does not taste or enjoy food
f. Special time is set aside
i. Usually at night
ii. Lasts from 30 minutes to 2 hours
g. Consumption of sweet, high carbohydrate convenience foods
i. Easily and comfortably purged
h. Food could supply 3000 kcal or more
i. When vomiting follows binge, 33 to 75% of food energy is already absorbed
ii. When laxatives or enemas used, 90% of food energy is absorbed
i. Many engage in excessive exercise to compensate for binge
j. Afterwards, feels guilty and depressed

3. Physical Effects of Bulimia Nervosa
a. Demineralization, decay, and/or loss of teeth due to repeated acid exposure from vomiting
b. Low blood potassium from vomiting or diuretics, leading to heart rhythm disturbances
c. Swollen salivary glands
d. Stomach ulcers and tears in the esophagus
e. Constipation from frequent laxative use
f. Toxic effects from ipecac syrup on heart, liver, kidneys

4. Treatment of Bulimia Nervosa
a. General
i. Experienced, multidisciplinary team of health professionals
ii. Weight loss, if present, must be treated before other therapy begins
iii. Hospitalization may be necessary
iv. First goal of treatment: decrease food intake during binge session
v. Impress patient with seriousness of BN's medical consequences

b. Nutrition Therapy
i. Develop regular eating habits
ii. Correct misconceptions about food
iii. Self-monitor:
iv. Food intake

v. Internal sensations of hunger
vi. Environmental factors that trigger binges
vii. Thoughts and feelings accompanying binge-purge cycle

c. Psychological and related therapy
i. Treatment for depression and high risk of suicide
ii. Improve self-acceptance
iii. Overcome preoccupation with body weight
iv. Correct all-or-none thinking
v. Develop appropriate coping mechanisms for stressful situations
vi. Accept some depression and self-doubt as normal
vii. Antidepressant medications in conjunction with other therapies
viii. Therapy should be long-term because relapse is likely

E. Binge-eating disorder
1. General
a. Recurrent binge-eating episodes
b. During binge, individuals:
i. Eat much more rapidly than usual
ii. Eat until feeling uncomfortably full
iii. Eat large amounts of food when not physically hungry
iv. Eat alone due to embarrassment
v. Feel distressed, depression, or guilt after overeating

2. Prevalence and Susceptibility
a. Eating large amounts of food frequently, rapidly, and until feeling uncomfortably full, even when not hungry
b. Alone because of embarrassment
c. Obesity and binge eating are not necessarily linked
d. Frequent dieting beginning in childhood or adolescence may be a precursor
e. Stress, depression, or anxiety can trigger binge
f. May come from dysfunctional families

3. Treatment of Binge Eating Disorder
a. Usually unsuccessful without professional help
b. Nutrition therapy is the same as with bulimia nervosa
c. Psychological therapy helps with identifying emotional needs and expressing emotion
d. Self-help groups aim to help with recovery
e. Antidepressants may be prescribed

F. Other Specified Feeding and Eating Disorders (OSFED)
1. Partial syndromes that do not meet all criteria for diagnosis with AN or BN
2. Vast majority of those with eating disorders fall into the OSFED category

G. Other Related Conditions
1. Muscle dysphormia (bigorexia)
a. Characterized by an excessive concern that one has underdeveloped muscles. Most people suffering from this condition tend to have well-developed muscles
b. More common in men, especially body builders
c. Spend many hours lifting weights and performing resistance exercises
d. Suffers exercise with injury and to the point that social relationships and school and work performance are impaired

e. Anabolic steroids or other muscle-enhancing drugs, nutritional supplements are sometimes used
f. Treatment from a sports medicine physician and counselor trained to work with athletes can help individuals overcome this condition

2. Orthorexia
   a. From the Greek word 'orthos', meaning straight, proper and 'orexia' (appetite)
   b. Sometimes referred to as the "health food eating disorder"
   c. Healthy eating taken to the extreme
   d. Spend many hours each day searching for 'pure' foods
3. Pregorexia
   a. Coined by popular media to describe women who decrease calorie intake and exercise excessively to control weight gain during pregnancy
   b. The best treatment will be similar to that for patients with anorexia nervosa

H. Prevention of Eating Disorders
1. Recognize that some concern over diet, health, and weight as well as variations in eating patterns, mood, and weight are normal
2. Treat physical and emotional problems early
3. Treatment of eating disorders is far more difficult than prevention; effects of eating disorders are far-reaching
4. Emphasize overall healthful diet and moderation rather than perfection
5. Caregivers should model positive habits, appropriate expectations, and healthy body image
   a. Discourage restrictive eating, meal skipping, and fasting (except for religious reasons)
   b. Encourage children to eat only when hungry
   c. Promote good nutrition and regular physical activity at home and school
   d. Promote regular family meals
   e. Provide information about changes that occur during puberty
   f. Correct misconceptions about nutrition, healthy body weight, and approaches to weight loss
   g. Carefully phrase comments and recommendations about weight
   h. Don't overemphasize weight; promote healthy eating habits
   i. Increase self-acceptance and self-appreciation
   j. Encourage weight-sensitivity among coaches
   k. Emphasize that thinness ≠ better athletic performance
   l. Enhance tolerance for diversity in body weight and shape
   m. Encourage normal expression of emotions
   n. Build respectful environments and supportive relationships
   o. Provide adolescents with appropriate, but not unlimited, independence, choice, responsibility, and self-accountability