

# CHAPTER 12

## Nutrition and Physical Activity: Keys to Good Health and In Depth

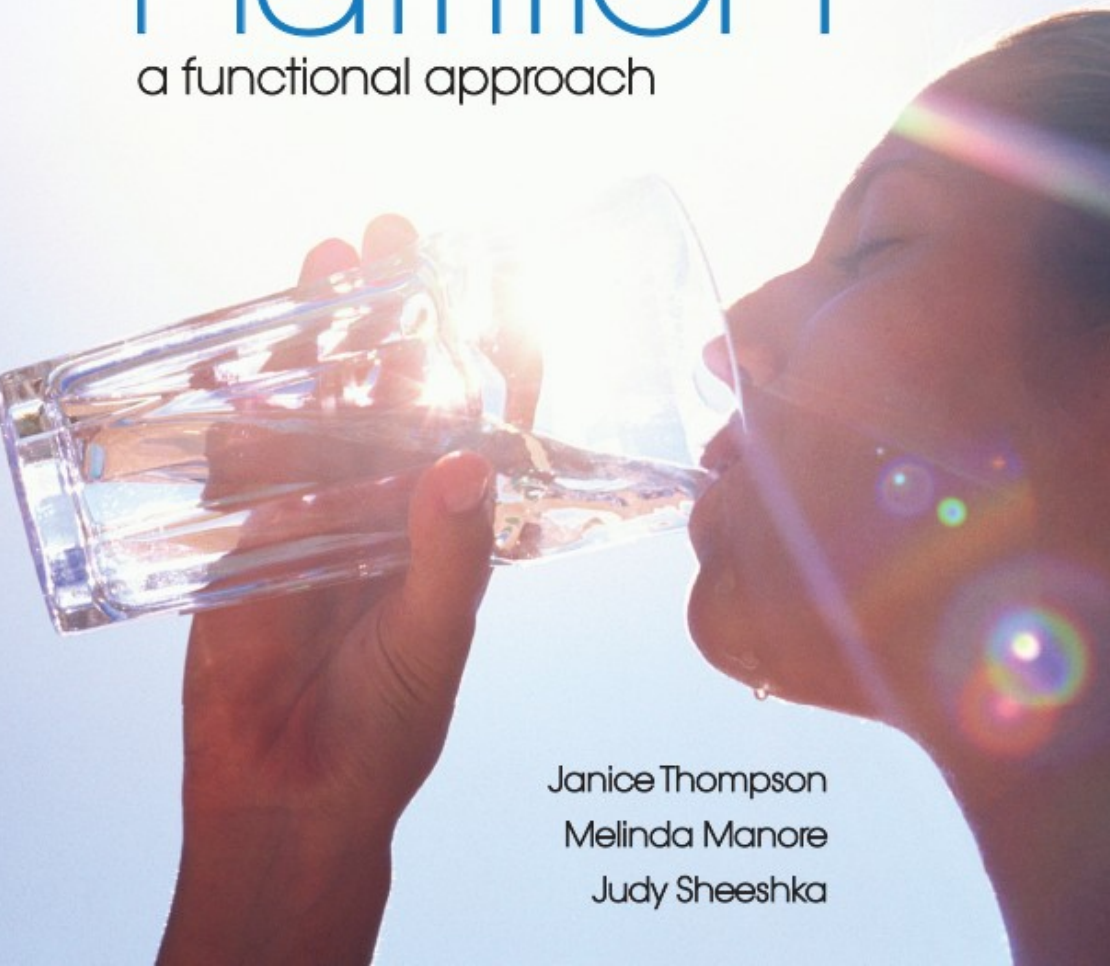
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Third Canadian Edition

# nutrition

a functional approach

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# Physical Activity Versus Fitness

**Physical activity:** any muscle movement that increases energy expenditure

**Leisure-time physical activity:** any activity unrelated to a person's occupation

- e.g., hiking, walking, biking
- includes **exercise**—purposeful, planned, and structured physical activity

# Physical Activity Versus Fitness

**Physical fitness:** state of being that is created by the interaction between nutrition and physical activity

Physical fitness includes

- Cardiorespiratory fitness
- Musculoskeletal fitness
- Flexibility
- Body composition

# Physical Activity Versus Fitness

**TABLE 12.1 The Components of Fitness**

Fitness Component	Examples of Activities One Can Do to Achieve Fitness in Each Component
Cardiorespiratory	Aerobic-type activities, such as walking, running, swimming, cross-country skiing
Musculoskeletal fitness:	Resistance training, weight lifting, calisthenics, sit-ups, push-ups
Muscular strength	Weight lifting or related activities using heavier weights with few repetitions
Muscular endurance	Weight lifting or related activities using lighter weights with more repetitions
Flexibility	Stretching exercises, yoga
Body composition	Aerobic exercise, resistance training

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Table 12.1

# Benefits of Physical Activity

## Regular physical activity

- Reduces the risk of heart disease, stroke, and high blood pressure
- Reduces the risk for obesity
- Reduces the risk for type 2 diabetes
- Reduces the risk for osteoporosis
- May reduce the risk of colon cancer

# Benefits of Physical Activity

Despite the clear benefits of regular physical activity

- only 54% of Canadians are physically active
- only 16% of schools offered physical activity classes (2001)

An active lifestyle during childhood increases the likelihood of a healthier life as an adult

# Sound Fitness Program

A sound physical fitness program

- Meets your personal goals
- Is varied, consistent, and fun
- Includes variety and consistency
- Appropriately overloads the body
- Includes a warm-up and cool-down period

# Sound Fitness Program

A sound physical fitness program meets your personal goals

An individual's fitness program will be different if he/she is

- Training for athletic competition
- Working toward cardiorespiratory fitness
- Trying to maintain overall health



# Sound Fitness Program

A sound physical fitness program includes variety and consistency, and is fun

A variety of activities prevents boredom

An individual's fitness program should focus on what he/she enjoys

- Outdoor activities
- Social recreation

# Canadian Physical Activity Guidelines

## Canadian Physical Activity Guidelines

FOR ADULTS - 18 – 64 YEARS

### Guidelines



To achieve health benefits, adults aged 18–64 years should accumulate at least 150 minutes of moderate- to vigorous-intensity aerobic physical activity per week, in bouts of 10 minutes or more.



It is also beneficial to add muscle and bone strengthening activities using major muscle groups, at least 2 days per week.



More physical activity provides greater health benefits.

### Let's Talk Intensity!

Moderate-intensity physical activities will cause adults to sweat a little and to breathe harder. Activities like:

- Brisk walking
- Bike riding

Vigorous-intensity physical activities will cause adults to sweat and be 'out of breath'. Activities like:

- Jogging
- Cross-country skiing

### Being active for at least 150 minutes per week can help reduce the risk of:

- Premature death
- Heart disease
- Stroke
- High blood pressure
- Certain types of cancer
- Type 2 diabetes
- Osteoporosis
- Overweight and obesity

And can lead to improved:

- Fitness
- Strength
- Mental health (morale and self-esteem)

### Pick a time. Pick a place. Make a plan and move more!

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Join a weekday community running or walking group. | <input checked="" type="checkbox"/> Rake the lawn, and then offer to do the same for a neighbour. |
| <input checked="" type="checkbox"/> Go for a brisk walk around the block after dinner. | <input checked="" type="checkbox"/> Train for and participate in a run or walk for charity!       |
| <input checked="" type="checkbox"/> Take a dance class after work.                     | <input checked="" type="checkbox"/> Take up a favourite sport again or try a new sport.           |
| <input checked="" type="checkbox"/> Bike or walk to work every day.                    | <input checked="" type="checkbox"/> Be active with the family on the weekend!                     |

**Now is the time. Walk, run,  
or wheel, and embrace life.**



Figure 12.2

# Sound Fitness Program

A sound physical fitness program appropriately overloads the body

**Overload principle:** put additional physical demands on the body to improve fitness

- Too much physical exertion is *not* recommended
- The **FIT principle** can be used to determine appropriate overload

# Sound Fitness Program

## The FIT principle

- **Frequency**—the frequency of physical activity varies with fitness goals
- **Intensity**—determining proper intensity may be based on maximal heart rate
- **Time of activity**—whether the total activity time is an accumulation of activities or completed all at once

# Sound Fitness Program

	Frequency	Intensity	Time
<b>Cardiorespiratory fitness</b> 	3–5 days per week	64–90% maximal heart rate	At least 20 consecutive minutes
<b>Muscular fitness</b> 	2–3 days per week	70–85% maximal weight you can lift	1–3 sets of 8–12 lifts* for each set  *A minimum of 8–10 exercises involving the major muscle groups such as arms, shoulders, chest, abdomen, back, hips, and legs, is recommended.
<b>Flexibility</b> 	2–4 days per week	Stretching through full range of motion	2–4 repetitions per stretch*  *Hold each stretch for 15–30 seconds.

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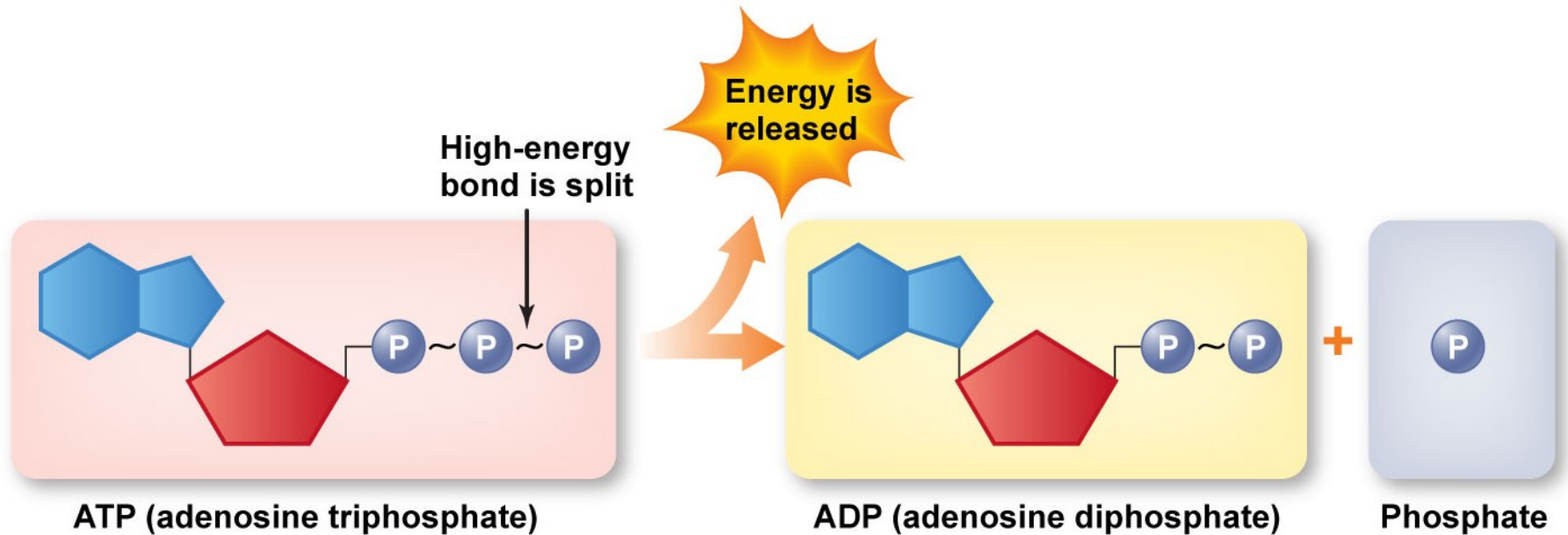
Figure 12.3

# Sound Fitness Program

A sound physical fitness program includes a warm-up and a cool-down period

- Includes stretching and calisthenics
- Helps prevent injuries
- May reduce muscle soreness
- Should last 5–10 minutes

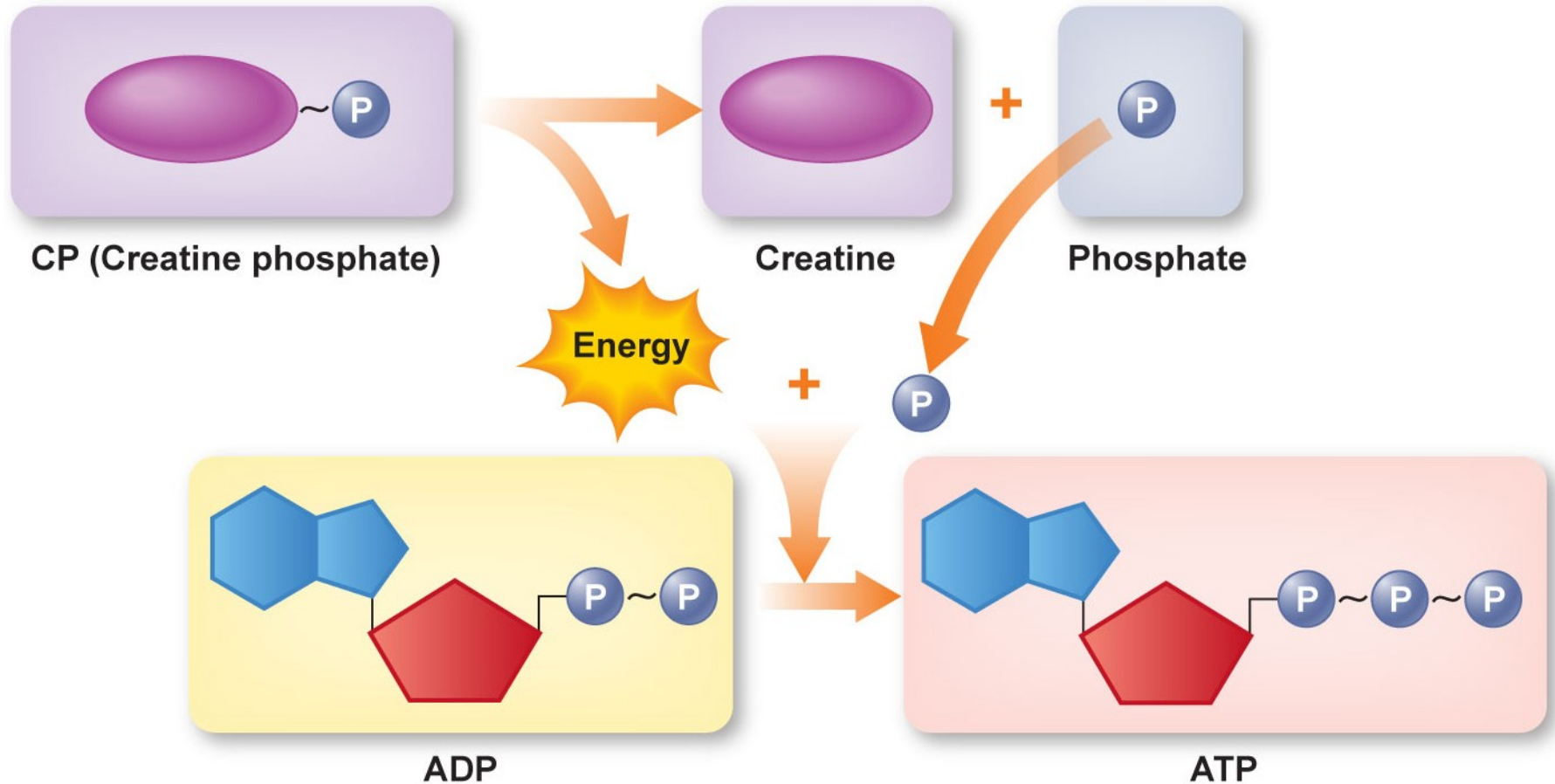
# Fuel for Physical Activity



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Figure 12.4

# Fuel for Physical Activity



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Figure 12.5



# Fuel for Physical Activity

Adenosine triphosphate (ATP): the carrying molecule in the body

- Must be generated continuously, since muscles store only enough ATP for 1 – 3 seconds of activity

After depleting ATP stores, muscles turn to other energy sources

- Creatine phosphate (CP) stores energy that can be used to generate ATP
  - Creatine phosphate can be broken down to support the regeneration of ATP for enough energy for 3–15 seconds of maximal physical effort

# Fuel for Physical Activity

After creatine phosphate, carbohydrates are the next source of energy for the production of ATP

Glucose is the primary carbohydrate used to generate ATP

## Metabolism of glucose

- **Anaerobic** (without oxygen) breakdown of glucose yields 2 ATP molecules
  - Lactic acid is produced
- **Aerobic** (with oxygen) breakdown of glucose yields 36–38 molecules of ATP
  - $\text{CO}_2$  and  $\text{H}_2\text{O}$  are produced

# Fuel for Physical Activity

Triglycerides (fats) can be metabolized to generate ATP

- For low-intensity exercise
- For exercise of long duration
- A very abundant energy source, even in lean people
- Provides more than 2 times the energy per gram as carbohydrate

# Fuel for Physical Activity

Carbohydrates and fats can both be used as energy sources for the production of ATP

- Carbohydrates are mostly used for high-intensity activity
- Fats are used for low-intensity exercise

Proteins (amino acids) are not a major fuel source for exercise

- 3–6% of energy needs during exercise

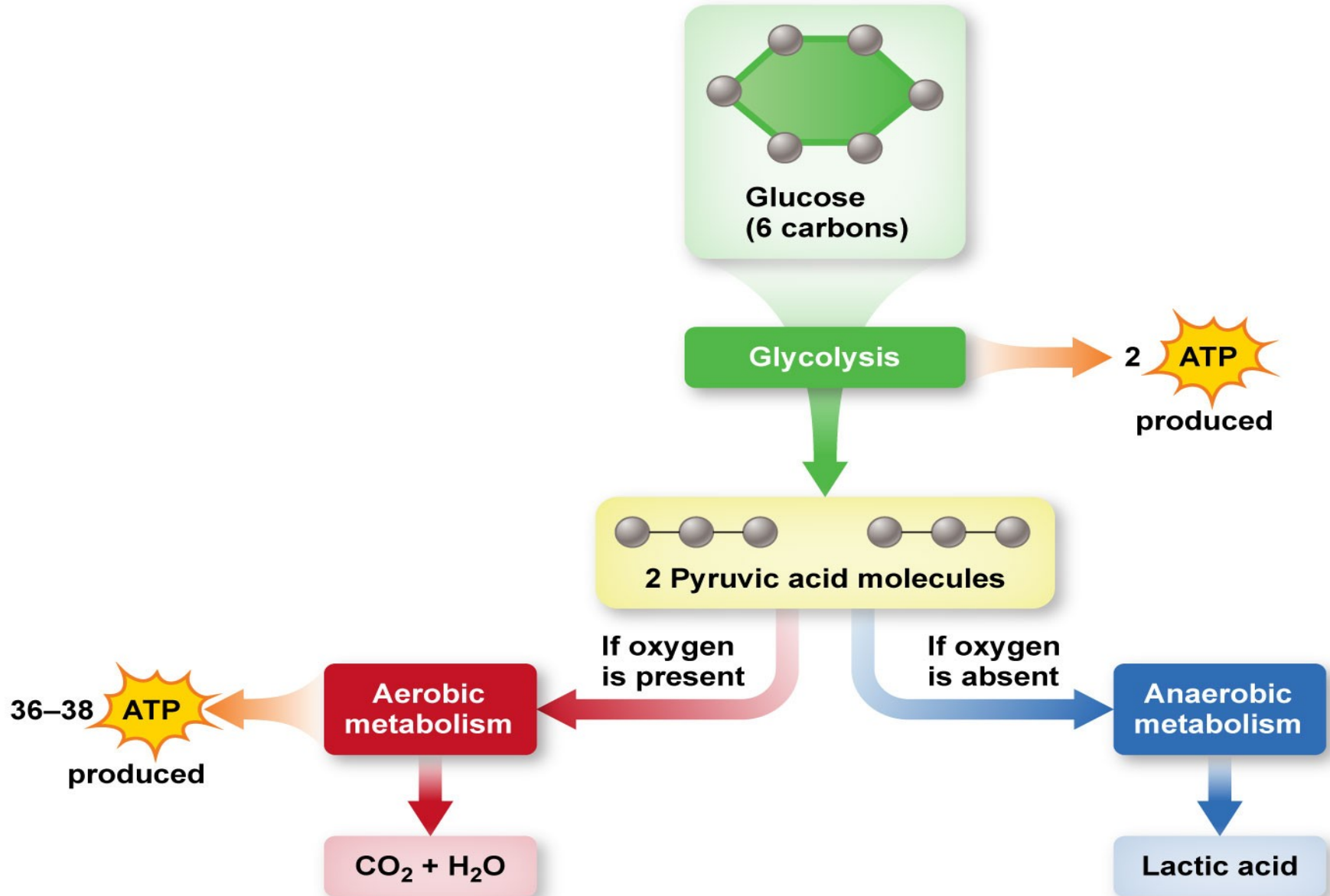
# Fueling Activity



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Figure 12.6

# Fueling Activity



# Fueling Activity

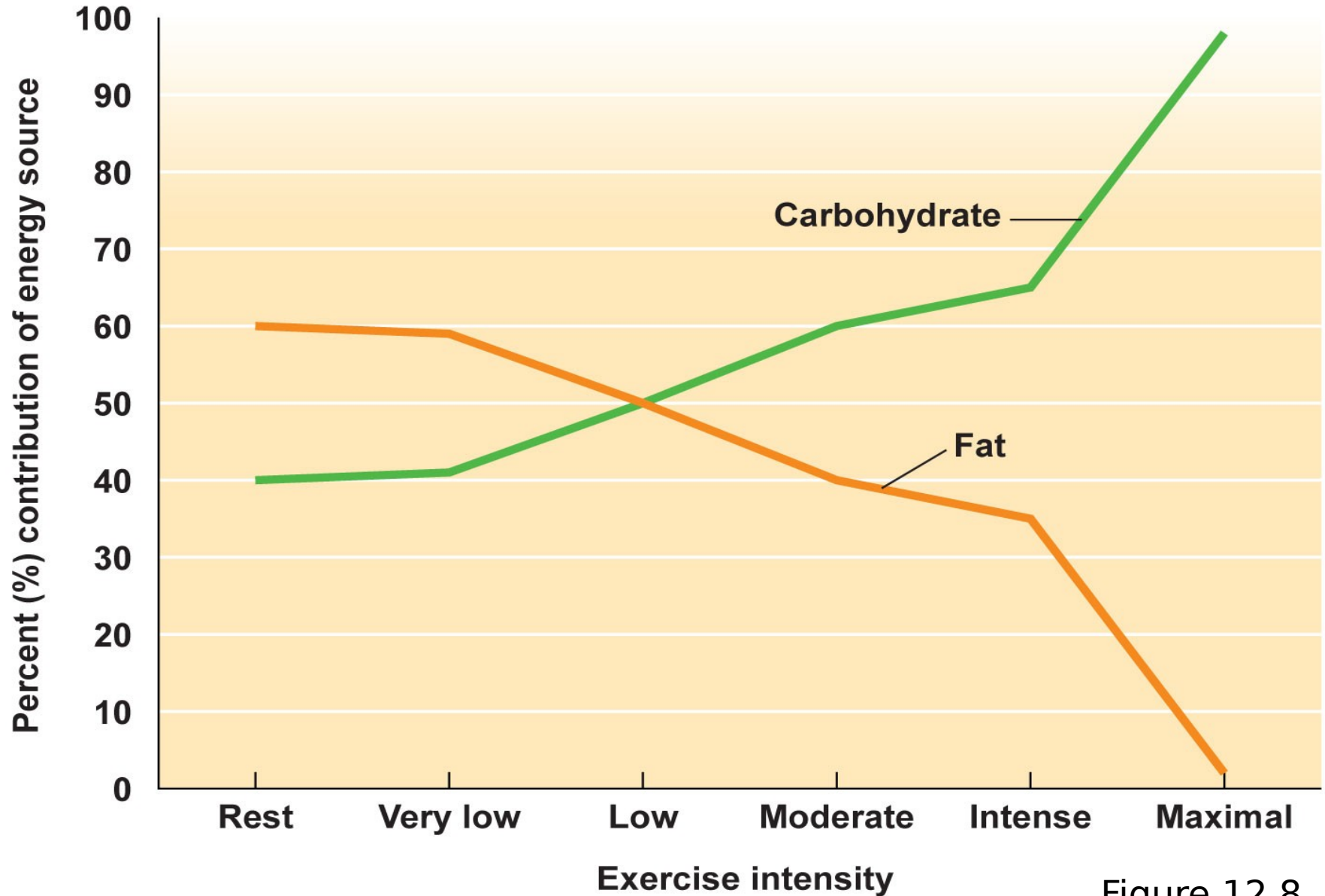


Figure 12.8

# Nutrition for Physical Activity

## Energy needs

- Energy needs may be higher for athletes
- Different energy needs for males and females
- Depends on body size
- Depends on the type of physical activity



# Nutrition for Vigorous Physical Activity

## Recommended diet for athletes

- 45–65% of kcal from carbohydrates
  - More carbs may be needed to support vigorous exercise
- 20–35% kcal from fat
- 10–35% kcal from protein
  - For endurance athletes: 1.2–1.4 g per kg body weight
  - For resistance athletes: 1.2–1.7 g per kg body weight

# Carbohydrates

- Important for athletes to consume enough carbohydrate to maintain glycogen stores and to time food intake optimally
- Complex, less process carbohydrate foods are best: whole grains and cereals, fruits, vegetables, and juices

# Carbohydrate Loading (aka Glycogen Loading)

- Involves altering exercise duration and carbohydrate intake to maximize amount of muscle glycogen
- Beneficial to athletes who participate in endurance-type activity: e.g., marathons, long-distance swimming, or cross-country skiing
- Carbohydrate loading does NOT always improve performance
- Can cause GI distress, such as diarrhea, or can leave athlete feeling sluggish

# Carbohydrate Loading (aka Glycogen Loading)

**TABLE 12.4 Recommended Carbohydrate Loading Guidelines for Endurance Athletes**

Days Prior to Event	Exercise Duration (minutes) at 70% Maximal Effort	Carbohydrate Content of Diet (g/kg of body weight)
6	90	5
5	40	5
4	40	5
3	20	10
2	20	10
1	Rest	10
Day of race	Competition	Precompetition food and fluid

Source: Data from Coleman, E. 2006. Carbohydrate and exercise. In: Dunford, M., ed. Sports Nutrition, 4th ed. Chicago, IL: The American Dietetic Association. Used with permission.

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Table 12.4

# Fats

- Important energy source for moderate physical activity and vigorous endurance training
- When fat is used as a fuel during exercise, carbohydrate is “spared” so that it can be used during prolonged, intense training or competition
- Less than 10% of daily fat consumption should come from saturated fat

# Protein

- Most inactive people and athletes consume MORE than adequate protein
- Athletes who do not consume enough protein: individuals with low energy intake, vegetarians who do not consume high protein food sources, and young athletes who are growing
- Food sources: lean meats, poultry, fish, eggs and egg whites, low-fat dairy products, legumes, and soy products
- Follow Canada's Food Guide: no supplements or specially-formulated foods are required

# Protein

**TABLE 12.5** Estimated Protein Requirements for Athletes

Group	Protein Requirements (g/kg of body weight)
Competitive male and female athletes	1.4–1.6
Moderate-intensity endurance athletes	1.2
Recreational endurance athletes	0.8–1.0
Football, power sports players	1.4–1.7
Resistance athletes, weight lifters (early training)	1.5–1.7
Resistance athletes, weight lifters (steady-state training)	1.0–1.2

Data from Tarnopolsky, M, 2006. Protein and amino acid needs for training and bulking up. In Clinical Sports Nutrition, 3rd ed., edited by L. Burke and V. Deakin. New York: McGraw-Hill.

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Table 12.5

# Nutrition for Physical Activity

Maintaining water balance is critical for physically active people

- Drink fluids before, during, and after exercise
- Consume enough water to maintain body weight
- Training in hot environments requires careful attention to water intake
- When training and competition lasts longer than 1 hour, sports beverages containing carbohydrate and electrolytes are recommended



# Nutrition for Physical Activity



## Symptoms of Dehydration During Heavy Exercise:

- Decreased exercise performance
- Increased level in perceived exertion
- Dark yellow or brown urine colour
- Increased heart rate at a given exercise intensity
- Decreased appetite
- Decreased ability to concentrate
- Decreased urine output
- Fatigue and weakness
- Headache and dizziness



▲ **Figure 12.11** Symptoms of dehydration during heavy exercise.

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Figure 12.11

# Nutrition for Physical Activity

The requirements for some vitamins and minerals may be elevated in athletes

- B-vitamins
- Calcium
- Iron

Adequate intake of these nutrients can be met with a healthy, balanced diet and should not require supplementation

# Ergogenic Aids

**Ergogenic aids:** substances used to improve exercise and athletic performance

- Many of these products are not effective
- Some of these products are dangerous
- Reliable research and accurate information on these products is hard to find
- Most are very expensive

# Ergogenic Aids

Ergogenic aids used to build muscles and increase strength include

- Anabolic steroids
  - Effective but illegal; numerous serious side effects
- Andro (androstenedione) and DHEA (dehydroepiandrosterone)
  - Precursors of testosterone
  - Not been shown to be effective

# Ergogenic Aids

- GHB (gamma-hydroxybutyric acid)
  - Severe side effects and some reported deaths
- Creatine
  - It may improve performance in sprint activities
  - It may be beneficial to increase strength gained during resistance exercise
  - Relatively minor side effects
  - Effects of long-term use are unknown

# Ergogenic Aids

Ergogenic aids used to increase energy levels and optimize fuel use include

- Caffeine
  - Increases fat use for energy during exercise
- Ephedrine
  - Stimulant, not approved for sale in Canada
  - Serious side effects

# Ergogenic Aids

Ergogenic aids found to be **ineffective**

- Carnitine
  - Claimed to increase transport of fatty acids into the mitochondria so they can be used for energy
- Chromium
  - Claimed to enhance insulin's action
- Ribose
  - Claimed to increase work output and speed up recovery time

# In Depth: Disordered Eating

**Disordered eating:** general term describing a variety of abnormal or atypical eating behaviours used to achieve or maintain a lower body weight

- Going on and off diets
- Refusing to eat any fat
- Usually doesn't make a person seriously ill



# In Depth: Disordered Eating

Eating disorders are not the same as disordered eating

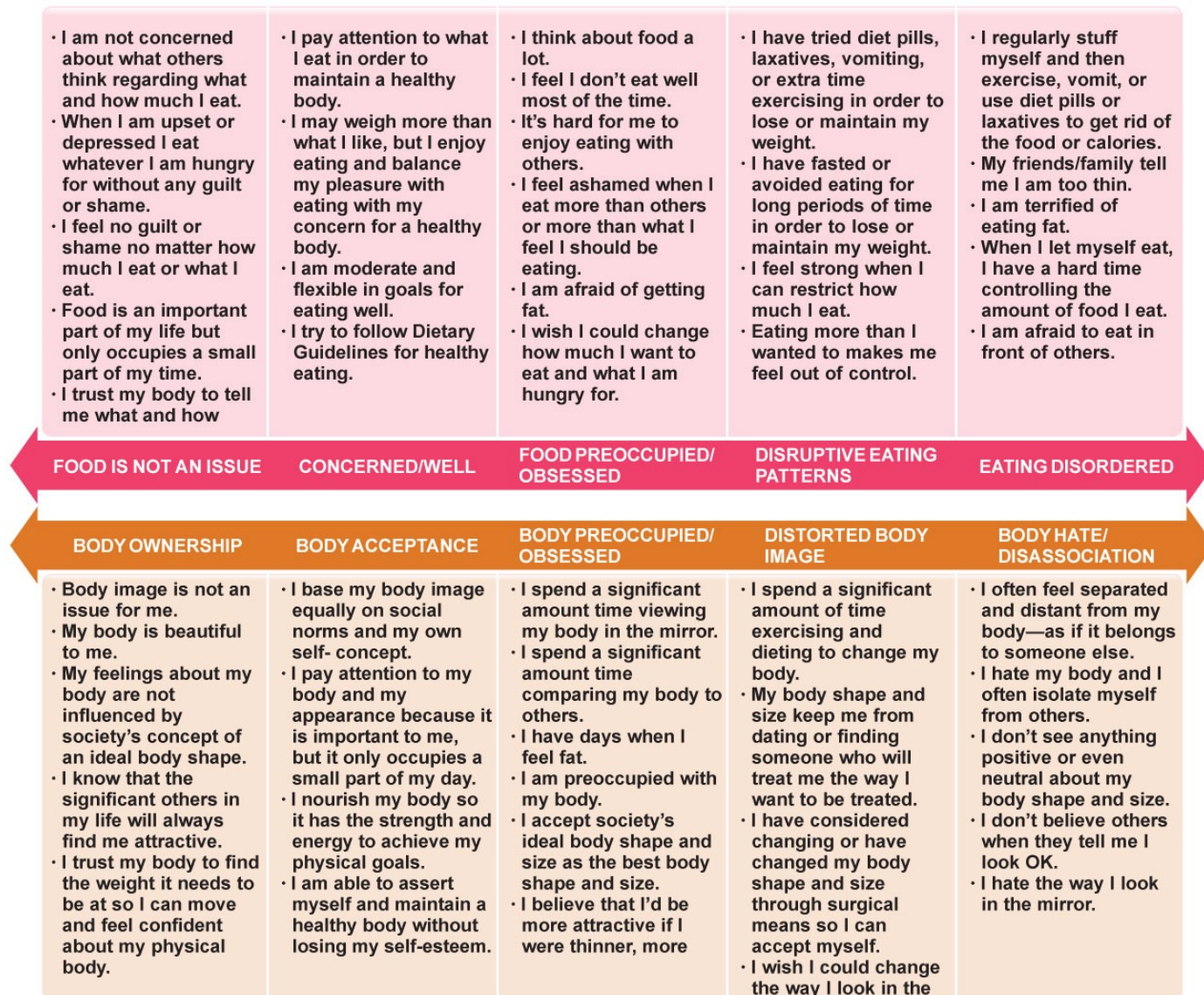
- **Eating disorder:** psychiatric condition involving extreme body dissatisfaction and long-term eating patterns harming the body
  - Condition is diagnosed by a physician
  - Must meet specific diagnostic criteria
  - Typically includes severe food restriction, obsessive exercising, self-induced vomiting, and/or laxative abuse

# In Depth: Disordered Eating

Determining an eating disorder first requires a definition for “normal” eating

Peoples’ attitudes toward eating and body image occur on a continuum – see following slide

# In Depth: Disordered Eating Continuum



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# In Depth: Disordered Eating

Multiple factors contribute to the development of disordered eating behaviours

- Genetic and biological factors
- Family environment
- Unrealistic media images
- Social and cultural values
- Personality traits

# Genetic and Biological Factors

- The chances of being diagnosed with anorexia or bulimia are higher in females, and if a biological relative also has an eating disorder
- This implies that there may be a genetic component
- However, it is difficult to separate genetic and environmental influences

# Family Environment

- Our family influences what we eat and our patterns with regard to eating
- Families with an anorexic member seem to have a more rigid family structure, less clear interpersonal boundaries, and are less open to discussions on topics of disagreement
- Families in which a member has bulimia show a less stable family organization, less nurturing, and more angry and disruptive interactions
- Childhood physical or sexual abuse can increase the risk of developing eating disorders

# Media Images

- Computer-enhanced images of lean, beautiful, “perfect” bodies fill the media
- Adolescents are not always able to distinguish between reality and media fantasy
- Comparing themselves to these images, adolescents may develop a negative body image
- Hard scientific evidence that the media actually *cause* increased eating disorders is difficult to obtain

# Social and Cultural Values

- Eating disorders are significantly more common in white females in developed Western societies
- Western culture values slenderness as beautiful and as a sign of health, wealth, and high fashion
- These cultural values influence a person's body image and can contribute to eating disorders
- Family, classmates, and co-workers also influence our self-perception



# Personality Traits

- It's difficult to tell if personality is the cause of or an effect of the eating disorder
- Personality traits associated with anorexia differ from those associated with bulimia nervosa
  - Anorexia is associated with perfectionism, social inhibition, compliance, and emotional restraint
  - Bulimia is associated with impulsiveness, low-self esteem, erratic personality, and seeking attention and admiration

# Anorexia Nervosa

**Anorexia nervosa:** a serious, potentially deadly medical disorder characterized by self-starvation, eventually leading to significant energy and nutrient deficiencies

- 90–95% of cases are young girls and women
- 0.3% of men and 2.1% of women in Ontario between 15 – 64 years of age had either anorexia nervosa or bulimia nervosa (Health Canada 2002)

# Anorexia Nervosa

## Symptoms

- Extremely restrictive eating practices
- Self-starvation
- Intense fear of weight gain
- **Amenorrhea**: no menstrual periods for at least 3 months
- Unhealthy body image
- Denial of the seriousness of current body weight

# Anorexia Nervosa

## Health risks

- Serious energy and nutrient deficiencies
- Electrolyte imbalance
- Cardiovascular and gastrointestinal problems
- Bone problems(can lead to osteoporosis)
- Muscle and organ wasting
- Skin, hair, and nails are adversely affected

# Anorexia Nervosa

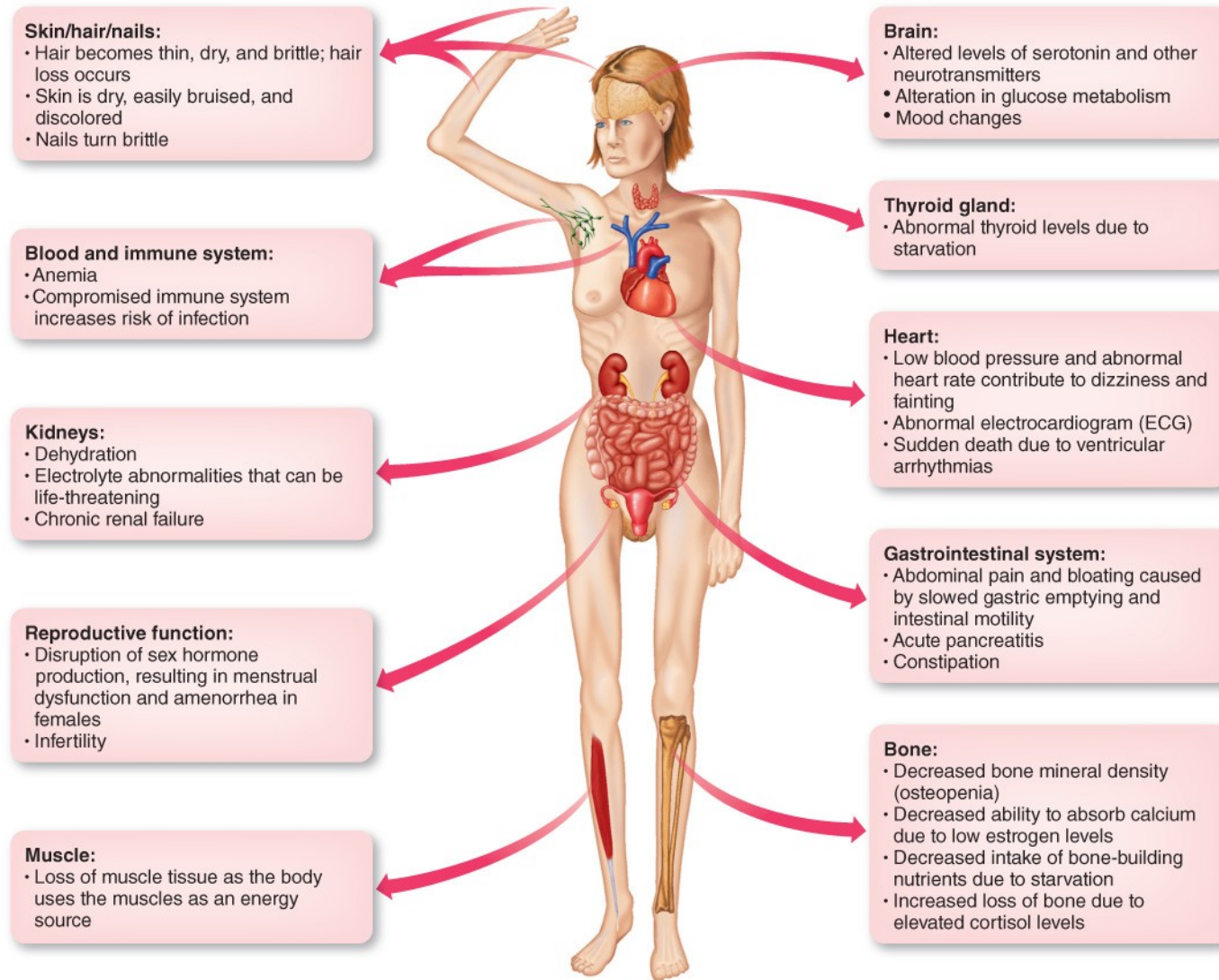


Figure 5 The impact of anorexia nervosa on the body.

# Bulimia Nervosa

- **Bulimia nervosa:** an eating disorder characterized by repeated episodes of binge eating followed by purging
  - Feeling of loss of self-control while binge eating
- **Binge eating:** eating a large amount of food in a short period of time
- **Purging:** an attempt to rid the body of unwanted food by vomiting, laxatives, fasting, excessive exercise, or other means

# Bulimia Nervosa

- Affects 1–4% of women
- Affects women more than men, with a male–female ratio of between 1:6 and 1:10
- 1% of bulimia patients die from complications within 10 years of diagnosis

# Bulimia Nervosa

## Symptoms

- Recurrent episodes of binge eating
- Recurrent inappropriate behaviour to compensate for binge eating (vomiting, laxatives, diuretics, enemas, fasting, exercise)
- Binge eating occurs on average at least twice a week for 3 months
- Negative body image
- Occurrences can often be accompanied by anorexia



# Bulimia Nervosa

## Physical warning signs

- Frequent binge eating with purging
- Chronically inflamed and sore throat
- Swollen neck and jaw glands
- Worn tooth enamel, tooth sensitivity and erosion
- Gastrointestinal reflux disorder
- General intestinal distress and irritation
- Kidney problems
- Severe dehydration

# Bulimia Nervosa

## Health risks

- Electrolyte imbalance (caused by dehydration and loss of sodium and potassium ions from vomiting)
- Gastrointestinal problems—  
inflammation, ulceration, rupture of  
esophagus and stomach
- Dental problems

# Binge-Eating Disorder

A disorder characterized by binge eating, on average, twice a week or more, usually without purging

- People with this disorder are often overweight
- Affects 2–3% of adults
- Accounts for 8% of the obese population
- Often common in men as well as women
- Our food environment often makes it hard for people with this disorder to avoid food triggers

# Binge-Eating Disorder

## Health risks

- Increased risk of overweight or obesity
- Foods eaten during binging are often high in fat and sugar
- Stress leads to psychological effects, such as low self-esteem, avoidance of social contact, depression, negative thoughts

# Night-Eating Syndrome

## Symptoms

- Most energy is consumed during the evening and late at night
- Combination of 3 disorders: eating disorder, sleep disorder, and mood disorder (depression)
- Unlike with bulimia, purging does not occur
- Usually associated with obesity

# Night-Eating Syndrome

## Health risks

- Increased risk of obesity and related impacts such as heart disease, high blood pressure, stroke, type 2 diabetes, and arthritis
- Increased risk for sleep apnea, which can further disrupt the night eater's abnormal sleep patterns

# Female Athlete Triad

**Female athlete triad:** serious medical syndrome frequently seen in female athletes that consists of

- Low energy availability (with or without eating disorders)
- Menstrual dysfunction (amenorrhea)
- Osteoporosis

Seen particularly in sports emphasizing extreme leanness and that exert pressure to meet specific weight standards or body-size expectations

# Female Athlete Triad



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# Treatment for Eating Disorders

Successful treatment usually involves a multidisciplinary approach, including

- Patient
- Physician
- Psychologist
- Nutritionist
- Family members

# Treatment for Eating Disorders

- Some patients may require immediate hospitalization
- Those who are stable may use outpatient programs
- Approach friends who may have eating disorders with sensitivity and locate specialized professional health resources