Objectives for Chapter 11

- List and describe the five basic components of fitness.
- Describe the FITT principle and how to use it to create a fitness program.
- Describe the roles of carbohydrate, fat, and protein during physical activity.
- List optimal food sources before, during, and after exercise.
- Describe the importance of vitamins and minerals for physical fitness.
- Explain the relationship between fluid intake and fitness.
- List and describe ergogenic aids that claim to improve athletic performance and physical fitness.
What Is Physical Fitness and Why Is It Important?

• Physical fitness: good health or physical condition, primarily the result of exercise and proper nutrition

• Physical fitness has five basic components:
  • Cardiorespiratory endurance: ability to sustain cardiorespiratory exercise for extended time
    • Examples: running, biking
    • Cardiovascular and respiratory systems must provide enough oxygen and energy to muscles
  • Muscle strength: ability to produce force for brief time
What Is Physical Fitness and Why Is It Important?, Continued

• Muscle endurance: ability to exert force for a long period of time without fatigue
  • Muscle strength and endurance best achieved with strength training

• Flexibility: range of motion around a joint
  • Improved with stretching

• Body composition: proportion of muscle, fat, water, and other body tissues that make up body weight
What Is Physical Fitness and Why Is It Important?, Continued-1

• Physical fitness provides numerous benefits
  • Helps achieve and maintain healthy body weight
  • Reduces risk of cardiovascular disease, type 2 diabetes, and some types of cancer
  • Improves body composition, bone health, and immune system
  • Improves overall health, such as more restful sleep and stress reduction
• Over half of adults in United States do not meet regular physical activity recommendations
# The Benefits of Physical Fitness

## Table 11.1 The Benefits of Physical Fitness

<table>
<thead>
<tr>
<th>Benefit</th>
<th>How It Works</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reduced Risk of Heart Disease</strong></td>
<td>Research has shown that moderate physical activity lowers blood pressure. In addition, exercise is positively associated with high-density lipoprotein (HDL) cholesterol.</td>
</tr>
<tr>
<td><strong>Reduced Risk of Type 2 Diabetes</strong></td>
<td>Exercise helps control blood glucose levels by increasing insulin sensitivity. This not only reduces risk for type 2 diabetes, but also improves blood glucose control for those who have been diagnosed with type 2 diabetes.</td>
</tr>
<tr>
<td><strong>Improved Body Composition</strong></td>
<td>Exercise helps burn excess stored body fat and builds muscle, resulting in a leaner body mass. Individuals with moderate cardiorespiratory fitness have less total fat and abdominal fat compared with people with low cardiorespiratory fitness.</td>
</tr>
<tr>
<td><strong>Reduced Risk of Some Forms of Cancer</strong></td>
<td>Increased physical activity has been associated with a reduced risk of colon, breast, endometrial, and lung cancers. This reduced risk is likely the result of a reduction in overall body weight and other hormonal and metabolic mechanisms.</td>
</tr>
</tbody>
</table>
Table 11.1 (*Continued*) The Benefits of Physical Fitness

<table>
<thead>
<tr>
<th><strong>Improved Bone Health</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>How It Works:</strong> Bone density has been shown to improve with weight-bearing exercise and resistance training, thereby reducing the risk for osteoporosis.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Improved Immune System</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>How It Works:</strong> Regular moderate exercise can enhance the immune system by increasing immunoglobulins in the body. Immunoglobulins function like antibodies, protecting against colds and other infectious diseases.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Improved Mental Well-Being</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>How It Works:</strong> Regular exercise protects against the onset of depression and anxiety disorders, reduces symptoms in people diagnosed with depression and anxiety, delays the incidence of dementia, and overall enhances mental well-being.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Improved Sleep</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>How It Works:</strong> People who engage in regular exercise often have better quality of sleep due to anxiety reduction, antidepressant effect, and changes in body temperature that promote sleep.</td>
</tr>
</tbody>
</table>
What Does a Physical Fitness Program Look Like?

- Cardiorespiratory exercise can improve cardiorespiratory endurance and body composition
  - Continuous activities that use large muscle groups
    - Examples: high-impact aerobics, stair climbing, brisk walking
    - Primarily aerobic because it uses oxygen
      - Heart rate and stroke volume increased to maximize blood flow delivery to muscles
    - Reduces stress and risk of heart disease; helps maintain healthy weight and improves body composition
What Does a Physical Fitness Program Look Like?, Continued

• Strength training can improve muscle strength, muscle endurance, and body composition
  • To increase muscle strength: low number of repetitions using heavy weights
  • To increase muscle endurance: high number of repetitions using lighter weights
  • Important to rest between sets of an exercise and between workouts to prevent muscle strains and injury

• Stretching can improve flexibility
What Does a Physical Fitness Program Look Like?, Continued

- The **FITT Principle** can help you design a fitness program: frequency, intensity, time, type
  - **Rate of perceived exertion** (RPE) is a self assessment that measures intensity of cardiorespiratory exercise
  - **Target heart rate** shows exercise intensity through heart rate (percentage of maximum)
  - **Repetition maximum** (RM) refers to intensity of strength training
- **Physical Activity Guidelines**: 60 minutes/week of moderate-intensity activity for some health benefits; 150 minutes/week for substantial benefits and reduced risk of chronic disease
  - 60 to 90 minutes daily to lose weight effectively


<table>
<thead>
<tr>
<th>Age</th>
<th>Percent of Maximum Heart Rate* 55%</th>
<th>Percent of Maximum Heart Rate* 65%</th>
<th>Percent of Maximum Heart Rate* 85%</th>
<th>Percent of Maximum Heart Rate* 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>106</td>
<td>126</td>
<td>164</td>
<td>184</td>
</tr>
<tr>
<td>25</td>
<td>105</td>
<td>124</td>
<td>162</td>
<td>181</td>
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<td>30</td>
<td>103</td>
<td>121</td>
<td>159</td>
<td>177</td>
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<td>35</td>
<td>101</td>
<td>119</td>
<td>156</td>
<td>174</td>
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<tr>
<td>40</td>
<td>99</td>
<td>117</td>
<td>153</td>
<td>171</td>
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<tr>
<td>45</td>
<td>97</td>
<td>115</td>
<td>150</td>
<td>168</td>
</tr>
<tr>
<td>50</td>
<td>95</td>
<td>113</td>
<td>147</td>
<td>165</td>
</tr>
</tbody>
</table>

*Maximum heart rate (HRmax) can be estimated using the following equation:

\[
206.9 - (\text{age in years} \times 0.67) = \text{estimated HRmax.}
\]
Physical Activity Pyramid

Helpful tips:
- Join a yoga or pilates class
- Use household objects as free weights (soup cans, gallon water jugs)
- Use resistance bands
- Increase treadmill speed
- Play team sports with friends

Examples:
- Watching TV
- Computer use
- Stretching
- Yoga
- Pilates
- Weight lifting
- Brisk walking
- Basketball
- Soccer
- Jogging
- Racquetball
- Walking
- Climbing stairs
- Light bicycling
- Playing with pets

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What Does a Physical Fitness Program Look Like?, Continued-2

- The **progressive overload principle** can help improve fitness over time
  - The body adapts to physical activities, producing fitness plateau
  - Modify one or more FITT principles to increase exercise and improve fitness
### Table 11.3 Using FITT to Improve Fitness

<table>
<thead>
<tr>
<th></th>
<th>Cardiorespiratory Fitness</th>
<th>Muscular Fitness</th>
<th>Flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
<td>3-5 days per week</td>
<td>2-3 days per week</td>
<td>2-3 days per week</td>
</tr>
<tr>
<td><strong>Intensity</strong></td>
<td>64-95% of maximum heart rate</td>
<td>60-80% of 1 RM</td>
<td>To the point of feeling tightness or slight discomfort</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>20-60 minutes per day (150 minutes per week), continuous or intermittent (minimum of 10-minute bouts)</td>
<td>8-10 different exercises performed in 2-4 sets, 8-12 repetitions</td>
<td>2-4 repetitions for each muscle group; hold static stretch for 10-30 seconds</td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td>Brisk walking, jogging, biking, step Aerobics</td>
<td>Free weights, machines with stacked weights, resistance bands</td>
<td>Stretching, yoga</td>
</tr>
</tbody>
</table>

Source: Data from American College of Sports Medicine, "Position Stand: Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory, Musculoskeletal, and Neuromotor Fitness in Apparently Healthy Adults: Guidance for Prescribing Exercise," *Medicine & Science in Sports & Exercise* 43 no. 7 (2011).
How Are Carbohydrate, Fat, and Protein Used during Exercise?

• Energy during first few minutes of physical activity is provided by anaerobic energy production (without oxygen) from breakdown of:
  • Adenosine triphosphate (ATP)
  • Creatine phosphate
    • Limited amount stored in cells
• As exercise continues, oxygen intake and aerobic energy production increase
  • Carbohydrate (glucose) and fatty acids broken down to yield ATP energy via aerobic metabolism
Energy Metabolism

Figure 11.2

(a) ATP → ADP + Phosphate + Energy

(b) Creatine phosphate + ADP → Free creatine + Regenerated ATP
The Energy Currency: ATP
What Fuels Our Activities?

Depending on the duration and intensity of the activity, our bodies may use ATP and creatine phosphate (CP), carbohydrate, or fat in various combinations to fuel muscular work. Keep in mind that the amounts and sources shown below can vary based on the person's fitness level and health, how well the person is before the activity, and environmental temperatures and conditions.

**SPRINT START (0–3 seconds)**
A short, intense burst of activity like sprinting is fueled by ATP and under anaerobic conditions. 100% ATP-CP

**100-M DASH (10–12 seconds)**
ATP and CP provide energy for about 10 seconds of quick, intense activity, after which energy is provided as ATP from the breakdown of carbohydrates. 50% ATP-CP

**1500-M RACE (4–6 minutes)**
Energy derived from ATP and CP is small and would be exhausted after about 10 seconds of the race. At this point, most of the energy is derived from aerobic metabolism of primarily carbohydrates. 94% Carbohydrates

**10-KM RACE (30–40 minutes)**
During moderately intense activities such as a 10-kilometer race, ATP is provided by fat and carbohydrate metabolism. As the intensity increases, so does the utilization of carbohydrates for energy. 60% Carbohydrates

**MARATHON (2.5–3 hours)**
During endurance events such as marathons, ATP is primarily derived from carbohydrates, and to a lesser extent fat. A very small amount of energy is provided by the breakdown of amino acids to form glucose. 75% Carbohydrates

**DAY-LONG HIKE (5.5–7 hours)**
The primary energy source for events lasting several hours at low intensity is fat (free fatty acids in the bloodstream which derive from triglycerides stored in fat cells). Carbohydrates contribute a lesser percentage of energy needs. 65% Fat

Figure 11.3
How Are Carbohydrate, Fat, and Protein Used during Exercise?, Continued

• Carbohydrate is the primary energy source during high-intensity exercise
  • Carbohydrate from blood glucose and stored glycogen in muscle and liver: about 2 hours of exercise
  • Well-trained muscles store 20 to 50 percent more glycogen than untrained muscles
  • Liver glycogen maintains normal blood glucose
  • Lactic acid is produced at high exercise intensities and shuttled to other tissues
    • Used for energy during low-intensity exercise
Intensity affects how much glucose and glycogen you use

- Glucose and glycogen use increases as intensity increases

How much carbohydrate do you need for exercise?

- Depends on duration of activity
  - During and/or after activity: bananas, bagels, corn flakes that are absorbed quickly
  - 2 hours before exercise: rice, oatmeal, pasta, corn enter blood more slowly for sustained energy
### Table 11.4 Carbohydrate Needs for Activity and Recovery

<table>
<thead>
<tr>
<th>Duration/Intensity of Activity (per Day)</th>
<th>Grams Carbohydrate/Kg Body Weight (per Day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 to 90 minutes moderate intensity</td>
<td>5-7</td>
</tr>
<tr>
<td>1 to 3 hours moderate to high Intensity</td>
<td>7-12</td>
</tr>
<tr>
<td>4 to 6+ hours extreme endurance</td>
<td>10-13</td>
</tr>
</tbody>
</table>

Carbohydrate Loading

- **4–6 days prior**
  - Taper exercise
  - Eat 4–5 g carbohydrates per kg body weight each day

- **1–3 days prior**
  - Taper exercise
  - Eat 10 g carbohydrates per kg body weight each day

- **Competition day**
  - Eat 250–300 g carbohydrates 3–4 hours before event
### Table 1 Sample One-Day Menu

<table>
<thead>
<tr>
<th>Breakfast</th>
<th>Lunch</th>
<th>Dinner</th>
<th>Snack</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cup orange juice</td>
<td>2 slices oatmeal bread</td>
<td>3 cups spaghetti (6 ounces uncooked)</td>
<td>1 cup vanilla yogurt</td>
</tr>
<tr>
<td>½ cup Grape-Nuts</td>
<td>3 oz turkey breast with lettuce, tomato</td>
<td>1 cup tomato sauce</td>
<td>6 fig bars</td>
</tr>
<tr>
<td>1 medium banana</td>
<td>8 oz apple juice</td>
<td>2 oz ground turkey</td>
<td></td>
</tr>
<tr>
<td>1 cup 2% milk</td>
<td>1 cup frozen yogurt</td>
<td>¼ loaf multigrain bread (4 ounces)</td>
<td></td>
</tr>
<tr>
<td>1 English muffin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 tbs jelly</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

750 calories 750 calories 1,300 calories 500 calories

85% carbohydrates 65% carbohydrates 70% carbohydrates 80% carbohydrates

**Total: 3,300 calories: 75% carbohydrates (610 g), 15% protein (125 g), 10% fat (40 g)**

Fat is the primary energy source during low-intensity exercise

- Two forms: fatty acids (from triglycerides) in adipose tissue and in muscle tissue
- Converting fatty acids into energy is slow and requires more oxygen compared with carbohydrate
How Are Carbohydrate, Fat, and Protein Used during Exercise?, Continued

- Intensity and training affect how much fat you use
  - Low-intensity exercise uses mostly fat from adipose tissue
  - Moderate-intensity exercise also uses fatty acids from muscle triglycerides
  - Well-trained muscles burn more fat than less trained muscles
    - Body uses less glycogen and more fat, increases endurance
How much fat do you need for exercise?
- 25 to 30 percent of calories should come from fat
  - Consume unsaturated fats and limit saturated fat to ≤10 percent of total calories
  - Too little fat (<20 percent) has nutritional risks
How Are Carbohydrate, Fat, and Protein Used during Exercise?, Continued

- **Fat-burning zone**: 65 to 73 percent of maximum heart rate
- **"Cardio" zone**: >73 percent of maximum heart rate
- Not necessary to stay in fat-burning zone to lose weight
  - Need to burn calories to produce overall calorie deficit
  - High-intensity exercise burns calories more quickly but lower-intensity workout can last longer and achieve more
ABC News Video: Coconut: How Healthy Is the Superfood?

Good Morning America
March 11, 2015

>> Robin Roberts: Now to the coconut craze.
Protein is primarily needed to build and repair muscle
  - Muscle damage results from exercise, especially in weight or strength training
  - Amino acids needed to promote muscle growth and recovery

Body can use protein for energy but prefers carbohydrate and fat as main energy sources
  - Amino acids are converted to glucose in liver

Endurance athletes need 1.2 to 1.4 g of protein/kg body weight

Resistance/strength activities: 1.2 to 1.7 g/kg body weight
How Are Carbohydrate, Fat, and Protein Used during Exercise?, Continued

- Total calorie needs depend on the type and schedule of exercise
- Timing of meals affects fitness performance
  - Optimal food choices vary before, during, and after exercise
How Does the Timing of Meals Affect Fitness and Athletic Performance?

• Optimal foods before exercise
  • Allow adequate time for digestion
    • Large meal: 3 to 4 hours; smaller meals: 2 to 3 hours; snack or liquid supplement: ½ to 1 hour
How Does the Timing of Meals Affect Fitness and Athletic Performance?, Continued

• Pre-exercise meal: 1 to 4.5 g carbohydrate/kg body weight, 1 to 4 hours before exercise
  • Carbohydrate 15 to 30 minutes before gives muscles immediate energy, spares glycogen stores, helps reduce muscle damage
  • Consuming protein before exercise as well as during exercise increases muscle glycogen synthesis and protein synthesis after exercise is over
  • High-fat foods should be avoided before exercise: take longer to digest, may cause stomach discomfort and sluggishness
• Optimal foods during exercise
  • For exercise >1 hour, begin carbohydrate intake shortly after start and every 15 to 20 minutes
    • 30 to 60 g carbohydrate/hour to avoid fatigue
  • Glucose, sucrose, maltodextrin are best choices for quick absorption
    • Avoid fructose, which can cause GI problems
  • Consuming both carbohydrate and protein is best for muscle maintenance and growth
How Does the Timing of Meals Affect Fitness and Athletic Performance?, Continued-2

• Optimal foods after exercise
  • The best postexercise meal is consumed quickly and contains both carbohydrate and protein:
    • Carbohydrate/protein ratio of 3:1 is ideal to promote muscle glycogen and protein synthesis and faster recovery time
  • Preferred protein choice: whey protein (in milk) is absorbed rapidly and contains all essential amino acids needed

• When consuming small snack or liquid supplement after exercise, should have a high-carbohydrate, moderate-protein, low-fat meal within 2 hours
What Vitamins and Minerals Are Important for Fitness?

- Vitamins and minerals play major role in metabolism of carbohydrate, fat, and protein for energy during exercise
- Some also act as antioxidants and help protect cells from the oxidative stress that can occur with exercise
What Vitamins and Minerals Are Important for Fitness?, Continued

• Antioxidants and cellular damage caused by exercise
  • Using more oxygen during exercise increases free radicals that damage cells
    • Supplements of antioxidant vitamins E and C not shown to improve athletic performance or decrease oxidative stress in highly trained athletes
    • Consume adequate amounts (RDA) from nuts, vegetable oils, broccoli, citrus fruits
Some minerals can be of concern in highly active people.

Iron: Low iron levels can reduce hemoglobin and blood's ability to transport oxygen to cells, causing early fatigue during exercise.

Female athletes more at risk for iron-deficiency anemia:
- Also long-distance runners, those in "make weight" sports and other sports
- Iron-rich foods and iron supplements may be needed

"Sports anemia": Decreased hemoglobin can result from strenuous training due to increased blood volume:
- Not same as iron-deficiency anemia and is self-correcting.
What Vitamins and Minerals Are Important for Fitness?, Continued-2

• Calcium: important to reduce risk of bone fractures
  • Calcium is lost in sweat
  • Exercise can increase bone mineral content and may be able to compensate for calcium lost in sweat
  • Supplements not recommended unless food intake is inadequate
What Vitamins and Minerals Are Important for Fitness?, Continued-3

• Vitamin and mineral supplements are generally not necessary
• Everyone, not just athletes, should obtain vitamins and minerals through nutrient-dense foods before considering the use of supplements
How Does Fluid Intake Affect Fitness?

• Fluid and electrolyte balance and body temperature are affected by exercise
  • Water is lost through sweat and exhalation
  • Sodium and chloride, and to a lesser extent potassium, are electrolytes lost in sweat
    • Electrolyte imbalance can cause heat cramps, nausea, lowered blood pressure, edema
  • Evaporation of sweat helps cool the body
    • Hot, humid weather reduces evaporation and body heat increases: increases risk of heat exhaustion and heat stroke
## Warning Signs of Heat Exhaustion and Heat Stroke

<table>
<thead>
<tr>
<th>Heat Exhaustion</th>
<th>Heat Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profuse sweating</td>
<td>Extremely high body temperature (above 103° F</td>
</tr>
<tr>
<td>Fatigue</td>
<td>[39.4° C], measured orally)</td>
</tr>
<tr>
<td>Thirst</td>
<td>Red, hot, and dry skin (no sweating)</td>
</tr>
<tr>
<td>Muscle cramps</td>
<td>Rapid, strong pulse</td>
</tr>
<tr>
<td>Headache</td>
<td>Rapid, shallow breathing</td>
</tr>
<tr>
<td>Dizziness or light-headedness</td>
<td>Throbbing headache</td>
</tr>
<tr>
<td>Weakness</td>
<td>Dizziness</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>Nausea</td>
</tr>
<tr>
<td>Cool, moist skin</td>
<td>Extreme confusion</td>
</tr>
<tr>
<td></td>
<td>Unconsciousness</td>
</tr>
</tbody>
</table>
How Does Fluid Intake Affect Fitness?, Continued

• You need fluids before, during, and after exercise
  • The American College of Sports Medicine has specific recommendations for how much fluid to drink before and during exercise
## ACSM Hydration Recommendations

**Table 11.6 ACSM Hydration Recommendations**

<table>
<thead>
<tr>
<th>When?</th>
<th>How Much Fluid?</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 hours before exercise</td>
<td>16-20 fl oz (2-2½ cups)</td>
</tr>
<tr>
<td>10 to 15 minutes before exercise</td>
<td>8-12 fl oz (1-1½ cups)</td>
</tr>
<tr>
<td>At 15- to 20-minute intervals when exercising less than 60 minutes</td>
<td>3-8 fl oz (3/8-1 cup)</td>
</tr>
<tr>
<td>At 15- to 20-minute intervals when exercising more than 60 minutes</td>
<td>3-8 fl oz (3/8-1 cup) sports beverage (5–8 percent carbohydrate with electrolytes)</td>
</tr>
<tr>
<td>After exercise for every pound of body weight lost</td>
<td>20-24 fl oz (2½-3 cups)</td>
</tr>
</tbody>
</table>

Some Beverages Are Better Than Others

- Sports drinks contain 6 to 8 percent carbohydrate and sodium and potassium: beneficial in long endurance events
  - For events <60 minutes, water is sufficient to replace fluids, and postexercise food will replace electrolytes
  - Sports drinks should be avoided as a daily beverage: damage tooth enamel, provide unwanted calories
- Not recommended during physical activity: fruit juice (too high carbohydrate concentration); carbonated drinks (bloating); alcohol and caffeine (diuretics, unwanted side effects)
Consuming Too Little or Too Much Fluid Can Be Harmful

- Thirst is not a good indicator of fluid needs for athletes
  - **Acute dehydration:** when not adequately hydrated over a short period of time
  - **Chronic dehydration:** when not adequately hydrated over extended period of time
    - Fatigue, muscle soreness, poor recovery from workout, headaches, nausea, dark urine
- **Hyponatremia:** low sodium blood levels due to consuming too much water without electrolytes
Effects of Dehydration on Exercise Performance

Figure 11.4

- Impaired aerobic performance
- Reduced muscle endurance
- Reduced muscle strength
- Heat cramps, heat exhaustion

Athletic Performance

Water loss as percentage of body weight:
- Fully hydrated
- 2%
- 4%
- 6%
- 8%
Can Dietary Supplements Contribute to Fitness?

• Dietary supplements are not strictly regulated by FDA
  • Manufacturers not required to prove safety or efficacy of supplement claims
• Dietary supplements and ergogenic aids may improve performance, but can have side effects
  • **Creatine**: research data mixed on enhancement of performance
    • Improves high-intensity, short-duration activities (like weight training) that rely on anaerobic metabolism
Can Dietary Supplements Contribute to Fitness?, Continued

• **Caffeine** enhances athletic performance, mostly during endurance events.
  • Stimulates central nervous system, breakdown of muscle glycogen, may increase fatty acid availability
  • Considered a banned substance by some athletic associations
Can Dietary Supplements Contribute to Fitness?, Continued

- **Anabolic steroids**: testosterone-based substances that promote muscle growth and strength (anabolic effect)
  - Androgenic effect (testosterone-promoting): hormone imbalance causes undesirable side effects in both men and women; also health risks
- **Growth hormone**: little research on effects on athletic performance, results mixed
  - Increases muscle mass and reduces body fat but does not increase muscle strength
  - Excess can cause acromegaly and serious health issues
Can Dietary Supplements Contribute to Fitness?, Continued-2

- **Erythropoietin and blood doping:** to increase oxygen-carrying capacity of the blood
  - Can increase blood viscosity, increase risk of stroke and heart attack
## Table 11.7 The Truth about Supplements and Ergogenic Aids

<table>
<thead>
<tr>
<th>Supplement/Ergogenic Aid</th>
<th>Belief or Claim</th>
<th>Evidence/Potential Side Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multivitamin/mineral (most common among college athletes)</td>
<td>Improves overall health and performance; provides energy</td>
<td>Will improve health and performance only when deficiencies exist. Avoid multivitamin/mineral supplements containing more than 100% RDA of contents. Vitamins and minerals do not directly supply energy, but assist with the breakdown of carbohydrate, fat, and protein to use for energy.</td>
</tr>
<tr>
<td>Creatine</td>
<td>Increases muscle mass and strength; makes athlete faster and Stronger</td>
<td>Mixed results in clinical trials. Has been shown to increase muscle mass and strength and improve performance in high-intensity, short-duration exercise by increasing ATP. Mixed results in improving performance in exercise of longer duration. No negative effects seen in healthy individuals.</td>
</tr>
<tr>
<td>Caffeine</td>
<td>Improves endurance</td>
<td>Has been shown to improve endurance in some athletes, but no improvement shown in short-duration activities. NCAA lists caffeine as a banned substance when urine concentrations exceed 15 mcg/ml.</td>
</tr>
<tr>
<td>Anabolic steroids</td>
<td>Increase muscle mass, size, and strength</td>
<td>Have been shown to increase muscle mass, size, and strength, but also contribute many negative side effects such as hormone imbalance, changes in hair growth, shrinkage of testicles and decreased sperm count in men, and psychiatric effects like extreme mood swings and aggressiveness. Steroids are illegal in the United States unless prescribed by a physician.</td>
</tr>
<tr>
<td>Growth hormone</td>
<td>Increases muscle mass and strength, decreases body fat</td>
<td>Mixed results in clinical trials regarding improved athletic performance. May improve body composition in well-trained adults, but not others. Can have negative side effects such as acromegaly, and the development of diabetes, atherosclerosis, and hypertension. NCAA lists GH as a banned substance.</td>
</tr>
<tr>
<td>Erythropoietin</td>
<td>Improves cardiorespiratory fitness and endurance</td>
<td>Has been shown to improve cardiorespiratory fitness and endurance in athletes, but can be dangerous by increasing blood thickness and possibly forming blood clots. Has been linked to sudden death during sleep among European cyclists. NCAA lists erythropoietin as a banned substance.</td>
</tr>
</tbody>
</table>
Sports bars, shakes, and meal replacers may provide benefits

- The main energy source in most sports bars and shakes is carbohydrate, with protein and fat contributing smaller amounts of energy
- Convenient alternative, but more expensive than whole foods
  - Often include vitamins and minerals, which may be unneeded
Bulking Up on Protein to Bulk Up?

Table 11.8 Bulking Up on Protein to Bulk Up?

Probably one of the biggest dietary misconceptions related to fitness is that to bulk up your muscles, you need to bulk up the protein or amino acids in your diet. Although athletes need more dietary protein than less active folks, their diets are likely supplying more than enough to build muscle. Expensive protein supplements are not only unnecessary, but may actually provide undesirable results.

The following chart will help you separate fact from fiction:

<table>
<thead>
<tr>
<th><strong>Fact</strong></th>
<th><strong>Fiction</strong></th>
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<td><strong>You need weight-resistance training to build muscle mass.</strong>&lt;br&gt;The purpose of resistance training is to stress the muscle tissue so it increases its bulk. This is the only process that will result in increased muscle strength.</td>
<td><strong>Protein intake is more important than weight-resistance training to build muscle.</strong>&lt;br&gt;This is pure fiction, as regularly scheduled weight-resistance exercises are a key component to building muscle. No matter how much protein you consume, you won’t build muscle without proper training.</td>
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<td><strong>Consuming adequate daily calories, especially from carbohydrates and fat, are vital to building muscle.</strong>&lt;br&gt;A diet adequate in all three nutrients—carbohydrates, fat, and protein—is a muscle must! You need adequate carbohydrates and fats to fuel your workouts so that your dietary protein will be preserved to build and repair your muscles.</td>
<td><strong>There isn’t any downside to eating a lot of protein.</strong>&lt;br&gt;Excessive amounts of protein, beyond your daily calorie needs, will be stored as body fat. Also, excessive protein burdens the kidneys to excrete the excess nitrogen as urea in urine.</td>
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<td><strong>The best recovery snack after your workout is one that will supply both carbohydrates and protein.</strong>&lt;br&gt;Carbohydrates are needed for post-workout recovery to replenish your glycogen stores. Protein is also needed to aid in muscle repair and growth. Peanut butter on crackers with a glass of milk, yogurt and fruit, or chocolate milk all make excellent post-workout snacks.</td>
<td><strong>The protein and amino acids in supplements are more easily used by the body.</strong>&lt;br&gt;Your body doesn’t distinguish between sources of protein and amino acids, but your wallet does. A supplement can cost more than $25 for 12 servings. Whole foods not only provide all three nutrients needed to build muscle, but they are also less expensive than overpriced supplements.</td>
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<td><strong>For best results, your recovery snack or meal should occur within 30 to 45 minutes of your workout.</strong>&lt;br&gt;It’s a fact!</td>
<td><strong>It doesn’t matter when you eat after your workout.</strong>&lt;br&gt;Wrong again. Timing is everything, and waiting too long will diminish the body’s ability to use the newly consumed carbohydrate and protein for glycogen replacement and muscle repair.</td>
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"No Oven Needed " Energy Bars

No Oven Needed Energy Bars

Ingredients:
- 5 Tablespoons natural peanut butter
- 6 scoops chocolate whey protein (~130 grams protein)
- 1 cup dry oats
- 1 cup non-fat dry milk
- 1 teaspoon vanilla
- 1/2 cup water

Directions:
Spray an 8x8 inch baking dish with non-stick cooking spray. Mix oats, whey protein, and non-fat dry milk in a bowl. Stir in peanut butter (mixture will look crumbly and dry). Add water and vanilla to mixture and stir until it forms a dough. Spray a clean spatula with non-stick cooking spray and use it to spread dough in baking dish. Refrigerate for a few hours, then cut into squares. Wrap bars individually in plastic wrap and keep in refrigerator until you are ready to eat them!
Energy Bars: Are They Needed?

with

Joan Salge Blake