What Is Fitness and Why Is It Important?

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

Fitness has five basic components:

1. **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

2. **Muscle strength:** The ability of muscles to work against resistance

Continued…
What Is Fitness and Why Is It Important?

3. **Muscle endurance**: ability to exert force for a long period of time without fatigue
   - Muscle strength and endurance best achieved with weight training

4. **Flexibility**: range of motion around a joint
   - Improved with stretching

5. **Body composition**: proportion of muscle, fat, water and other body tissues which make up body weight
The Essentials of Fitness

• To be physically fit, you need to develop enough flexibility, muscle strength, muscle endurance, and cardiorespiratory endurance to allow yourself to meet the demands of everyday life with some to spare, and you need to have a reasonable body composition.

• Training
  • Regular practice of an activity
  • Leads to physical adaptations of the body with improvement in
    • Flexibility, strength, and endurance
Fitness provides numerous benefits:

- Overall health and physical fitness
- Reduces risk of cardiovascular disease and type 2 diabetes
- Improves body composition, bone health and immune system
- Improves sleep and reduces stress

Over half of adults in U.S. do not meet regular physical activity recommendations
What Does a 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 risk of heart disease, helps maintain healthy weight and improve body composition
Aerobic Exercise

- Aerobic activity improves cardiopulmonary endurance
- Best type of exercise to burn fat stores in the body is what?
How Does Cardiorespiratory Training Benefit the Heart?

- Cardiorespiratory endurance training enhances the ability of the heart and lungs to deliver oxygen to the muscles.
- The heart becomes stronger, breathing becomes more efficient, and the health of the entire body improves.
What Does a Fitness Program Look Like?

Weight 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.
How Does Weight Training Benefit Health and Fitness?

- Weight training offers health and fitness benefits to adults.
- Weight training reduces the risk of cardiovascular disease, improves mobility, and helps maximize and maintain bone mass.
- **Weight training – (anaerobic) not requiring oxygen**
## 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>55–90% of maximum heart rate</td>
<td>8–12 RM</td>
<td>Enough to develop and maintain range of motion</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>20–60 minutes, continuous or intermittent (minimum of 10-minute bouts)</td>
<td>8–10 different exercises performed in 1–3 sets</td>
<td>At least 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>Weight training</td>
<td>Stretching</td>
</tr>
</tbody>
</table>

Source: Adapted from American College of Sports Medicine. Position Stand: The Recommended Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness, and Flexibility in Healthy Adults. Medicine & Science in Sports & Exercise 30 no. 6 (June 1998). Used by permission of Lippincott Williams & Wilkins.
What Does a Fitness Program Look Like?

The **FITT Principle** can help you design a fitness program: frequency, intensity, time, type.

- **Rate of perceived exertion** (RPE) measures intensity of cardiorespiratory exercise.
- **Repetitions of maximum** (RM) refers to intensity of weight training.

*Dietary Guidelines for Americans* recommends at least 30 minutes of moderate-intensity physical activity most days for moderate health benefits.

- 60-90 minutes daily to lose weight effectively
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** increases.
  - Carbohydrate (glucose) and fatty acids broken down to yield ATP energy via aerobic metabolism
Aerobic Use of Glucose

- Aerobic activity:
  - Moderate physical activity, such as easy jogging, uses glycogen (storage form of glucose) slowly.
  - The person breathes easily and heart beats faster than at rest, but steadily.
  - Muscles get energy from both glucose and fatty acids (this conserves glycogen stores).
How Are Carbohydrate, Fat, and Protein Used During Exercise?

Carbohydrate is the primary energy source during high-intensity exercise.

- Carbohydrate through blood glucose (25gms) and stored glycogen in muscle (525gms) and liver (100gms): about 2 hours of exercise
- Well-trained muscles store 20-50% more glycogen than untrained muscles.
- Liver glycogen maintains normal blood glucose.
- Lactic acid is produced by the muscles at high exercise intensities and shuttled to other tissues.
Lactate

- **Lactate** is produced by the anaerobic breakdown of glucose during intense activity.
  - Lactate travels from muscles to liver where it is converted back to glucose.
  - When rate of lactate production exceeds the rate of clearance, intense activity can be maintained for only one to three minutes.

- **Lactic acid**
  - A compound produced during the breakdown of glucose during anaerobic metabolism
How Are Carbohydrate, Fat, and Protein Used During Exercise?

• Intensity affects how much glucose and glycogen you use
  • Glucose and glycogen use increases as intensity increases. Excess glucose stored as fat.

• How much carbohydrate do you need for exercise?
  • Depends on duration of activity
    • During and/or after activity: baked potatoes, bagels, corn flakes that are absorbed quickly
    • 2 hours before exercise: rice, oatmeal, pasta, corn enter blood more slowly for sustained energy
How Are Carbohydrate, Fat, and Protein Used During Exercise?

- Carbohydrate and fat contribute most of the energy needed for activity, while protein is best used to promote muscle growth and recovery.
Glucose use during physical activity depends on the duration of the activity and its intensity.

- First 10 minutes – glycogen used by muscles
- First 20 minutes of moderate activity – about 1/5 of available glycogen used up
- A person who exercises for longer than 20 minutes begins to use less glucose and more fat for fuel
Activity Duration Affects Glucose Use

- Glycogen depletion occurs after ~2 hours of vigorous exercise.
- After that, vigorous activity can continue for a short time as the liver converts lactate and some amino acids into glucose.
- Finally, hypoglycemia occurs which brings the nervous system almost to a halt, making intense activity almost impossible.
- This is what marathon runners call “hitting the wall.”
Carbohydrate Loading

Goal: to maximize storage capacity of muscle glycogen to improve endurance for events lasting >90 minutes
How Are Carbohydrate, Fat, and Protein Used During Exercise?

**Fat** is the primary energy source during low- to moderate-intensity exercise.

- Two forms: fatty acids (from triglycerides) in adipose tissue and muscle tissue
- Converting fatty acids into energy is slow and requires more oxygen compared with carbohydrate, which metabolizes more quickly
To Burn More Fat during Activity, Should Athletes Eat More Fat?

• “Spot Reducing” does not work; muscles do not own the fat that surrounds them.

• Fat cells release fatty acids into the blood for all the muscles to share.

• A tennis player has same fatfold measurement in both arms but one may have better-developed muscles than the other.
How Are Carbohydrate, Fat, and Protein Used During Exercise?

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 and from adipose.**
- **Well-trained muscles burn more fat than less trained muscles.**
- Body uses less glycogen for energy and more fat, which has the potential to increase endurance.
How much fat do you need for exercise?

- 25-30% of calories should come from fat
- Consume unsaturated fats and limit saturated and trans fats to ≤10% of total calories
- Too little fat (<20%) has nutritional risks
- It takes about 15 to 20 minutes of aerobic exercise for oxidation of fat for energy to occur.
How Are Carbohydrate, Fat, and Protein Used During Exercise?

- **Fat-burning zone**: 65-73% of maximum heart rate
- **“Cardio” zone**: >73% of maximum heart rate
- **MHR = 220 - Age**
- 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 can exercise longer with lower-intensity workout
Aerobic & Anaerobic Activities
How Are Carbohydrate, Fat, and Protein Used During Exercise?

- **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 - 1.4 g of protein/kg body weight.
- Resistance/strength activities: 1.6 - 1.7 g/kg body weight.
The body handles protein differently during activity than during rest.

The branched chain amino acids include: leucine, isoleucine, valine. Present in large amounts in skeletal muscle tissue. They can provide energy directly to that muscle tissue.
How Are Carbohydrate, Fat, and Protein Used During Exercise?

Eating before exercise

- Allow adequate time for digestion
- Large meal: 3 - 4 hours; smaller meals: 2 - 3 hours; snack or liquid supplement: ½ - 1 hour
Nutrients of Special Concern

- Active people who eat well-balanced meals do not need vitamin or mineral supplements.
- Vitamin E and iron will be discussed because many athletes take supplements and iron is special to female athletes.
- Excessive intake of niacin may impair performance because glycogen is depleted more rapidly, therefore, reducing endurance capacity.
What Vitamins and Minerals Are Important for Fitness?

- Minerals 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?

- Calcium: important to reduce risk of bone fractures
  - Calcium is lost in sweat.
  - Supplements not recommended unless food intake is inadequate
  - Calcium plays various roles in the body. It assists with blood clotting, hormonal activity and muscle contraction (especially the heart)
How Does Fluid Intake Affect Fitness?

- Fluid and electrolyte balance and body temperature affected by exercise
  - Water is lost through sweat and exhalation.
  - Sodium and chloride, and to lesser extent potassium, are electrolytes lost in sweat
    - Electrolyte imbalance can cause heat cramps, nausea, lowered blood pressure, edema
  - Evaporation of sweat helps cool body
    - Hot, humid weather reduces evaporation and body heat increases: increases risk of heat exhaustion and heat stroke
You need fluids before, during, and after exercise.

Table 11.6

ACSM Hydration Recommendations

<table>
<thead>
<tr>
<th>When?</th>
<th>How Much?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 to 3 hours before exercise</td>
<td>14–22 fluid ounces (2–3 cups)</td>
</tr>
<tr>
<td>5 to 10 minutes before exercise</td>
<td>4–8 fluid ounces (½–1 cup)</td>
</tr>
<tr>
<td>As tolerated</td>
<td></td>
</tr>
<tr>
<td>At 15- to 20-minute intervals after exercise has begun</td>
<td>6–12 fluid ounces (¾–1½ cups)</td>
</tr>
</tbody>
</table>

To replace sweat losses: consume 2-3 cups of fluid for every pound of body weight lost. (the amount of weight lost is due to losses in body water)
Some Beverages Are Better Than Others

- Sports drinks contain 6-8% carbohydrate and sodium and potassium: beneficial in long endurance events
  - For events <60 minutes, water is sufficient to replace fluids and food to replace electrolytes.
  - Sports drinks should be avoided as a daily beverage: damages tooth enamel and can provide unwanted calories (60 calories per cup)
- Not recommended during physical activity: fruit juice (carbohydrate concentration too high); carbonated drinks (can cause bloating); alcohol, caffeine: diuretics and side effects
- Water is the best drink for most physically active people, but endurance athletes need drinks that supply glucose as well as fluids.
Consuming Too Little or Too Much Fluid Can Be Harmful

- Thirst not a good indicator of fluid needs for athletes.
- **Acute dehydration**: when not adequately hydrated before strenuous exercise
- **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
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 regarding enhancement of performance
  - Improves high-intensity, short-duration activities (like weight training) that rely on anaerobic metabolism
Can Dietary Supplements Contribute to Fitness?

**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?

- **Anabolic steroids**: testosterone-based substances that promotes muscle growth and strength (anabolic effect)
  - Androgenic effect: hormone imbalance causes undesirable side effects in both men and women and **health risks** (liver cancer, severe acne, shrinkage of testicles in men)
  - May increase muscle mass but not muscle strength
  - Excess can cause acromegaly (tissues, bones, organs grow abnormally large)

- **Growth hormone**: little research on effects on athletic performance, results mixed
Can Dietary Supplements Contribute to Fitness?

- **Erythropoietin and blood doping:** to increase oxygen-carrying capacity of the blood
  - Can increase blood viscosity (thicken), increase risk of stroke and heart attack
- Sports bars, shakes, and meal replacements may provide benefits.
  - Convenient sources of carbohydrate and protein but more expensive than whole foods
  - May include extra amounts of vitamins and minerals not needed