15.5: Physical Exercise

Stroller Moms

These moms are setting a great example for their children by engaging in physical exercise. Adopting a habit of regular physical exercise is one of the most important ways to maintain fitness and good health. From higher self-esteem to a healthier heart, physical exercise can have a positive effect on virtually all aspects of health, including physical, mental, and emotional health.

What Is Physical Exercise?

**Physical exercise** is any bodily activity that enhances or maintains physical fitness and overall health and wellness. We generally think of physical exercise as activities that are undertaken for the main purpose of improving physical fitness and health. However, physical activities that are undertaken for other purposes may also count as physical exercise. Scrubbing a floor, raking a lawn, or playing active games with young children or a dog are all activities that can have...
fitness and health benefits, even though they generally are not done mainly for this purpose.

How much physical exercise should people get? In the United States, both the Centers for Disease Control and Prevention and the Surgeon General have recommended that every adult who is able should participate in moderate exercise for a minimum of 30 minutes a day. This might include walking, swimming, and/or household or yard work.

Types of Physical Exercise

Physical exercise can be classified into three types, depending on the effects it has on the body: aerobic exercise, anaerobic exercise, and flexibility exercise. Many specific examples of physical exercise (including playing soccer and rock climbing) can be classified as more than one type.

Aerobic Exercise

**Aerobic exercise** is any physical activity in which muscles are used at well below their maximum contraction strength, but for long periods of time. Aerobic exercise uses a relatively high percentage of slow-twitch muscle fibers that consume a large amount of oxygen. The main goal of aerobic exercise is to increase cardiovascular endurance, although it can have many other benefits, including muscle toning. Examples of aerobic exercise include cycling, swimming, brisk walking, jumping rope, rowing, hiking, and tennis.

Anaerobic Exercise

**Anaerobic exercise** is any physical activity in which muscles are used at close to their maximum contraction strength, but for relatively short periods of time. Anaerobic exercise uses a relatively high percentage of fast-twitch muscle fibers that consume a small amount of oxygen. Goals of anaerobic exercise include building and strengthening muscles, as well as improving bone strength, balance, and coordination. Examples of anaerobic exercise include push-ups, lunges, sprinting, interval training, resistance training, and weight training (such as biceps curls with a dumbbell, as pictured below).

![Figure 2: Pitting the biceps muscle in the upper arm against a heavyweight helps to build and strengthen](https://bio.liberextes.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_(Wakim_and_Grewal)/15%3A_Muscular_S...)
Flexibility Exercise

Flexibility exercise is any physical activity that stretches and lengthens muscles. Goals of flexibility exercise include increasing joint flexibility, keeping muscles limber, and improving the range of motion, all of which can reduce the risk of injury. Examples of flexibility exercise include stretching, yoga, and tai chi.

Health Benefits of Physical Exercise

Figure (PageIndex(3)): The U.S. Department of Health and Human Services (HHS) recommends that adults aged 18 to 64 engage in regular aerobic physical activity for 2.5 hours at moderate intensity (1.25 hours at vigorous intensity) each week. Moderate activities are those during which a person could talk but not sing. Vigorous activities are those during which a person could say only a few words without stopping for breath. When people exercise at 50 percent of the HHS guidelines, they gain an average of 1.5 years of life. Exercising at 100 percent of the HHS guidelines results in a gain of almost four years of life. The gain in life expectancy starts to level off at about 300 percent of the HHS guidelines. (CC BY-NC 3.0; US Government: NCI)

Many studies have shown that physical exercise is positively correlated with a diversity of health benefits. Some of these benefits include maintaining physical fitness, losing weight and maintaining a healthy weight, regulating digestive health, building and maintaining healthy bone density, increasing muscle strength, improving joint mobility, strengthening the immune system, boosting cognitive ability, and promoting psychological well-being. Some studies have also found a significant positive correlation between exercise and both quality of life and life expectancy. People who participate in moderate to high levels of physical activity have been shown to have lower mortality rates than people of the same ages who are not physically active. The years of life gained with different amounts of physical activity are shown in the graph in Figure (PageIndex(3)).

The underlying physiological mechanisms explaining why exercise has these positive health benefits are not completely understood. However, developing research suggests that many of the benefits of exercise may come about because of the role of skeletal muscles as endocrine organs. Contracting muscles release hormones called myokines, which promote tissue repair and the growth of new tissue. Myokines also have anti-inflammatory effects, which, in turn, reduce the risk of developing inflammatory diseases. Exercise also reduces levels of cortisol, the adrenal cortex stress hormone...
that may cause many health problems — both physical and mental — at sustained high levels.

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**Cardiovascular Benefits of Physical Exercise**

The beneficial effects of exercise on the cardiovascular system are well documented. Physical inactivity has been identified as a risk factor for the development of coronary artery disease. There is also a direct correlation between physical inactivity and cardiovascular disease mortality. Physical exercise, in contrast, has been demonstrated to reduce several risk factors for cardiovascular disease, including hypertension (high blood pressure), “bad” cholesterol (low-density lipoproteins), high total cholesterol, and excess body weight. Physical exercise has also been shown to increase “good” cholesterol (high-density lipoproteins), insulin sensitivity, the mechanical efficiency of the heart, and exercise tolerance, which is the ability to perform physical activity without undue stress and fatigue.

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**Cognitive Benefits of Physical Exercise**

Physical exercise has been shown to help protect people from developing neurodegenerative disorders, such as dementia. A 30-year study of almost 2,400 men found that those who exercised regularly had a 59 percent reduction in dementia when compared with those who did not exercise. Similarly, a review of cognitive enrichment therapies for the elderly found that physical activity — in particular, aerobic exercise — can enhance the cognitive function of older adults. Anecdotal evidence suggests that frequent exercise may even help reverse alcohol-induced brain damage. There are several possible reasons why exercise is so beneficial for the brain. Physical exercise:

- increases blood flow and oxygen availability to the brain
- increases growth factors that promote new brain cells and new neuronal pathways in the brain
- increases levels of neurotransmitters (such as serotonin), which increase memory retention, information processing, and cognition
Mental Health Benefits of Physical Exercise

Numerous studies suggest that regular aerobic exercise works as well as pharmaceutical antidepressants in treating mild-to-moderate depression. A possible reason for this effect is that exercise increases the biosynthesis of at least three neurochemicals that may act as euphoriants. The euphoric effect of exercise is well known. Distance runners may refer to it as “runner’s high,” and people who participate in the crew (as in the photo below) may refer to it as “rower’s high.” Because of these effects, health care providers often promote the use of aerobic exercise as a treatment for depression.

![Figure 4](https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_(Wakim_and_Grewal)/15%3A_Muscular_S…)

Additional mental health benefits of physical exercise include reducing stress, improving body image, and promoting positive self-esteem. Conversely, there is evidence to suggest that being sedentary is associated with an increased risk of anxiety.

Sleep Benefits of Physical Exercise

A recent review of published scientific research suggests that exercise generally improves sleep for most people, and helps sleep disorders, such as insomnia. Exercise is the most recommended alternative to sleeping pills for people with insomnia. For sleep benefits, the optimum time to exercise may be four to eight hours before bedtime, although exercise at any time of day seems to be beneficial. The only possible exception is a heavy exercise undertaken shortly before bedtime, which may actually interfere with sleep.

Other Benefits of Physical Exercise

Some studies suggest that physical activity may benefit the immune system. For example, moderate exercise has been found to be associated with a decreased incidence of upper respiratory tract infections. Evidence from many studies has found a correlation between physical exercise and reduced death rates from cancer, specifically breast cancer and colon cancer. Physical exercise has also been shown to reduce the risk of type 2 diabetes and obesity.
Variation in Responses to Physical Exercise

Not everyone benefits equally from physical exercise. When participating in aerobic exercise, most people will have a moderate increase in their endurance, but some people will as much as double their endurance. Some people, on the other hand, will show little or no increase in endurance from aerobic exercise. Genetic differences in slow-twitch and fast-twitch skeletal muscle fibers may play a role in these different results. People with more slow-twitch fibers may be able to develop greater endurance because these muscle fibers have more capillaries, mitochondria, and myoglobin than fast-twitch fibers. As a result, slow-twitch fibers can carry more oxygen and sustain aerobic activity for a longer period of time than fast-twitch fibers. Studies show that endurance athletes (like the marathoner pictured below) generally do tend to have a higher proportion of slow-twitch fibers than other people.

![Marathoner](CC BY 2.0; walknboston; via Wikimedia.org: Gashaw Asfaw. jpg)

There is also great variation in individual responses to muscle building as a result of anaerobic exercise. Some people have a much greater capacity to increase muscle size and strength, whereas other people never develop large muscles, no matter how much they exercise them. People who have more fast-twitch than slow-twitch muscle fibers may be able to develop bigger, stronger muscles because fast-twitch muscle fibers contribute more to muscle strength and have greater potential to increase in mass. Evidence suggests that athletes who excel at power activities (such as throwing and jumping) tend to have a higher proportion of fast-twitch fibers than do endurance athletes.
Can You “Overdose” on Physical Exercise?

Figure \(\PageIndex{6}\): New military recruits may suffer muscle damage from overexertion of unconditioned muscles. The drill instructor pictured here (in orange shirt) is doing his best to encourage these marine recruits to expend their maximum effort. (public domain; Marines; via wikimedia.org)

Is it possible to exercise too much? Can too much exercise be harmful? Evidence suggests that some adverse effects may occur if exercise is extremely intense and the body is not given proper rest between exercise sessions. Athletes who train for multiple marathons have been shown to develop scarring of the heart and heart rhythm abnormalities. Doing too much exercise without prior conditioning also increases the risk of injuries to muscles and joints. Damage to muscles due to overexertion is often seen in new military recruits (Figure \(\PageIndex{6}\)). Too much exercise in females may cause amenorrhea, which is a cessation of menstrual periods. When this occurs, it generally indicates that a woman is pushing her body too hard.

Many people develop delayed onset muscle soreness (DOMS), which is pain or discomfort in muscles that is felt one to three days after exercising and generally subsides two or three days later. DOMS was once thought to be caused by the buildup of lactic acid in the muscles. Lactic acid is a product of anaerobic respiration in muscle tissues. However, lactic acid disperses fairly rapidly, so it is unlikely to explain pain experienced several days after exercise. The current theory is that DOMS is caused by tiny tears in muscle fibers, which occur when muscles are used at too high a level of intensity.

Feature: My Human Body

Most people know that exercise is important for good health, and it’s easy to find endless advice about exercise programs and fitness plans. What is not so easy to find is the motivation to start exercising — and to stick with it. This is the main reason why so many people fail to get regular exercise. Practical concerns like a busy schedule and bad weather can certainly make exercising more of a challenge, but the biggest barriers to adopting a regular exercise routine are mental. If you want to exercise but find yourself making excuses or getting discouraged and giving up, here are some tips that may help you get started and stay moving:

- **Avoid an all-or-nothing point of view.** Don’t think you need to spend hours sweating at the gym or training for a marathon to get healthy. Even a little bit of exercise is better than nothing at all. Start out with ten or 15 minutes of moderate activity each day. Taking a walk around your neighborhood is a great way to begin! From there, gradually increase the amount of time until you are exercising to at least 30 minutes a day, five days a week.
• **Be kind to yourself, and reinforce positive behaviors with rewards.** Don’t be down on yourself because you are overweight or out of shape. Don’t beat yourself up because of a supposed lack of willpower. Instead, look at any past failures as opportunities to learn and do better. When you do achieve even small exercise goals, treat yourself to something special. Did you just complete your first workout? Reward yourself with a relaxing bath or other treats.

• **Don’t make excuses for not exercising.** Common complaints include being too busy or tired or not athletic enough. Such excuses are not valid reasons to avoid exercising, and they will sabotage any plans to improve your fitness. If you can’t find a 30-minute period to work out, try to find ten minutes, three times a day. If you’re feeling tired, know that exercise can actually reduce fatigue and boost your energy level. If you feel clumsy and uncoordinated, remind yourself that you don’t need to be athletic to take a walk or engage in vigorous house or yard work.

• **Find an activity that you truly enjoy doing.** Don’t think you have to lift weights or run on a treadmill to exercise your muscles. If you find such activities boring or unpleasant, you won’t stick with them. Any activity that increases your heart rate and uses large muscles can provide a workout, especially if you’re not in the habit of exercising, so find something you like to do. Do you like to dance? Put on some music and dance up a sweat! Do you enjoy gardening? Get out in the yard and dig up some dirt! Still not interested? Try an activity-based video game, such as Wii or Kinect. You may find it so much fun that it doesn’t seem like exercise until you realize you’ve worked up a sweat.

• **Make yourself accountable.** Tell friends and family members that you’re going to start exercising. You’ll be letting them — as well as yourself — down if you don’t follow through. Some people find that keeping an exercise log to track their progress is a good way to be accountable and stick to an exercise program. Perhaps the best way to keep at it is to find an exercise partner. If you’ve got someone waiting to exercise with you, you will be less likely to make excuses for not exercising.

• **Add more physical activity to your daily life.** You don’t need to follow a structured exercise program to increase your activity level. Do your house or yard work briskly for a workout. Park your car further than necessary from work or the mall, and walk the extra distance. If you live close enough, leave the car at home and walk to and from your destination. Rather than taking elevators or escalators, walk up and down stairs. When you take breaks at work, take a walk instead of sitting. Every time a commercial comes on while you’re watching TV, take a quick exercise break — run in place or do some curls with hand weights.

**Summary**

• Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health. Activities such as household chores may count as physical exercise, even if they are not done for their health benefits. Current recommendations for adults are 30 minutes a day of moderate exercise.

• Aerobic exercise is any physical activity that uses muscles at less than their maximum contraction strength, but for long periods of time. This type of exercise uses a relatively high percentage of slow-twitch muscle fibers that consume large amounts of oxygen. Aerobic exercises increase cardiovascular endurance and include cycling and brisk walking.

• Anaerobic exercise is any physical activity that uses muscles at close to their maximum contraction strength, but for short periods of time. This type of exercise uses a relatively high percentage of fast-twitch muscle fibers that consume small amounts of oxygen. Anaerobic exercises increase muscle and bone mass and strength, and they include push-ups and sprinting.

• Flexibility exercise is any physical activity that stretches and lengthens muscles, thereby improving range of motion and reducing the risk of injury. Examples include stretching and yoga.

• Many studies have shown that physical exercise is positively correlated with a diversity of physical, mental, and emotional health benefits. Physical exercise also increases the quality of life and life expectancy.

• Many of the benefits of exercise may come about because contracting muscles release hormones called myokines, which promote tissue repair and growth and have anti-inflammatory effects.

• Physical exercise can reduce risk factors for cardiovascular disease, including hypertension and excess body weight.
Physical exercise can also increase factors associated with cardiovascular health, such as the mechanical efficiency of the heart.

- Physical exercise has been shown to offer protection from dementia and other cognitive problems, perhaps because it increases blood flow or neurotransmitters in the brain, among other potential effects.
- Numerous studies suggest that regular aerobic exercise works as well as pharmaceutical antidepressants in treating mild-to-moderate depression, possibly because it increases the synthesis of natural euphoriant in the brain.
- Research shows that physical exercise generally improves sleep for most people and helps sleep disorders, such as insomnia. Other health benefits of physical exercise include better immune system function and reduced risk of type 2 diabetes and obesity.
- There is great variation in individual responses to exercise, partly due to genetic differences in proportions of slow-twitch and fast-twitch skeletal muscle fibers. People with more slow-twitch fibers may be able to develop greater endurance from aerobic exercise, whereas people with more fast-twitch fibers may be able to develop greater muscle size and strength from anaerobic exercise.
- Some adverse effects may occur if exercise is extremely intense and the body is not given proper rest between exercise sessions. Many people who overwork their muscles develop delayed onset muscle soreness (DOMS), which may be caused by tiny tears in muscle fibers.

Review

1. How is physical exercise defined?
2. What are the current recommendations for physical exercise for adults?
3. Describe aerobic exercise, and give examples of aerobic exercises.
4. How does anaerobic exercise differ from aerobic exercise, and what are some examples of exercises that are anaerobic?
5. Define flexibility exercise, and state its benefits. What are two examples of flexibility exercises?
6. In general, how does physical exercise affect health, quality of life, and longevity?
7. What mechanism may underlie many of the general health benefits of physical exercise?
8. Relate physical exercise to cardiovascular disease risk.
9. What may explain the positive benefits of physical exercise on cognition?
10. How does physical exercise compare with antidepressant drugs in the treatment of depression?
11. Identify several other health benefits of physical exercise.
12. Explain how genetics may influence the way individuals respond to physical exercise.
13. Can too much physical exercise be harmful?
14. Lifting very heavy weights for a short period of time is likely to:
   A. use a relatively high percentage of fast-twitch muscle fibers
   B. use a relatively high percentage of slow-twitch muscle fibers
   C. be an aerobic exercise
   D. use a large amount of oxygen
15. Walking quickly for an extended period of time is likely to:

   A. use a relatively high percentage of fast-twitch muscle fibers
   B. use a relatively high percentage of slow-twitch muscle fibers
   C. use muscles at close to their maximum contraction
   D. cause the muscles to use only a small amount of oxygen

Explore More
https://bio.libretexts.org/link?16813#Explore_More

Watch this fascinating TED talk to learn why some people find it more difficult to exercise than others, and what they can do to make it easier for them to adopt an exercise routine.

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