

# The Basics of Health, Wellness, and Fitness [Revised Edition]



# THE BASICS OF HEALTH, WELLNESS, AND FITNESS [REVISED EDITION]

JESSICA ALSUP

ROTEL (Remixing Open Textbooks with an  
Equity Lens) Project  
Fitchburg, Massachusetts



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Jessica Alsup is an Associate Professor of Exercise and Sport Science at Fitchburg State University. She has been teaching health, fitness, and wellness courses since 2013 in many formats, including in-person, asynchronous, and hybrid. As a professor of exercise science, Jessica is often teaching students to become future practitioners and thus spends a great deal of time covering theory and practice, but with health, fitness, and wellness courses, she has the opportunity to focus on teaching students how to apply health, fitness and wellness concepts and practices to their life. Over the years, she has developed a health, fitness, and wellness course that focuses on what health and wellness are, the components of wellness, the components of fitness, as well as stress, sleep, and self-care. Her aim is to teach a course that is geared toward the students learning about themselves, making positive health and wellness changes, as well as influencing future behaviors.

# PREFACE

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Before you begin enhancing your health, wellness, and fitness through chapters in this text, I want to make sure you know who this book is written for. This book is written for anyone who could benefit from learning more about health, wellness, and fitness. Throughout the following chapters, you will learn about health and wellness, setting goals, physical activity and exercise, cardiovascular fitness, muscular strength and endurance, body composition, flexibility, stress management, as well as self-care and sleep. If you have ever wondered about or had questions pertaining to any of these areas, this book is for you.

We all have our strengths and our weaknesses. I hope that in the following chapters, you can identify your strengths and areas for improvement and then utilize your goal-setting skills to do so.

I want to leave you with the following:

We are all dealt different hands in life, and we all have our history and our own experiences, but one thing we all have in common is that we can start now from wherever we are and make small changes to improve the various areas of health, wellness, and fitness.



# SEX AND GENDER IN THIS TEXT

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Please note that the terms gender and sex are used within this text. These terms are not used interchangeably. Please refer to the following definitions from the National Academies of Sciences, Engineering, and Medicine (2022).

## Sex

“**Sex** is a multidimensional construct based on a cluster of anatomical and physiological traits that include external genitalia, secondary sex characteristics, gonads, chromosomes, and hormones (National Academies of Sciences, Engineering, and Medicine, 2022).”

## Gender

“**Gender** is a multidimensional construct that links gender identity, which is a core element of a person’s individual identity; gender expression, which is how a person signals their gender to others through their behavior and appearance (such

as hairstyle and clothing); and cultural expectations about social status, characteristics, and behavior that are associated with sex traits (National Academies of Sciences, Engineering, and Medicine, 2022).”

Throughout this text there are a few instances where you will be asked to compare your fitness results to standardized norms. These norms are broken down by the female sex and the male sex. While there are well-known physiological differences across the sexes that lend themselves to these norms, this is arguably an overly simplistic view. In reality, the physiological differences that influence fitness and performance differences between individuals of the male sex and female sex are more of a continuum than two distinctly separate groups. The hormones that influence these physiological differences vary within females and within males.

When looking at these norms, understand that this is not necessarily your gender but your sex that you are being asked to select. Additionally, suppose you are in a position where you are transitioning to a different sex, and you have begun hormone replacement therapy. In that case, it may make the most sense to use the sex category that you are transitioning to.

With the above noted, once again, the purpose of this textbook is for you to learn more about your own personal wellness and fitness. It is of the utmost importance to approach these standards in a way that you feel comfortable with.

# LAND ACKNOWLEDGEMENT STATEMENT FOR THE ROTEL GRANT

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## Land Acknowledgement Statement for the ROTEL Grant

As part of ROTEL Grant's mission to support the creation, management, and dissemination of culturally-relevant textbooks, we must acknowledge Indigenous Peoples as the traditional stewards of the land, and the enduring relationship that exists between them and their traditional territories. We acknowledge that the boundaries that created Massachusetts were arbitrary and a product of the settlers. We honor the land on which the Higher Education Institutions of the Commonwealth of Massachusetts are sited as the traditional territory of tribal nations. We acknowledge the painful history of genocide and forced removal from their territory, and other atrocities connected with colonization. We honor and respect

the many diverse indigenous people connected to this land on which we gather, and our acknowledgement is one action we can take to correct the stories and practices that erase Indigenous People's history and culture.

## Identified Tribes and/or Nations of Massachusetts

### Historical Nations

- Mahican
- Mashpee
- Massachuset
- Nauset
- Nipmuc
- Pennacook
- Pocomtuc
- Stockbridge
- Wampanoag

### Present-Day Nations and Tribes

- [Mashpee Wampanoag Tribe](#)
- [Wampanoag Tribe of Gay Head Aquinnah](#)
- [Herring Pond Wampanoag Tribe](#)
- [Assawompssett-Nemasket Band of Wampanoags](#)

- [Pocasset Wampanoag of the Pokanoket Nation](#)
- [Seaconke Wampanoag Tribe](#)
- [Chappaquiddick Tribe of the Wampanoag Indian Nation](#)
- [Nipmuc Nation](#) (Bands include the Hassanamisco, Natick)
- [Nipmuck Tribal Council of Chaubunagungamaug](#)
- [Massachusetts Tribe at Ponkapoag](#)

At the time of publication, all links were active.

## Suggested Readings

[Massachusetts Center for Native American Awareness](#)

[A guide to Indigenous land acknowledgment](#)

[‘We are all on Native Land: A conversation about Land Acknowledgements’](#) (YouTube video)

[Native-Land.ca | Our home on native land](#) (mapping of native lands)

[Beyond territorial acknowledgments – âpihtawikosisân](#)

[Your Territorial Acknowledgment Is Not Enough](#)

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*This land acknowledgement is based on the land acknowledgement of the [Massachusetts] [Digital Commonwealth](#).*



1.

# HEALTH AND WELLNESS

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Figure 1: Scrabble game pieces spelling out “live well.”

Chapter Objectives

At the end of this chapter, the student should be able to...

1. define **health**.
2. define **wellness**.
3. distinguish between health and wellness.
4. explain the **dimensions of wellness**.
5. explain the difference between **controllable** and **uncontrollable** health factors.
6. explain what “**health disparities**” means.
7. define the phrase “**social determinants of health**.”
8. identify the five categories that the **social determinants of health** can be broken into.

## The Basics of Health And Wellness

In this chapter, we will be addressing **health** and **wellness**.

Consider how you use these terms. Do you use them interchangeably? Take a moment and write down (in your own words) how you would define each.



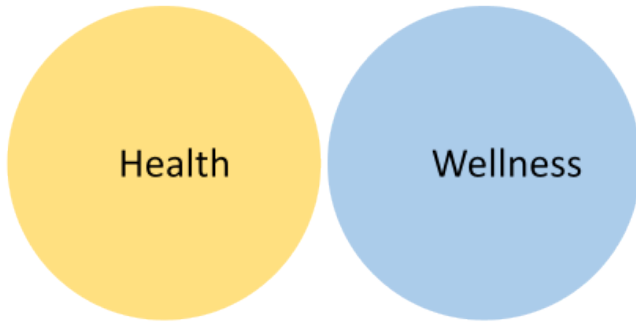


Figure 2: Health and wellness depicted as two separate circles.

A brief Google search will reveal numerous definitions of “health.” As recently as 2013, the Oxford Dictionary defined health as “the state of being free from illness and injury” (Brüssow, 2013). When we look at health through this lens, one would think that the only criteria for health is the lack of illness and/or injury. An arguably better and more holistic definition of health is probably this one from the World Health Organization (WHO). The WHO defines **health** as “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (World Health Organization, n.d.)” Through this lens, **wellness** would appear to be a component of health. It appears that many sources, including the Oxford online dictionary, have adapted this or similar definitions of health.



Figure 3: Health and wellness are depicted as circles overlapping.

But what is wellness? **Wellness** is a holistic compilation of dimensions that enhance one's quality of life and enable them to reach their full potential (Stoewen, 2015). While there are aspects of our health that we cannot control (more on this later on – see **Health Factors**), with **wellness**, we have some control over most aspects. Often, wellness influences our overall health. There are 8 **dimensions of wellness**, which include emotional wellness, physical wellness, occupational wellness, social wellness, spiritual wellness, intellectual wellness, environmental wellness, and financial wellness (Stoewen, 2015: 8 Dimensions of well-being).

## Dimensions of Wellness

1. **Emotional Wellness** – The ability to deal with stressors and the ups and downs of life in an effective and positive way (National Institutes of Health, n.d.).
2. **Physical Wellness** – the ability to care for one's physical body (Stoewen 2015). It includes physical activity, fitness, exercise, nutrition, substance use, and disease prevention (8 Dimensions of Well-being).
3. **Occupational Wellness**– Wellness surrounding your satisfaction with your career or job (8 Dimensions of well-being). This dimension can be linked to financial wellness (see below), but there are some other considerations as well. Beyond the financial implications of your job or the career you have, your happiness and well-being are important. Consider things like job satisfaction, job safety, and work-life balance. Occupational wellness can also be called vocational wellness (Stoewen, 2015).
4. **Financial Wellness**–The ability to live within your means, set goals, and plan for the future (Stoewen, 2015). There are two sides to financial wellness, including your income as well as the amount that you are spending. Just because one person makes more money than someone else does not mean they necessarily have a higher level of financial wellness, and vice versa.
5. **Intellectual Wellness** is the desire and ability to learn

and inquire (Stoewen, 2015). While traditional education is one way to achieve intellectual wellness, it is not the only way. Individuals with high intellectual wellness are lifelong learners (Stoewen, 2015). They are inquisitive, curious, and creative and use the resources available to them to expand their knowledge.

6. **Social Wellness**– Social wellness is having good interpersonal relationships (Stoewen, 2015). It has more to do with the quality of relationships than the quantity of them. Someone with a high level of social wellness will have positive relationships with friends, family members, and significant others. They will be able to depend on their social group when needed and be available for others when those others are in need.
7. **Spiritual Wellness**—Spiritual wellness is believing in something that gives your life value and meaning (Stoewen, 2015). It can be related to religion, but it does not need to be.
8. **Environmental Wellness**- Environmental wellness relates to the relationship one has with the environment around them and how it impacts health and well-being (Stoewen, 2015). You can look at this in a few different ways. One way relates to what your current environment provides, such as clean water and clean air, and another is how you care for your environment (for example: recycling).



Figure 4: The Eight Dimensions of Wellness[pb\_glossary] are named in this image. They are emotional wellness, physical wellness, occupational wellness, social wellness, spiritual wellness, intellectual wellness, environmental wellness, and financial wellness.

## Health Factors

Some factors that affect our health we can control, but there are others we cannot. For instance, we cannot control genetics, race and ethnicity, age, or sex. A genetic disorder is caused

by an abnormality that exists in someone's genetic material (Centers for Disease Control and Prevention, n.d). Additionally, some ethnicities are at an increased risk for certain diseases. Our risk of getting certain diseases also differs based on our biological sex and our age. There are still other **uncontrollable** influences on our health. For example, sometimes we are unknowingly exposed to harmful things in our environment. These environmental elements might include unknown pollutants in the air we breathe or the water we drink. There are also random events that can influence health and are out of our control—for example, injury or disability caused by extreme weather or the behaviors of others.

But there are also many aspects of health that we **can control**. For instance, we can choose to be more physically active, eat a more balanced diet, abstain from illicit drug use, smoking, and alcohol consumption, practice safe sex, surround ourselves with people who support us emotionally, and utilize safe online practices.

## Social Determinants Of Health

When addressing health factors, it is important to consider **health disparities**. This can be done by looking at the social determinants of health. According to the U.S. Department of Health and Human Services. (n.d.) “Social determinants of

health are the conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks.” The **social determinants of health** influence one’s **health** and **wellness**. Social determinants of health have been broken down into 5 domains, including healthcare access and quality, neighborhood and built environment, social and community context, economic stability, and education access and quality.

There are different ways the domains may influence health outcomes. Disparities within these domains can influence one’s exposure to various environments or situations that could impact health, level of vulnerability to certain health outcomes, and what the consequences of different conditions might be (U.S. Department of Health and Human Services, n.d.).



Before reading on, list the 5 domains of the **social determinants of health**, write down what you think each domain means, and how each of these 5 domains may influence someone’s health.

**Health care access and quality** – When thinking about

healthcare access and quality, you can think about your ability to receive proper medical treatment in a timely manner (U.S. Department of Health and Human Services, n.d.). You could look at this as related to your physical distance from a hospital in an emergency. Other factors that may influence health care include health insurance, financial means, and **health literacy**. The U.S. Department of Health and Human Services, (n.d.), defines **health literacy** from individual people as “the degree to which individuals have the ability to find, understand, and use information and services to inform health-related decisions and actions for themselves and others.” Organizational health literacy can also be “the degree to which organizations equitably enable individuals to find, understand, and use information and services to inform health-related decisions and actions for themselves and others (Centers for Disease Control and Prevention, n.d.).”

**Neighborhood and built environment**— When considering the neighborhood or built environment someone lives in, we can consider how safe the area is where someone spends the majority of their time (U.S. Department of Health and Human Services, n.d.). This can include where someone lives, works, plays, learns, worships, and more. From an activity point of view, is this a safe place to be active? Is there a high crime rate? Are there sidewalks or parks where people can walk, jog, or ride a bike? Is there crime in the area, making it unsafe to be outside? Additionally, we need to consider environmental exposures such as the air and water in the areas



we spend our time. According to the U.S. Department of Health and Human Services, (n.d.), individuals with low income, as well as racial and ethnic minorities, have a greater likelihood of living in places that pose safety and health risks.

**Social and community context** – Our overall well-being, health, and safety can also be positively or negatively impacted by our families (U.S. Department of Health and Human Services, n.d.). Individuals are influenced and affected in different ways by the choices, beliefs, and actions of their families. In addition to our families, we are impacted by other members of our communities in schools, places of worship, and beyond. Especially for children, adolescents, and young adults, having role models and a good support system can increase exposure to good, safe environments and decrease one's vulnerability to dangerous or unhealthy behaviors.

**Economic stability-** Economic stability can influence one's health when basic needs cannot be met (U.S. Department of Health and Human Services, n.d.). Beyond basic needs, economic stability can influence the likelihood that one will attend regular doctor's appointments and seek medical attention when necessary. Financial strain can additionally cause added stress that increases one's risk of various health outcomes.

**Education access and quality-** A higher education level is typically linked to higher income and better health (U.S. Department of Health and Human Services, n.d.). According to the U.S. Department of Health and Human Services, (n.d.),

Children who experience discrimination, have disabilities, or are from low-income households are more likely to struggle with math and reading and less likely to attend college or even graduate from high school. This is important to mention when discussing access to quality education, but there is also more to consider than just the relationship between education, income, and health. It is also important to consider how one's literacy influences health outcomes. Specifically, **health literacy** and information literacy are important when considering accessing health information and appropriate healthcare.

# Social Determinants of Health



Figure 5: The Social Determinants of Health are named in this image. They are Education Access and Quality, Health Care Access and Quality, Neighborhood and Built Environment, Social and Community Context, and Economic Stability.





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*can view them online here:*

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For more information on the **social determinants of health**, refer to the U.S. Department of Health and Human Services, (n.d.) [Healthy People 2023](#).

## Practical Application/ Laboratory Activities

### Complete the Wellness Assessment

- [Personal Assessment: 8 Dimensions of Wellness](#)

### Answer The Following Questions

1. Of the eight **dimensions of wellness**, select 3-4 that you identified as your strongest based on your personal wellness assessment.

Explain why you are strong in these areas.

2. Of the eight **dimensions of wellness**, select 3-4 that you identified as “needing improvement” based on your personal wellness assessment. Explain why these areas are more of a challenge for you. Brainstorm what you can do to strengthen these areas.

### Self-Reflection

According to the U.S. Department of Health and Human Services (n.d.), **social determinants of health** are the conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks.” In Chapter 1, the five domains related to social determinants of health were discussed. Share a time or situation where you, someone you know, or someone you heard of (no names or identifying information) was negatively impacted from a health standpoint due to a

factor that falls under one or more of these domains.

## Chapter Overview

In chapter one, you learned about health and wellness. Health is, as defined by the World Health Organization, “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (World Health Organization, n.d.),” and wellness is a holistic compilation of interconnected dimensions that all lead to increased quality of life and overall well-being (Stoewen 2015). The eight **dimensions of wellness** include emotional wellness, physical wellness, occupational wellness, social wellness, spiritual wellness, intellectual wellness, environmental wellness, and financial wellness. There are health factors that we can control and others that we cannot control. Additionally, it is important to consider **health**

**disparities.** This analysis of control of factors can be done by looking at the **social determinants of health.** According to the U.S. Department of Health and Human Services (n.d.), “Social determinants of health are the conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks.”

**Key Terms / Phrases:**

- **Health**
- **Wellness**
- **Dimensions of wellness**
- **Controllable health factors**
- **Uncontrollable health factors**
- **Health literacy**
- **Health disparities**
- **Social determinants of health**

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2.

# BEHAVIOR CHANGE

---



Figure 1: Hands holding change and a note that says “make a change.”

## Chapter Objectives

At the end of this chapter, the student should be able to...

1. define **self-efficacy**.
2. explain the concept of **locus of control**.
3. explain the **Stages of Change Model (Transtheoretical Model)** and how it would apply to physical activity.
4. understand the benefits of the **SMART goal design**.
5. develop their own **SMART goal**.

## The Basics of Behavior Change

In Chapter 1, we spent time talking about **health** and **wellness**. We all have areas of strength and areas in which we can use some improvement. Think back to the **dimensions of wellness** evaluation you took in Chapter 1. You likely scored high in some areas and not as high in others. That is completely normal and to be expected, but what if, now that you have the knowledge you obtained about yourself in chapter one, you want to make some changes? That is what we will begin doing in Chapter 2!

## Self-efficacy

**Self-efficacy** can be defined as “People’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances (Bandura, A. 1986)”. In other words, **self-efficacy** is the belief we have in ourselves in regard to a given goal or situation. One’s belief in their ability to make a change will impact whether the change is made. Albert Bandura’s **Self-Efficacy Theory** has been applied in numerous contexts, including those related to psychology, health, athletics, politics, business, and education (Artino, 2012).



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Albert Bandura’s **Self-Efficacy Theory** explains how individuals perceive their ability to perform specific behaviors. Based on the theory, self-efficacy can be enhanced or hindered by past performance, vicarious experience, social persuasion, and physiological state (Pekmezi et al. 2009). Past performance

is suggested to have the largest impact on self- efficacy. For example, past successes or failures greatly influence your self- efficacy about the same or a similar situation or event.



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## Exercise

Take a moment to think about how past performance, vicarious experience, social persuasion, and physiological state might influence your **self-efficacy** for making a behavior change.

## Locus of Control

When discussing behavior change, it is important to understand the notion of locus of control. **Locus of control**

pertains to how an individual perceives their personal level of control or lack thereof over situations (Fahey et al., 2020). For example, a person with a strong internal **locus of control** would take personal responsibility for outcomes, both good and bad, while an individual with a strong external **locus of control** may believe how things end up is largely out of their control. Another way to look at the difference is that someone with a strong internal locus of control views themselves as making things happen, while someone with an external locus of control would view things as happening to them or being a result of fate.

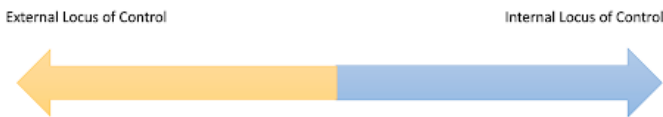


Figure 2: This image shows two types of control along a continuum:  
External Locus of Control on the left and Internal Locus of Control on the right.

Take a moment to think about where you are on this continuum! Do you have a more internal or

external **locus of control**? Think of a situation in which having an internal locus of control would be beneficial. Why?

Can you also think of when an external locus of control could be beneficial? Why? Which do you think would be more beneficial for behavior change?

## Stages Of Change Model

In order to change our behavior, we have to move from where we are now to where we want to be! The Transtheoretical Model, also referred to as the **Stages of Change Model**, is one tool we can use to do this. It can also be used across any number of behaviors. The model is broken down into five stages, including pre-contemplation, contemplation, preparation, action, maintenance, and termination (Fahey et al., 2020).

**Precontemplation-** In this stage, the benefits of change do not outweigh the downsides (pros do not outweigh the cons) (Fahey et al., 2020). At this point, a person has no intent to make a behavior change. People can remain in

precontemplation for a long time, or even forever if they never move any closer to making the behavior change. In this stage, a person may not be aware of the need to change. They could be in denial, or they just have no desire to change. For example, someone may know that being active is important for their health, but for them, the benefits of being active do not outweigh the downsides (this could include time, discomfort, etc.).

**Contemplation**– In this stage, people begin to see that the benefits of change may outweigh the downsides of change (Fahey et al., 2020). Individuals at this stage will begin to think about making the change, but they are likely not completely sure how to proceed to overcome barriers. Someone in this stage might be planning to make a change within the next six months. Or individuals may start gathering the resources they need in order to make the desired change. For example, if someone is looking to begin exercising, they may schedule an appointment with their physician, look into purchasing appropriate footwear, and possibly seek out access to a fitness center.

**Preparation**– In this stage, people are within a month of taking complete action (Fahey et al., 2020). In addition to preparing to begin, individuals may be actively making attempts. Perhaps the ultimate behavior they would like to achieve is walking three days a week. At this point, they may have gone for a walk! So, while they are not completely

participating in the behavior (three walks a week), they are taking small steps in that direction.

**Action-** In this stage, the benefits clearly outweigh the downsides (pros outweigh the cons), and the individual is taking action. They have started to make the change and are committed to it (Fahey et al., 2020). It is important to note that it is not impossible or even unlikely that someone relapses. It often takes many attempts to make a behavior change.

**Maintenance-** Maintenance is achieved when a person has made the behavior change and stuck with it for a minimum of six months (Fahey et al., 2020). Based on the previous examples, they have been walking three times a week for the past six months.

**Termination**– At this stage, the behavior has become a part of the person’s lifestyle, and they are unlikely to relapse (Fahey et al., 2020).

**Relapse – relapse is not one of the stages, but it is important to address** – it is not uncommon for someone to fall back to a previous stage. For example, if someone is exercising 3 days a week, they may suddenly stop doing that. It is important to acknowledge the relapse but not dwell on it, and move forward with the behavior change. Fahey et al. (2020) suggest forgiving yourself, giving yourself credit for what you have accomplished, and moving forward.



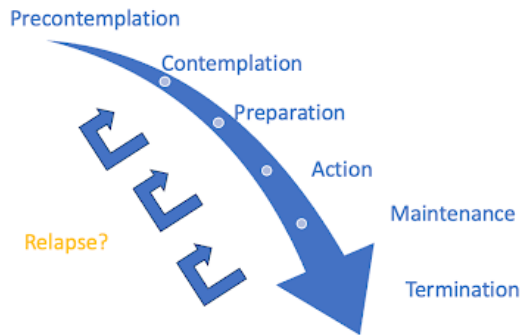


Figure 3: This image shows the Transtheoretical Stages of Change model with the five stages, including pre-contemplation, contemplation, preparation, action, maintenance, and termination as well as the potential for relapse at any stage.

## Smart Goal

As mentioned above, relapses with behavior changes are common. Often, goals are too vague. One way to make success more likely is to design a goal that meets the **SMART** criteria. **SMART** criteria include making sure a goal is specific, measurable, attainable, realistic and time-frame specific (Fahey et al., 2020).

## SMART

**S stands for specific.** Specific means that someone's goal needs to clearly state what they want to achieve. For example, saving money is vague, while saving \$100 is more specific. Saving \$100 a week by not eating out is even more specific.

**M stands for measurable.** People need to be able to measure their progress. For example, dollars, pounds, and time are all easily measurable. They can measure the money they save by counting the dollars they have.

**A stands for attainable.** People need to be capable of doing what is needed to succeed. For example, do they have access to the resources they will need to achieve this?

**R stands for realistic.** People need to make sure their expectations are not too big to start. For example, if they want to save money, they should make sure the amount they are looking to save per month is within reason for their current income.

**T stands for time-frame specific.** People should consider how long (start to end) they are giving themselves to achieve this goal. For example, they may want to have \$400 dollars put into a savings account by the end of the month. They should make sure the time-frame is something that makes sense based on their circumstances and the goal.

### Practical Applications/Laboratory Activities

We all have areas of strength and areas that we can improve on. We are all a work in progress.

Take a moment and think back to the wellness assessment you completed in Chapter 1. Based on this assessment, make a list of at least 3 behaviors you think you do well, and at least three things you think you could improve upon.

Think about the behaviors you listed under “needs

improvement.” Select one that you want to start working towards improving now! This will be your target behavior. For the purpose of this assignment, the behavior you select to improve needs to promote health and wellness. For example, maybe your target behavior may relate to improving physical health by adding something like physical activity or trying to quit a habit like smoking. Your target behavior could also be linked to other areas of wellness. Maybe you want to increase the amount of money in your bank account, improve your grades, meet new people, or decrease your stress level. If you are not sure if your behavior change can be linked to health or wellness, scroll back to Chapter 1 and refresh your memory!

### **Target Behavior:**

Now, turn the target behavior into a **SMART** goal! Remember, a SMART goal needs to meet the following criteria. It needs to be Specific, Measurable, Attainable, Realistic, and Time-Frame Specific.

### **Smart Goal:**

Use the attached worksheet to make sure your SMART goal meets all the SMART criteria!

Note: your **SMART goal** should be aimed at improving wellness. For example, it is fine if someone wants to reach a certain level of a video game, but that doesn't meet the criteria for this assignment. Think back on your dimensions of wellness. If your goal can fit into one of these categories, you're likely on the right track. If you are not sure if your goal fits this criteria, please check with your course instructor.

### [SMART GOAL Worksheet](#)

#### **Self Reflection**

##### **Weekly Journal**

Now that you have developed a **SMART goal**, it is time to try to achieve it! Moving forward, you should reflect weekly on your progress. Each goal reflection entry should include

1. Your **SMART goal**.
2. The dates you are covering with your

reflection.

3. A reflection on your SMART goal behavior, such as

- What progress have you been making?
- What changes are you making to be successful?
- Have you encountered any barriers?
  - If so, were you able to overcome them?
    - If so, what strategies did you try? What worked?
  - If not, what might work in the future if you are faced with the same, or a similar barrier?
- Include anything else you want to in your reflection.

Note: There is no shame in barriers or relapse. The goal on reflection is to see your

improvement over time, and learn from barriers and relapses.

## Chapter Overview

In Chapter 2, you learned about behavior change, attributes that influence behavior change, the **Stages of Change Model** for behavior change, and how to develop **SMART goals**. Both one's **self-efficacy** and **locus of control** can influence one's likelihood of success with behavior change. Self-efficacy is the belief we have in ourselves in regard to a given goal or situation. Self-efficacy is influenced by past performance, vicarious experience, social persuasion, and physiological state (Pekmezi et al. 2009). An individual's locus of control can influence how likely they are to make a behavior change. Someone with a more internal locus of control feels as though they have control over outcomes while an individual with a high external

locus of control believes that end results are largely out of their control (Fahey et al., 2020). The

**Transtheoretical Stages of Change Model** is

broken down into 4 stages including

precontemplation, contemplation, action, and

maintenance (Fahey et al., 2020) . When making

changes, we work from one stage to the next.

Finally, in Chapter 2 we discussed **SMART goals**.

One way to make success more likely with behavior

change is to design a goal that meets the SMART

criteria. SMART criteria include making sure a goal is

specific, measurable, attainable, realistic (Fahey et

al., 2020), and time-framed.

### **Key Terms/ Phrases:**

- **self-efficacy**
- **locus of control**
- **Stages of Change Model**
- **SMART goal**

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### 3.

# PHYSICAL ACTIVITY, EXERCISE, AND FITNESS

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Figure 1: This image depicts six individuals participating in different forms of physical activity.

## Chapter Objectives

At the end of this chapter, the student should be able to...

1. define **physical activity**.
2. understand the benefits of **physical activity**.
3. define **exercise**.
4. be able to explain the difference between physical activity and exercise.
5. understand how much physical activity/exercise is recommended.
6. define **fitness**.
7. identify and define the 5 **health-related components of fitness**.
8. identify and define the 6 **skill-related components of fitness**.

# The Basics of Physical Activity, Exercise, And Fitness

## Physical Activity And Exercise

Consider how you use these terms. Take a moment and think about how you would define the term “**physical activity**?”

How would you define the term “**exercise**?” How are the two the same, and how are they different?

The terms **physical activity** and **exercise** are often used interchangeably, but there are some important differences. The American College of Sports Medicine (ACSM, 2013) defines “physical activity” as “any bodily movement produced by the contraction of skeletal muscles that results in a substantial increase in caloric requirements of resting energy expenditure (ACSM, 2013).” On the other hand, they define “exercise” as “a type of physical activity consisting of planned, structured, and repetitive bodily movement done to improve or maintain one or more of the components of physical fitness (ACSM, 2013).”

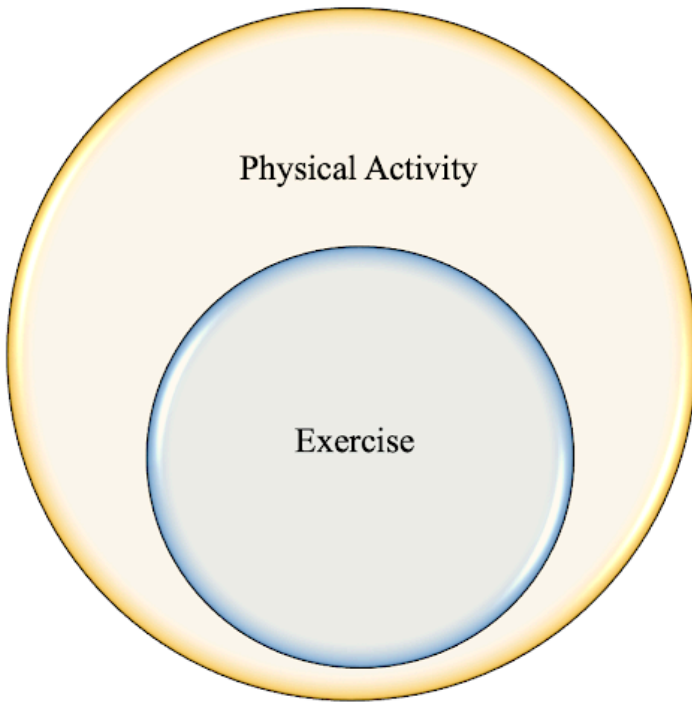


Figure 2: This image depicts exercise as fitting within physical activity and suggests that all exercise is physical activity but not all physical activity is exercise.

Based on these definitions, any form of exercise is physical activity but not all physical activity is exercise. What makes something exercise instead of physical activity is largely based on the intent. For example, if you go for a hike because you are an avid nature lover, that activity is more along the lines of physical activity, but if you go on a hike because you are trying to improve or maintain your **cardiovascular endurance**

(more to come on that), or get a specific number of steps in, or expend a certain amount of energy, then that activity is also exercise! There are activities we might do for enjoyment or work that cause muscle contractions and a substantial increase in energy expenditure that are not exercise. For example, splitting wood, construction, or shoveling snow are all examples of physical labor that would fall under physical activity and would not be considered exercise.

## Fitness

According to the ACSM (2013), **physical fitness** is “a set of attributes or characteristics that individuals have or have achieved that relates to their ability to perform physical activity.” Above, you learned that exercise differs from physical activity because, with exercise, you are specifically aiming to improve or maintain an area of physical fitness. These “areas” or components can be grouped into **health-related components of fitness** and **skill-related components of fitness**.

## Components Of Fitness

We will discuss the five **health-related components of fitness** and the six **skill-related components of fitness**. The health related components are the components of fitness that

are important in order to maintain health. The **health-related components of fitness** include **cardiovascular fitness**, **muscular strength**, **muscular endurance**, **flexibility**, and **body composition** (ACSM, 2013). Your **skill-related components of fitness** are aspects of fitness that will benefit you from a sport or athletic standpoint but are not considered essential for optimal health. **Skill-related components** of fitness include agility, coordination, balance, power, speed, and reaction time (ACSM, 2013). In the following section, each component of fitness is defined and explained. Throughout subsequent chapters, each of the health-related components will be discussed in greater detail and assessed.

## Health-Related Components of Fitness

The health-related components are the components of fitness that are important aspects of health. The **health-related components of fitness** include **cardiovascular fitness**, **muscular strength**, **muscular endurance**, **flexibility** and body composition (ACSM, 2013). It is important to note that while you need these components of fitness for general health, that does not mean we all must achieve high levels of fitness in these areas to maintain health. For example when we talk about cardiovascular fitness, you can have a sufficient cardiovascular fitness level in order to maintain health, but you don't have to be a marathon runner. Similarly, **flexibility** is important for

overall health and wellness, but you don't need to have dancer- or gymnast-level flexibility to have enough for health. With that said, having a high or superior level of fitness in any of these areas is great, if that's what you want to do!

1. **Cardiovascular Fitness**– The ability of the body to transport oxygen.
2. **Muscular Strength**– The ability of skeletal muscles to overcome resistance.
3. **Muscular Endurance**– The ability of skeletal muscle to resist fatigue.
4. **Body Composition**– The ratio of fat vs fat free mass.
5. **Flexibility**– The available range of motion at a joint.

(ACSM, 2013; Porcari et al., 2015)

Brainstorm some activities you could participate in that would help you improve your level of fitness in each area.

Moving on in this text, each of the above levels of fitness will be addressed in detail. You will have the opportunity to assess your current level of fitness in each area, allowing you



to determine both your strengths and areas of improvement, and learn what you can do to either maintain or improve your current levels of fitness.

## Skill Related Components of Fitness

**Skill related components of fitness** are those that are not necessary for optimal health, but are often important in sport and athletic endeavors. For example your overall speed does not impact health, but it is important in many sports.

1. **Speed** – The ability to move quickly from one point to another.
2. **Agility** - The ability to move quickly with changes in direction and/ or other movements.
3. **Power** – The ability to overcome a force at speed.
4. **Coordination** – The ability to move with control and accuracy.
5. **Balance** – The ability to maintain equilibrium when stationary or moving.
6. **Reaction Time** – The time it takes to respond to a stimulus.

(ACSM, 2013; Porcari et al., 2015)

## Physical Activity / Exercise Recommendations

When we talk about how much exercise someone should get, we need to consider the goal of the individual. For example, if someone wants to be a high level athlete, they are going to need to commit more time to exercise than someone who is not. The time commitment could also look different if weight loss is a goal vs. exercise for health. For now, we will just talk about general recommendations for a healthy lifestyle. According to the ACSM (2013), adults between the ages of 18-65 who are healthy, should at least participate in 150 min (example: 30 min/ 5 times a week) of moderate intensity aerobic (think exercise that raises your heart rate and breathing rate) a week or participate in 60 min (20 min/ 3 times a week) of vigorous exercise. In subsequent chapters we will address determining intensity!

Before we move on to other minimum recommendations, it is also important to note that if it is not possible to complete your aerobic exercises all in one 30 min or 20 min session that is ok. You can break the exercise time down into multiple 10 minute sessions (or shorter if necessary). The end goal should be to complete them in one session, but remember, in the absence of contraindications, something is always better than nothing!

NOTE: Sometimes there is too much of a risk for someone

to exercise. The term contraindication is used if the risk is greater than the benefit. This is why health screening is important! You will be completing a PARQ (physical activity readiness questionnaire below).

The ACSM (2013) recommends all adults participate in activities that increase **muscular strength** and/or endurance two to three times a week. Activities that would fall in this category would be weight training exercises like lifting weight, using resistance bands, or body weight resistance exercises. It is important to note that 48 hours rest should be given between resistance training in the same muscle group (ACSM, 2013). We will go into more detail on muscular strength and endurance in chapter 6. Finally, the ACSM also recommends participating in flexibility type activities two to three times a week. Examples include stretching and yoga. More information on flexibility can be found in chapter 7.

Again, it is important to remember that the above recommendations are just the minimum guidelines. Many people have goals that may require them to do more than minimum, but for your general health/ wellness you should aim to at least complete the above. It is also important to note that it is ok to build up to these recommendations, and that doing something is always better than doing nothing! So start where you are, and where you are comfortable.

While most people are healthy enough to meet these minimum recommendations, it is never a bad idea to check with your doctor. Below is a PAR-Q (Physical Activity

readiness questionnaire). It is important that you complete this form truthfully and completely before you begin any physical activity in this class! Not often, but sometimes, people have contraindications to exercises. Meaning because of an acute or chronic condition they have it may not be safe for them to participate in certain types of physical activity.

## Benefits of Physical Activity / Exercise:

There are many benefits to being physically active. The figures below (from the center for disease control and prevention, CDC) outline benefits of being physically active for adults, children, and older adults (65 and older). More specifics about these benefits can be found at the following CDC webpage.

[Health Benefits of Physical Activity for Adults](#)

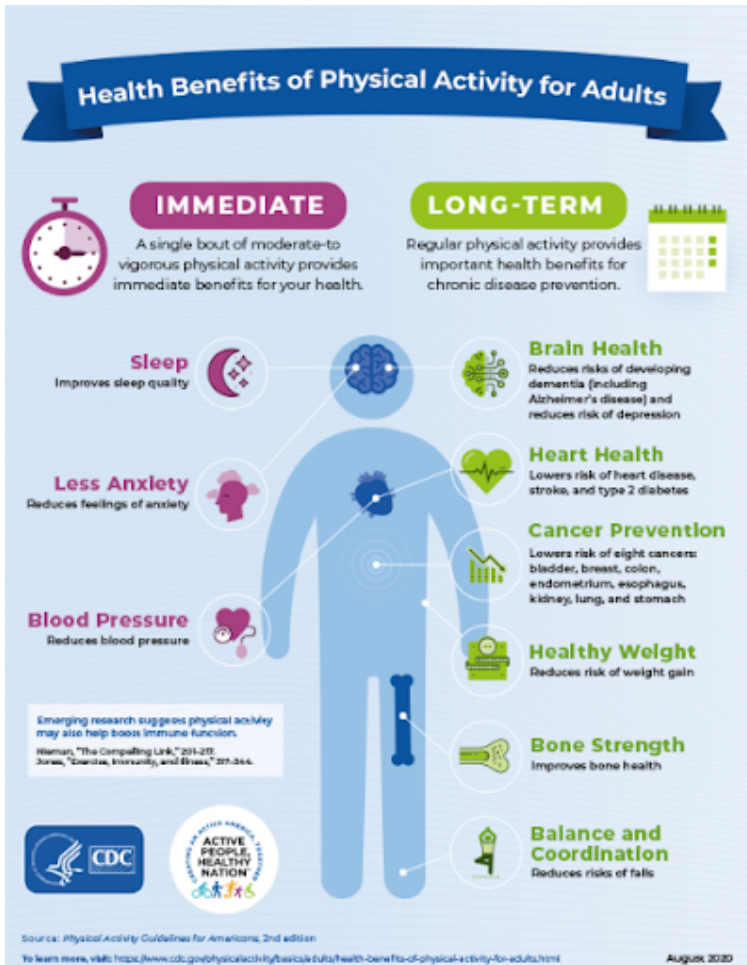


Figure 3: This image explains the health benefits of physical activity for adults (64 and under). Benefits are broken down into immediate and long-term benefits. The immediate benefits include improved sleep, reduced anxiety, and reduced blood pressure. Long term benefits include reduced risks of developing depression, dementia, heart disease, stroke, type 2 diabetes, 8 different cancers ( bladder, breast, colon, endometrium, esophageal, kidney, lung and stomach), reduced risk of weight gain, and falls. Physical activity also

improves bone health.

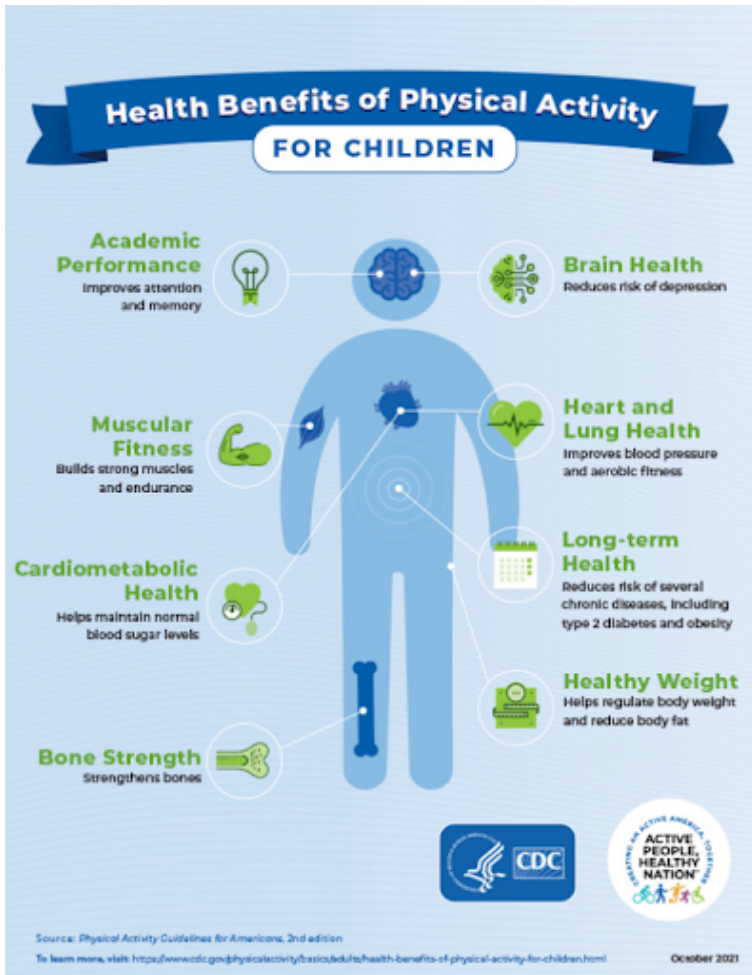


Figure 4: This image explains the health benefits of physical activity for children. Benefits include improved attention and memory, muscular strength and endurance, blood sugar levels, bone strength, aerobic fitness, blood pressure, and reduces the risk of depression, and chronic diseases such as obesity and type 2 diabetes. Additionally, physical activity helps to regulate body weight and reduce body fat.

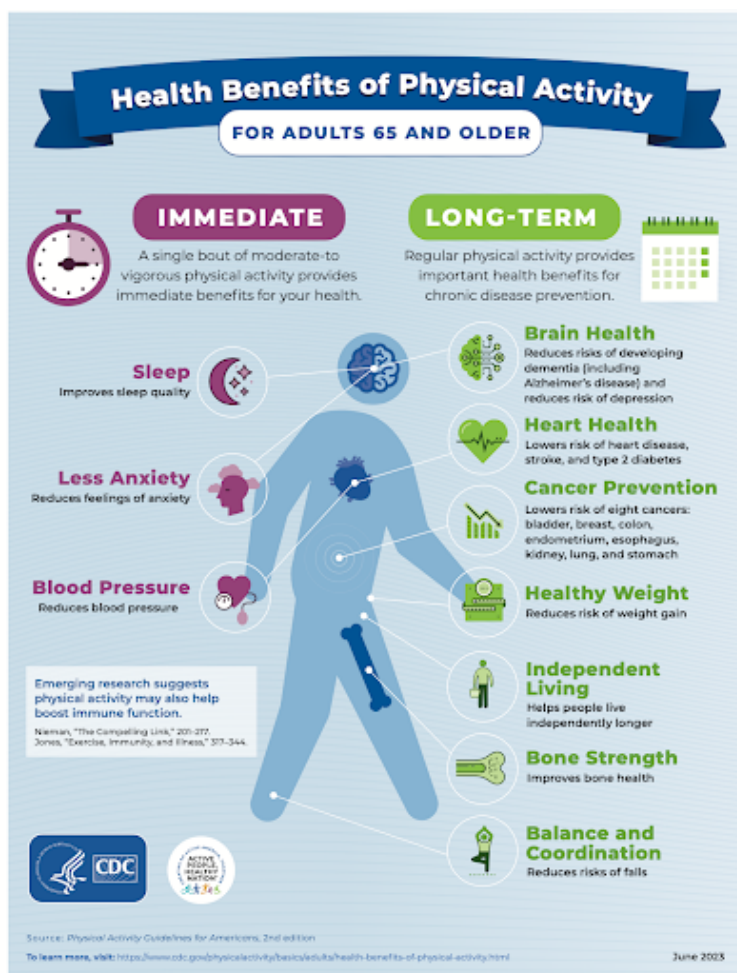


Figure 5: This image explains the health benefits of physical activity for older adults (65 and over). Benefits are broken down into immediate and long-term benefits. The immediate benefits include improved sleep, reduced anxiety, and reduced blood pressure. Long-term benefits include reduced risks of developing depression, dementia, heart disease, stroke, type 2 diabetes, eight different cancers ( bladder, breast, colon, endometrium, esophageal, kidney, lung, and stomach), and reduced risk of weight gain, and improves



bone health. In addition, physical activity reduces the risk of falls and helps older individuals live independently longer.



Using the CDC images above and the link provided, take a moment and note the benefits of physical activity that you were aware of and those that you were not aware of before today.

[Health Benefits of Physical Activity for Adults](#)

## Practical Applications/ Laboratory Activities

Complete the following Physical Activity Readiness Questionnaire (PAR-Q). Moving forward, some laboratory activities will require you to be physically active. It is important that you first make sure it is safe for you to do so at this time

[2023 PAR-Q+: The Physical Activity Readiness  
Questionnaire for Everyone](#)

### **Self Reflection**

Complete: Barriers to Being Active Quiz

[Barriers to Being Active Quiz](#)

Reflect on your results.

1. What (if any) potential barriers did you score a 5 or more in? If you did not receive a 5 or more in any area, select the two categories in which you scored the highest.
2. Why do you think these categories pose the greatest challenge/ barrier for your becoming physically active?
3. What can you do to overcome the barriers (listed in question 1)?
4. Which potential barriers do not seem to be barriers for you at all? Why aren't these barriers?

## Chapter Overview

In Chapter 3, you learned about physical activity, exercise, and fitness. The ACSM (2013) defines *physical activity* as “any bodily movement produced by the contraction of skeletal muscles that results in a substantial increase in resting energy expenditure (ACSM, 2013).” They define *exercise* as a type of physical activity consisting of planned structures and repetitive bodily movement done to improve or maintain one or more of the components of physical fitness (ACSM, 2013). Fitness is defined as “the ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure-time pursuits and meet unforeseen emergencies (ACSM, 2013).” There are different areas of fitness, which means you can have a high level of fitness in one area and not as high of a level in another area. There are five health-related components of fitness, including cardiovascular fitness, muscular strength, muscular endurance, flexibility, and body composition (ACSM, 2013). Additionally, there are six skill-related components of fitness. Skill-related components of fitness include

agility, coordination, balance, power, speed, and reaction time. In Chapter 3, you also learned about minimum recommendations for physical activity/exercise. More specifics related to exercise can be found in Chapters 5, 6, and 7.

**Key Terms / Phrases:**

- **Physical Activity**
- **Exercise**
- **Physical Fitness**
- **Health-related Components of Fitness**
- **Muscular Endurance**
- **Muscular Strength**
- **Flexibility**
- **Body Composition**
- **Cardiovascular Endurance**
- **Skill-Related Components of Fitness**
- **Power**
- **Speed**
- **Reaction time**
- **Balance**
- **Coordination**
- **Agility**

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- Light bulb

## 4.

# NUTRITION

---



Figure 1: This image shows a wide variety of whole foods, including fish, poultry, vegetables such as carrots, radishes, beans, broccoli, cauliflower, asparagus, green beans, and various leafy greens, as well as nuts, milk, fruit, pasta, bread, and other grains.

### Chapter Objectives

At the end of this chapter, the student should be able to...

1. define nutrients.
2. explain the difference between **essential** and **non-essential** nutrients.
3. understand what a **calorie** is (and what it isn't).
4. list and give examples of each **macronutrient**.
5. list and give examples of each **micronutrient**.

## The Basics of Nutrition

Nutrition is a hot topic. You are likely inundated with nutrition advice regularly whether you want it or not. In this chapter, we will go over the basics of nutrition, but there is so much more that you can learn about the topic. After this chapter, if you are interested in learning more about nutrition, please make sure you are getting your information from reliable sources and from credentialed individuals. While this applies to any advice related to your health and well-being, the author believes it is of particular importance in regard to nutrition. There are many people on social media, as well as

those you meet in person, who give nutritional “advice” and “diet recommendations.” However, they may not have the education or background in these areas. When looking for information, it is important that you are getting the information from a reliable source. A dietitian is an expert in the field of nutrition, which is the science of food (Fahey et al., 2020). In this chapter, we will be covering nutrients, both **essential** and **non-essential**, **macro-** and **micronutrients**, and very general recommendations. Specific diets are beyond the scope of this chapter, though some general information and warnings about “**fad diets**” and also a video link will be provided to yield some “general information” regarding what “diets” are.

## Nutrients

Nutrients are defined by Morris and Mohiuddin (2023) as “chemical substances required by the body to sustain basic functions and are optimally obtained by eating a balanced diet” (Morris & Mohiuddin, 2023). There are roughly 50 different nutrients (Kumar et al., 2017 ). These nutrients can be broken down into **essential nutrients** and **non-essential nutrients**. The majority of nutrients are essential nutrients. **Essential nutrients** are nutrients that we need to consume because we cannot make sufficient quantities fast enough or at all on our own (Fahey et al., 2020). **Non-essential nutrients** are nutrients that the body can make on its own (Kohlmeier,



2015). It is important to note that being able to make a nutrient on our own does not mean that the amount of the nutrient produced will cover an individual's needs for that nutrient (Kohlmeier, 2015). The terms **essential nutrients** and **non-essential nutrients** do not distinguish which nutrients are more important, but rather the nutrients we can make ourselves (non-essential) vs. the ones that we cannot make ourselves (essential). We need to prioritize the consumption of the essential nutrients. This is not to say that it is not ideal to consume nonessential nutrients as oftentimes we do not get to make enough of them. Vitamin D is a non-essential nutrient that people are often deficient in.

## Calories

Think about the term “**Calorie**.” When you hear the term, what do you think about? What immediately comes to mind? Does the term illicit feelings? Does it have a negative or positive connotation for you, or neither?

A kilocalorie can be defined as “The amount of heat needed to raise the temperature of 1L of water by 1°C” (Kent, 2007). The term “**Calorie**” that you see on food labels is actually a name for kilocalorie. A kilocalorie is 1,000 calories. The use of “Calorie” is so commonly used in place of kilocalorie, moving forward in this text, we will use the term “Calorie” to denote kilocalorie. Calories are used to measure the energy we get from foodstuffs, as well as the energy we expend. We need

calories to live. Everything our body does, from breathing to digesting food to exercising, requires energy, and we get those Calories from things we consume (food/ drinks) in order to provide energy.

Does this change how you view/feel about the term "Calories?"

Calories Provided Per Gram of Nutrient

**Carbohydrates: 4 Cal/Grams**

**Protein: 4 Cal/ Grams**

**Fat: 9 Cal/ Grams**

The US Department of Agriculture and US Department of Health and Human Services (USDA and USDHHS 2020) recommend the following average caloric consumption daily for males and females. Males and females between the ages of 19 and 30 should consume an average of 2,400 and 2,000 Kcal/ per day, respectively. Calorie recommendations decrease slightly with age. Please note that true caloric needs are highly individualized, and the actual ideal intake for each individual depends on other factors, including but not limited to activity level and body size. There are many people that need to consume more calories than those recommended.

**A Note On Alcohol:** Another source of potential calories is alcohol. Alcohol provides 7 calories per gram consumed (Fahey, 2020). The author uses the term “potential” as alcohol is not a nutrient we need to consume. According to the USDA and USDHHS (2020), 66% of adults consume alcohol on at least a monthly basis, and of those 1/2 report binge drinking. Individuals who cannot control the amount they drink, have an alcohol use disorder, are under 21, or are pregnant should not consume alcohol. For adults who choose to consume alcohol safely, the USDA and USDHHS (2020) recommend limiting consumption to 1 drink or less per day in females and 2 drinks or less in males.

## Macronutrients

**Macronutrients** are nutrients that we need to consume in relatively large amounts (Faley et al., 2020). There are four macronutrients, including protein, carbohydrates, fats (also called lipids), and water.

## Carbohydrates

The primary function of **carbohydrates** is to provide energy. **Carbohydrates** also have a role in the synthesis of nonessential amino acids (Kumar et al., 2017).

When **carbohydrates** are consumed, they are broken down and converted to glucose (Kenny et al., 2015). This glucose can be found circulating in our blood, being transported to different cells to be utilized for energy, and being stored in the form of glycogen in the muscle and liver. Some cells, such as those found in the brain, nervous system, and in blood, prefer glucose as an energy source (Fahey et al., 2020). Our muscles also utilize glucose as a primary fuel source during exercise.

Primary carbohydrate sources include grains, fruit, and vegetables.

**Carbohydrates** can be classified as complex or simple. Complex carbohydrates are carbohydrates from starches (grains, potatoes, legumes) and high-fiber carbohydrates (grains, some vegetables, legumes, and some fruits) (Fahey et al., 2020). Simple carbohydrates are single and double sugar molecules. They are found naturally in fruits and milk and added to sweetened desserts, candy, sodas, and sweet beverages such as juices (Fahey et al., 2020).

Complex **carbohydrates**, specifically complex carbohydrates that are grains, can further be divided into whole-grain carbohydrates or refined carbohydrates. A whole grain is just that, a grain that has all of its original components.

These components include the bran, endosperm, and the germ. Whole grains contain fiber, vitamins, and minerals. Examples of whole grains include buckwheat, oats, millet, quinoa, brown and wild rice, amaranth, barley (not pearled), as well as crackers, cereals, breads, and pastas that are labeled as whole grain (USDA and USDHHS 2020). When grains are processed, the bran and germ become removed, and the endosperm is left. Refined grains include white breads, cereals, pastas, and rice. Crackers made from refined grains will not be labeled whole grain (USDA and USDHHS 2020).

The glycemic index is an assessment of how different foods affect blood glucose levels (Esfahani, 2009). As mentioned above, when we consume carbohydrates, they are broken down and converted to glucose. Some carbohydrates are broken down more quickly and cause a fast increase in blood glucose (Fahey et al., 2020). Foods that raise blood glucose levels quickly are considered high glycemic index foods, and foods that offer a slower increase are called low glycemic index foods. Complex carbohydrates (especially those with more fiber) tend to have a lower glycemic index, while simple carbohydrates, as well as starches, have a higher glycemic index.

**A Note On Fiber:** Fiber is a non-digestible carbohydrate (Fahey et al., 2020). Because it

takes longer to break down, it will allow for a slow, more sustained rise in blood glucose. This non-digestibility is one reason why high-fiber carbohydrates are typically considered healthier options. Fiber also plays a role in digestion, as it is non-digestible/bulk-forming and can thus help prevent constipation (Fahey et al., 2020).

According to the USDA and USDHHS (2020) over 90% of females and 97% of males are not meeting the recommended intakes for dietary fiber. Foods high in fiber include vegetables, fruit, and whole grains. Not surprisingly, 85% of adults are not getting the recommended amount of fruit, vegetables, and whole grains (USDA and USDHHS, 2020).

**A Note On Added Sugar:** According to the USDA and USDHHS (2020), most adults consume more than the recommended amount of added sugar. Added sugar is often found in

desserts and beverages such as soda, juice, sweetened teas, and coffees, as well as energy drinks. More than 40% of added sugar consumed daily is from beverages and the other 30% is from sweet snacks, treats, desserts, and cereals (USDA and USDHHS, 2020). The USDA and USDHHS (2020) recommend less than 10% of total calories consumed per day from added sugar.

The USDA and USDHHS (2020) recommend that 45-65% of your total daily calories come from carbohydrates. In some contexts, carbohydrates have been viewed negatively. It is important to remember not all carbohydrates are the same. Hopefully, after reading this section on carbohydrates, you can see how the quality of carbohydrates consumed is important. The large majority of carbohydrates consumed should be from whole grains, vegetables, and fruit, which are high in fiber and micronutrients. Eating whole grains, vegetables, and fruit is drastically different from eating refined carbohydrates and added sugars.

## Protein

**Proteins** also contribute to energy, yielding 4 kcal/ gram consumed but also are key components of the body's structure. Proteins have structural roles in the blood as components of plasma protein, hemoglobin and coagulation factors (Kumar et al. 2017), and aid in the synthesis of enzymes, cell membranes, and some hormones (Faley et al. 2020). Proteins can also be found in antibodies (Kumar et al. 2017). Proteins make up important structural components of bone and muscle (Faley et al. 2020). Finally, in addition to the above, protein plays a vital role in the balance of both water and pH (acid vs. base) (Kumar et al. 2017). After reading the above, the importance of protein should be obvious. It is imperative for growth and repair (Kumar et al. 2017). When most people think of **protein** sources, they likely think of animal products, which are a good source of protein, but there are numerous plant sources of protein as well. According to Kumar et al. (2017), all foods contain protein, excluding refined sugar, oil, and fats. With that said, not all protein sources are equal. Proteins are made up of amino acids. There are a total of 20 amino acids, of which nine are considered essential and the other 11 are nonessential.



Before moving on, think back to earlier in this chapter when we discussed essential and nonessential nutrients. Based on what you remember, how are the 9 essential amino acids different from the 11 nonessential?

While plants do provide protein, they are considered incomplete sources of protein. This means that a single plant does not provide all 9 essential amino acids while animal proteins do contain all 9 essential amino acids (Fahey et al. 2020). For a vegetarian, vegan, or someone who gets the majority of their protein from plant sources, it is important to make sure you are getting all your essential amino acids every day. There is one exception to this rule, which is soy. Unlike other plant sources of protein, soy contains all 9 essential amino acids (Kumar et al. 2017) and thus is a complete protein. The USDA and USDHHS (2020) recommend that 10-35% of your total daily calories come from protein. As with carbohydrates, the source of protein is important. Protein from chicken, fish, tofu, whole grains, and lean meats is superior to highly processed sources like hot dogs, hams, and lunch meats.

## Fat

**Fats**, which are also called lipids, offer energy, specifically during rest and low intensity activities (Fahey et al., 2020). Beyond providing energy, fat is important for insulation, protection, and the absorption of fat-soluble vitamins (see micro nutrients) (Fahey et al., 2020). Dietary fats can be separated into three categories– saturated fats, unsaturated fats, and trans fats.

Saturated fat is found in animal products (such as butter, whole milk, cream and high-fat meats) and is solid at room temperature. There are some plant fats that also contain saturated fats, including coconut oil. The USDA and USDHHS (2022) recommend keeping saturated fat to less than 10% of total daily calories. Once again, the source of saturated fat matters. Saturated fat from quality meat sources is ideal. According to the USDA and USDHHS (2022), the primary sources of saturated fat for individuals in the US include burgers and other sandwiches, tacos and burritos, as well as desserts, sweets, and grain-based dishes such as pastas. Unsaturated fats are plant fats and are typically liquid at room temperature. Unsaturated fats can be broken into monounsaturated fats (olive oil and canola oil) and polyunsaturated fats (corn oil, sunflower oil, and soy oil). The USDA and USDHHS (2022) suggest trading some saturated fats for unsaturated fats, particularly polyunsaturated fats.

Trans fats are created when hydrogen is added to

unsaturated fats. The process of adding hydrogen to unsaturated fats is termed hydrogenation. This is done in order to turn a fat that would typically be liquid at room temperature into a solid. The USDA and USDHHS (2020) recommend trans fat consumption be as low as possible. Though some trans fats can be found naturally in animal products, before 2018 the vast majority of trans fats consumed were from partially hydrogenated oils. Due to safety and health concerns, in 2018 the use of partially hydrogenated oils was banned in the US (USDA and USDHHS, 2020).

The USDA and USDHHS (2020) recommend 25% to 35% of daily calorie consumption be from fat, but only 10% from saturated fat and as little as possible trans fats. Research exists linking both saturated fats and trans-fats to increase cardiovascular disease risk.

**A Note On Cholesterol:** For a long time, it was thought that dietary cholesterol was linked to elevated blood cholesterol and cardiovascular disease. Research does not exist to support this claim (Solamin, 2018), and thus the 300 mg/day cholesterol recommendation was removed from the Dietary Guidelines for Americans in 2015. It should be noted that besides eggs and shrimp,

which are low in saturated fat, the majority of high-cholesterol foods are also high in saturated fats, which, when overconsumed, have been linked to cardiovascular disease.

## Water

**Water** is often overlooked in the discussion of **macronutrients**. Water doesn't provide calories, but it is incredibly important. We are able to survive much longer without food (potentially up to 50 days) than without water (a couple of days) (Fahey et al, 2020). Proper hydration is important in order to maintain blood volume, cellular functions, and body temperature. Total water intake comes from water consumed by drinking plain water, water that is found in other beverages, and water that is in the foods we eat (National Academies of Sciences, Engineering, and Medicine, 2005). The Adequate Intake (AI) for water (including other drinks and food containing water) is 3.7 L for young males (19-30 years of age) and 2.7 L for females. Of this amount, 3.0L and 2.2 L for young males and females respectively should come from beverages (not food). That is not to say that some individuals don't need more. It is imperative that body water

intake balances body water loss. A hot, humid environment, as well as exercise, will increase water loss. Water loss that causes a 3% reduction in body weight has been associated with negative impacts on endurance performance in cool environments, while as little as a 2% reduction in body weight has been associated with negative impacts on endurance performance in hot environments (Armstrong, 2000). Dehydration can also negatively impact cognition (Popkin et al., 2010).

**Note:** It is beyond the scope of this text, but individuals participating in ultra-endurance events should make sure also to replenish electrolytes lost in sweat and be careful of hyponatremia. Hyponatremia is characterized by low sodium levels (Mayo Clinic Staff., n.d.). If too much sodium is lost through sweat, sodium is needed in addition to water. Sports drinks can come in handy in these situations. Symptoms of hyponatremia include nausea, vomiting, fatigue, headache, confusion, muscle cramps and in extreme cases seizures and coma.

## Micronutrients

**Micronutrients** are nutrients we need in small quantities (a fraction of a mg to multiple grams). There are two groups of micronutrients, **vitamins** and **minerals** (Kumar et al. 2017).

### Vitamins

**Vitamins** play a role in different body processes. Some vitamins aid in chemical processes including metabolism, while others act as antioxidants (aiding in cellular health), assist with red blood cell production, and help maintain nerve, skeletal, and immune functions (Fahey et al., 2020). There are 13 different vitamins (A, C, D, E, K and the eight B vitamins). Some vitamins are fat soluble, while others are water soluble. Water soluble vitamins can be absorbed into the bloodstream, while fat-soluble vitamins are stored in the liver and fatty tissue (Fahey et al., 2020).

Vitamins D and K are our only non-essential vitamins. However, remember that when a nutrient is classified as “non-essential,” it doesn’t mean that it doesn’t need to be consumed to have adequate amounts (Kohlmeier, 2015). Vitamin D deficiency is actually very common (USDA and USDHHS, 2020).

Vitamins are best and most easily absorbed when we consume them from foods we eat (vs. in supplement form).

Both vitamin deficiencies and vitamin excess can lead to negative health outcomes. This differs depending on the vitamin one is deficient in or consuming in excess. Use the link below for more resources with specific information about individual vitamins.

[Vitamins](#)

**A note about Vitamin D:** Vitamin D is a vitamin that individuals are commonly deficient in. According to the USDA and USDHHS (2020), 90% of adults are deficient in vitamin D. Vitamin D is important for bone health and promotes calcium absorption. Adequate Vitamin D and calcium are important for adequate bone density and the prevention of osteoporosis.

## Minerals

There are 17 essential **minerals**, which, like vitamins, all have differing roles. Generally speaking, minerals aid growth, regulating various body functions and assisting in the release of energy (Fahey et al., 2020). Minerals can be separated into two groups, major minerals and trace minerals. Major minerals

are minerals that should be consumed in greater quantities (100 + mg/day), and trace minerals are needed in smaller amounts on a daily basis. Major minerals include calcium, phosphorus, magnesium, sodium, chloride, and potassium. Trace minerals include iodine, copper, fluoride, iron, selenium, and zinc (Fahey et al., 2020). As with vitamins, mineral deficiencies and mineral excess can lead to negative health outcomes. Use the link below for more resources with specific information about individual minerals.

### [Minerals](#)

**A note about sodium:** As mentioned above, sodium is one of our major minerals. The average American consumes 3,400 mg of sodium a day while the USDA and USDHHS (2020) recommend no more than 2,300 mg per day (or 1 teaspoon).

**A note about Calcium:** Calcium is a mineral that individuals are commonly deficient in.



According to the USDA and USDHHS (2020) roughly 30% of males and 60% of females are deficient in calcium. Calcium is important for bone health, especially bone density and the prevention of osteoporosis.

**A note about Iron:** Iron is found in hemoglobin and thus plays a role in oxygen transportation. Low iron levels can be attributed to low iron intake, low iron stores, and/or a high amount of iron loss (which can be caused by blood loss)(Miller, 2013). Iron deficiency affects roughly 10 million people in the US, and of those, 5 million have iron deficiency anemia. Iron deficiency anemia is a much larger concern in underdeveloped countries and affects two billion people worldwide (Miller, 2013). Iron deficiency is a greater concern for pregnant women and young children. Iron can be found in meat, poultry, some fish, and some plant sources

(USDA and USDHHS, 2020). The iron found in meat, poultry and fish is called heme iron. Heme iron is more easily absorbed by the body than non-heme iron, which is the iron found in plants such as dark green vegetables as well as beans and lentils (USDA and USDHHS, 2020).

## Deficiency And Excess

As mentioned above, there are recommendations for all nutrients. Being deficient in a nutrient has consequences, as does over consuming a nutrient. It is important to note whether we are referring to **macronutrients** or **micronutrients**. Dietary Reference Intakes (DRI) are reference values related to nutrient intake for healthy people and include recommended dietary allowance (RDA), adequate intake (AI), estimated average requirement (EAR), as well as tolerable upper limit (National Institute of Health Office of Dietary Supplements, n.d.). RDA is the average intake that is enough to meet the nutritional needs of most healthy adults. The designation AI is used when there is not enough information to develop an RDA, and it is what is assumed as adequate or enough to meet the nutritional needs of most

adults. EAR is the nutritional intake that is estimated to meet the needs of 50% of healthy people. Finally, UL is the amount of a nutrient one could likely consume before the negative effects of overconsumption could be expected. The National Institute of Health’s “Nutrient Recommendations and Databases” as well as the “Dietary Guidelines for Americans” are linked below if you want more information to learn about specific guidelines for different nutrients.

[Nutrient Recommendations and Databases](#)

[Dietary Guidelines for Americans 2020 – 2025](#)

## Diets

You or someone you know has likely been on a diet at one point or another. Interest in weight loss is becoming increasingly popular. Research by Teng et al. (2020) shows Internet searches about weight loss increased between 2004 and 2018 with a peak in searches in the spring months. While weight loss (specifically fat loss) can be healthy, many individuals are interested in quick fixes that likely are unsustainable. A fad diet can be defined as “a weight loss plan that promises dramatic results over a short-term period” (Gui, 2008). Some characteristics of fad diets include promising fast weight loss, restricting or fully eliminating food groups, use of gimmicks as well as personal anecdotes, and failing to acknowledge physical activity (Gui, 2008). Some popular **fad**

**diets** include low-carbohydrate diets, [ketogenic diets](#), [Paleolithic diets](#), low-fat diets, vegan and vegetarian diets, [intermittent fasting](#) (Anderson, 2023), and detox diets (Tahreem et al. 2022).

**A note about intermittent fasting:** While intermittent fasting has been used by some as a fad diet, there is evidence to support intermittent fasting as a treatment modality for type 2 diabetics (Albosta & Bakke, 2021). Intermittent fasting is essentially restricting eating periods so that there are periods of times lasting from hour to days where one does not take in any calories. According to Albosta and Bakke (2021) and Cho et al. (2019) research exists to suggest that intermittent fasting may help treat type 2 diabetes by promoting weight loss, decreasing insulin resistance and influencing levels of the hormones leptin and adiponectin.

If you, or someone you know, has tried what would be considered a **“Fad Diet,”** What happened? Was weight loss achieved? Were they able to maintain the diet? Were they able to maintain the weight loss?

This is not to say that weight loss is never a good idea. Weight loss, when needed, can be achieved but should be done so with sustainable changes that do not restrict any food groups. For example, Gui (2008) suggests monitoring calorie consumption, consuming moderate amounts of primarily complex carbohydrates (fruits, vegetables, and whole grains), protein, and fat, and utilizing foods with low caloric density to satisfy the need for larger portions without the added calories, and consuming foods that taste good and fit your lifestyle.

The author of this text strongly believes that food should be enjoyed, and we should allow space for all foods (that we can safely consume and enjoy) in our daily diet.

The following video sheds more light on what “healthy eating” is.



*One or more interactive elements has been excluded from this version of the text. You can view them online here:*

<https://rotel.pressbooks.pub/health-and-fitness3/?p=59#oembed-1>

## Food Deserts

A **food desert** is a low income community where there is limited access to food that is considered both affordable and healthy (Ver Ploeg et al., 2011). The USDA defines food deserts as communities with low income and low access (U.S. Department of Agriculture, Economic Research Service, 2022). A low income community is defined as one with a poverty rate of 20% or more, or a median family income that falls below 80% of the state or metropolitan median family income. Low access is defined in urban communities as a community with at least 500 people or 1/3 of the community population living over 1 mile from a large grocery store, and in rural communities as a community with at least 500 people or 1/3 of the community population living over 10 miles from a large grocery store. Vehicle availability is also a consideration when addressing access. Food deserts may contribute to diet and weight related health consequences (Ver Ploeg et al. 2011).

Take a moment and think back to Chapter 1 when we talked about the social determinants of health. According to the U.S. Department of Health and Human Services. (n.d.) “Social determinants of health are the conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks.” Can you make a connection between food deserts and the social determinants of health?

## Practical Applications/Laboratory Activities

Use the links provided in the “micronutrients” section and those provided under “deficiency and excess.” Make a list of the 13 vitamins and the listed trace and major minerals.

- a. What is the role of the **micronutrient**?
- b. What foods is the micronutrient found in?
- c. How much of this micronutrient should you be consuming daily?
- d. Based on what you have learned, the information in the resources provided, and current eating habits, do you think you likely get an adequate amount of this nutrient?

### Self Reflection

Take some time to think about your relationship with food. Why do you consume the foods you

choose to eat? Do you eat solely for nourishment? Do you eat for enjoyment? How is food linked to your culture, family and other aspects of your social life?

## Chapter Overview

In Chapter 4 you learned about nutrients. Nutrients can be broken down into essential and non-essential nutrients. Essential nutrients are nutrients that we need to consume because we cannot make sufficient quantities fast enough, or at all, on our own (Fahey et al., 2020). Non-essential nutrients are nutrients the body needs but has the ability to make (Kohlmeier, 2015). Nutrients can also be broken down into macronutrients and micronutrients. Macronutrients are those we need in large quantities, and micronutrients are those we need in small amounts. The four macronutrients include carbohydrates, protein, fat, and water. The two groups of micronutrients are vitamins and minerals



(Kumar et al., 2017). Being deficient in any nutrient has consequences as does the overconsumption of a nutrient. According to the USDA and USDHHS 2020, most males and females between the age of 19 and 30 should consume an average 2,400 and 2,000 Kcal/ per day respectively, with 25% to 35% coming from fat, 45- 65% from carbohydrates, and 10-35% from protein.

### **Key Terms / Phrase**

- **Calories**
- **Essential Nutrients**
- **Non-essential Nutrients**
- **Macronutrient**
- **Micronutrient**
- **Carbohydrate**
- **Protein**
- **Fat/Lipid**
- **Vitamins**
- **Minerals**
- **Water**
- **Fad diets**

## Media Attributions

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5.

# CARDIOVASCULAR ENDURANCE

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Figure 1: Two individuals jogging on the beach.

## Chapter Objectives

At the end of this chapter, the student should be able to...

1. define **cardiovascular endurance**
2. understand how **oxygen is transported**.
3. define **heart rate** and understand ranges.
4. understand and be able to calculate target HR.
5. define blood pressure and understand ranges.
6. explain basic changes that happen to the cardiovascular system with exercise.
7. understand the importance of **cardiovascular endurance**.
8. assess their own muscular endurance and strength.

## The Basics of Cardiovascular Endurance

In Chapter 3, we talked about the five components of health-related fitness. In Chapter 5, we will focus specifically on cardiovascular endurance. **Cardiovascular endurance** is the ability of the body to transport oxygen to working muscles (Kenny et al., 2015). We are going to talk about cardiovascular

fitness as it relates to the average person. A high-level endurance athlete would have a superior level of cardiovascular endurance in order to compete at the level they are competing. With that said, it is important to remember that it is important for non-athletes to at least have a threshold level of cardiovascular endurance for health reasons and to have a good quality of life.

## Oxygen Transportation

**Oxygen is transported** via the blood throughout the body. The majority of this oxygen is transported through the blood bound to hemoglobin (found in red blood cells) (Kenny et al., 2015). We rely on this oxygen in order to yield energy for our body to do the work it needs to do (note: there are non-oxidative energy sources, but these are only helpful during short bursts). For example, we need oxygen for our heart to contract and for the work needed to digest food. When we exercise, we increase our body's demand for oxygen because we are doing more work than we are doing at rest! When an individual has better cardiovascular fitness, they are better able to provide the working tissues with enough oxygen to complete the exercise task at hand. For example, if you are running, now you need more blood going to your working muscles so that they are receiving more oxygen! Whether or not you are able to maintain the pace at which you are walking, jogging, or running is dependent on whether your heart, lungs,

and blood are able to provide enough oxygen. Someone who is more cardiovascularly fit will be better at doing this and thus may be able to maintain a specific running pace much longer than someone with lower cardiovascular endurance.

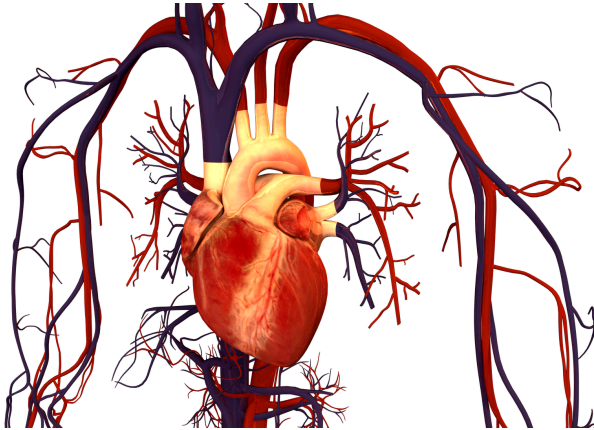


Figure 2: An image of a human heart and circulation surrounding it.

## Heart Rate

**Heart rate** is the number of times your heart contracts or beats every minute (Kenny et al. 2015). A resting heart rate is typically between 50-90 bpm (beats per minute) (Fahey et al., 2020). When the heart rate is less than 60 bpm, the term used to describe this is **bradycardia** (Kenny et al., 2015). Sometimes, bradycardia is cause for concern, but it can also be a result of someone who has a high level of cardiovascular fitness. The term **tachycardia** is given to heart rates above 100

bpm. While a high resting heart rate can be caused by various pathological reasons, heart rate may also be elevated during exercise (Kenny et al., 2015) or even in high-stress/ emotional situations.

## Blood Pressure

The term **blood pressure** is likely one you have heard before. Blood pressure is the pressure put on the blood vessels by the blood traveling through them (Kenny et al., 2015). This pressure is caused by the pumping action of the heart (Fahey et al., 2020). If we think of the heart as a pump, it makes sense that the pressure would be greatest in the blood vessels closest to the heart and decrease the further away the vessels are from the heart. Typically blood pressure is measured in the brachial artery (located in the arm). The standards you have likely heard of related to blood pressure are specific to the pressure in this artery.

Blood pressure is expressed as two numbers, **systolic/diastolic**. The **systolic** (top number) is the pressure during ventricular (lower heart chambers) contraction, and the **diastolic** is the pressure during ventricular relaxation (Kenny et al. 2015). The link below includes the systolic and diastolic recommendations for adults recommended by the American Heart Association.

[Understanding Blood Pressure Readings](#)

Blood pressure that is too high (**hypertension**) increases

the risk of having a cardiovascular event such as a heart attack or a stroke (Fahey et al., 2020). For people with blood pressure that is on the high side of the normal range, physical activity, weight management, and nutritional changes can aid in preventing blood pressure from getting to a hypertensive level. With that said, it is important to listen to a physician's recommendations regarding blood pressure management (often medication is prescribed), and what physical activity is safe for individuals with hypertension.

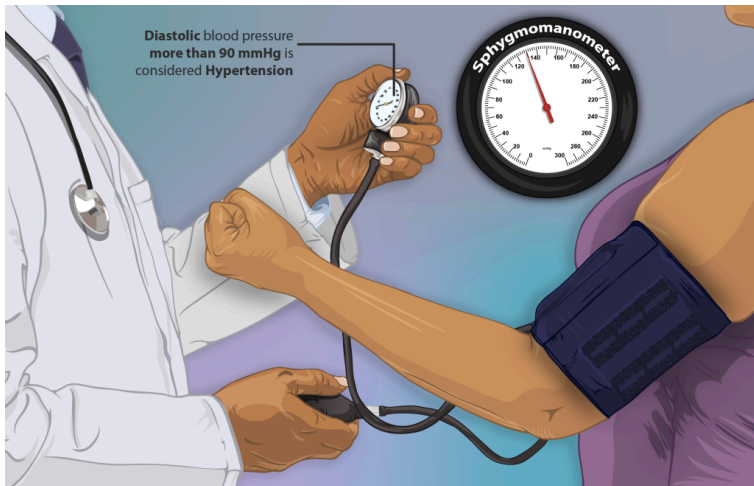


Figure 3: An image of a hypertensive patient's blood pressure being checked.

## Changes To The Cardiovascular System With



## Exercise

At rest, the cardiovascular system functions at a mostly steady pace. For example, healthy individuals typically have a resting heart rate (RHR) between 60 and 80 bpm (Kenny et al., 2015) and **breathing rates** of about 15 breaths per minute (Breathe, 2020). Additionally, only about 15-20% of blood leaving the heart goes to the working muscles. During exercise, the demand placed on the cardiovascular system increases in order to deliver more oxygen to working muscles (Kenny et al., 2015). In order to meet the increased demand for cardiovascular activity or exercise, **HR** will increase.

Additionally, the heart will send out more blood with each contraction. The term used for the amount of blood leaving the heart every contraction (beat) is stroke volume (Kenny et al., 2015). So the heart is not only contracting more each minute, but with each contraction, more blood is leaving the heart. There are also changes in blood flow patterns. We dramatically increase the amount of blood being sent to the working muscles. During maximal exercise, 80-85% of blood goes to the working muscles.

Regarding breathing rate, we can increase our breaths per minute. Breathing rate can increase up to 40-60 breaths per minute (Breathe, 2020). In addition, with each breath, we also bring in a great volume of air! Systolic blood pressure also increases during an exercise bout (Kenny et al., 2015).

## Why Is Cardiovascular Endurance Important?

Take a moment and think about why cardiovascular endurance is important. Brainstorm some reasons.

You may wonder what happens to an individual who is inactive and has a very low level of cardiovascular endurance. If this is the case, as time goes on, even low-level activity can become challenging and become work for the body. Often, in these cases, the individual with low cardiovascular fitness starts to do even less. They may stop taking stairs and only use elevators, or they may spend as little time moving as possible. It becomes a downward spiral— as fitness decreases, the person does less, and fitness decreases more. What happens if this individual needs to be physically active? What if they need to remove snow from their car or chase after a pet that got loose. These narratives are all too common, but they do not need to be the narrative! If someone's cardiovascular fitness is lower than they would like, there are things they can do to improve it!

Exercise that maintains or improves **cardiovascular endurance** is called aerobic exercise (exercise that requires

oxygen). Participating in aerobic activities decreases the chance of premature death from all causes, but primarily cardiovascular disease (ACSM, 2013).

As mentioned in Chapter 3, The ACSM (2013) recommends that adults between the ages of 18-65 who are healthy participate at a minimum of 150 min (30 min/five times a week) of **moderate-intensity aerobic exercise** (exercise that raises your heart rate and breathing rate) or participate in 60 min (20 min/ 3 times a week) of vigorous exercise. In Chapter 3, we also talked about what vigorous vs moderate intensity means. **Moderate intensity cardiovascular exercise** raises heart rate to roughly 64 – <76% of your Max HR (ACSM, 2021).

## Measuring Cardiovascular Exercise Intensity

As mentioned above, a common way to determine your cardiovascular exercise intensity is to determine the percentage of your maximal HR that you are working at. Below are two ways in which to determine your **Target HR** zone. One being the *Traditional Method* and the other being the ***Karvonen Method***.

## Traditional Method of Determining Target HR Zone

Take a moment and determine your **age predicted** maximal heart rate:

$$220 - \text{age} = \text{predicted HR}_{\text{max}}$$

$$220 - \text{---} = \text{predicted HR}_{\text{max}} \text{ (in beats per minute (bpm))}$$

The above equation estimates **HR max**. This equation is easy to complete and gives most people a good estimate of their maximal HR (ACSM, 2021). Once you have your Max HR you can then multiply that number by a percentage to determine your **target HR** range. For example if you are looking to exercise at a **moderate intensity**, you would likely be looking to exercise between 64– <76% of your Max HR (ACSM, 2021).

Note: Remember that this is an estimation! To get your actual HR max, you would need to complete something called a graded exercise test (every few minutes, often times every 3 minutes, the cardiovascular demand of the exercise gets harder) to maximal exertion. A maximum graded exercise test is designed to eventually get you to a point where even when you increased the exercise intensity/ cardiovascular demand, HR would not increase. This would yield someone's true HR max! This test can be time consuming, potentially unsafe for some people, and oftentimes people stop the exercise before they reach a true HR max (thus not giving the needed information).

$$220 - \text{age} = \text{predicted hr max}$$

**Moderate intensity (64%-76% of Max HR (ACSM, 2021)) calculation for a 20 year old.**

$$220 - 20 = 200 \text{ bpm}$$

(For this example, 20 is the age. This number would change for someone of a different age.)

$$\text{THR} = 200 \times .64 = 128 \text{ bpm}$$

$$\text{THR} = 200 \times .76 = 152 \text{ bpm}$$

Target heart rate range = 128-152 bpm

Note: if the same person wanted to exercise at **vigorous intensity**, instead of 64% – 76%, vigorous intensity range would be 77%-95%.

**Vigorous intensity (77%-95% of Max HR (ACSM, 2021)) calculation for a 20 year old**

$$220 - \text{age} = \text{predicted HRmax}$$

$$220 - 20 = 200 \text{ bpm}$$

(For this example, 20 is the age. This number would change for someone of a different age.)

$$\text{THR} = 200 \times .77 = 154$$

$$\text{THR} = 200 \times .95 = 190$$

Target heart rate range = 154 – 190 bpm

Below is the **Karvonen method** of estimating Target HR. In order to complete this method, you need to determine your resting heart rate. One way to do this is to take your **pulse**! Many wearable devices can also give you this information.

**Taking your pulse:** In order to take your pulse, you first need to locate it! The easiest location to do this is via the radial artery, located on the thumb side of your wrist, or the carotid artery, located in your neck. The video below can help you locate both your radial and carotid pulses. When taking your pulse, you should use your index and middle finger (first two fingers after your thumb). you could count your pulse for an entire minute to get your bpm (beats per minute), or you can count a 10-second pulse and multiply it by 6!



*One or more interactive elements has been*

— excluded from this version of the text. You can view them online here:

<https://rotel.pressbooks.pub/health-and-fitness3/?p=65#oembed-1>

## Karvonen Method of Determining Target HR Zone

The **Karvonen method** of determining target heart rate differs because it takes **Heart Rate Reserve (HRR)** into consideration ( $\text{HR}_{\text{max}} - \text{HR}_{\text{rest}}$ ) (Kenny et al., 2015). Resting HR is typically lower in individuals who are more cardiovascularly fit. So the benefit of this method is that it takes more than just age into account. It also takes cardiovascular fitness into consideration. To get your true resting HR, you would want to take your pulse first thing in the morning. If that is not possible, you should, at the very least, sit and rest for 5 min before taking your pulse (Your resting pulse may be altered by recent activity, stress, or caffeine).

**Karvonen Method of Determining Target HR Zone for a 20-year-old****predicted HRmax**

$$220 - \text{age} = \text{predicted HRmax}$$

$$220 - 20 = 200 \text{ bpm}$$

(For this example, 20 is the age. This number would change for someone of a different age.)

**Heart Rate Reserve (HRR)** = Maximum HR – Resting HR

$$\text{HRR} = 200 - \text{Resting HR}$$

$$\text{HRR} = 200 - 60 \text{ bpm}$$

(For this example, 60 is being used as the resting HR. This number will vary from person to person.)

$$\text{HRR} = 140 \text{ bpm}$$

ACSM (2021) suggests using 40% – <59% HRR for moderate-intensity exercise and 60% – <89% HRR for vigorous exercise.

$$\text{Target Heart Rate} = \text{Resting HR} + (\% \text{ Intensity} \times (\text{max HR} - \text{resting HR})).$$



### **Karvonen Method of Determining Target HR Zone for a 20-year-old**

#### **Moderate intensity (64% – <76% ACSM (2021)) calculation for a 20 year old**

$$\text{THR} = 60 + (.40 \times (200 - 60)) = 116 \text{ bpm}$$

$$\text{THR} = 60 + (.59 \times (200 - 60)) = 142.6 \text{ bpm}$$

Target heart rate range = 116-143 bpm (**Note:** HR is never expressed as a decimal.)

Note: if the same person wanted to exercise at vigorous intensity, instead of 40% – <59%, the range would be 60 – <89%.

### **Karvonen Method of Determining Target HR Zone for a 20-year-old**

#### **(Vigorous 77% - <95% (ACSM 2021)) intensity calculation for a 20 year old**

$$\text{THR} = 60 + (.60 \times (200 - 60)) = 144 \text{ bpm}$$

$$\text{THR} = 60 + (.89 \times (200 - 60)) = 184.6 \text{ bpm}$$

Target heart rate range = 144 – 185 bpm

Note: The above examples are for a 20-year-old with a resting pulse of 60 bpm.

Another simple way to estimate your cardiovascular exercise intensity is the **Talk Test**. If you are participating in cardiovascular exercise at an intensity that allows you to talk conversationally but not sing (you would be too out of breath), you are likely working at moderate intensity. According to Fahey et al., (2020), if you could not talk conversationally, as you would be too short of breath, you are likely working at a vigorous intensity.

## Measuring Cardiovascular Endurance

As you may recall from Chapter 3, cardiovascular endurance is one of the health related components of fitness. This means that individuals need to have a threshold level of cardiovascular endurance for health. The gold standard to measure cardiovascular endurance is a **VO2max** test (Kenny et al., 2015). The **VO2max** test assesses one's max aerobic or cardiovascular capacity. In other words, the maximal amount

of oxygen an individual is capable of consuming at max cardiovascular exercise. A true  $\text{VO}_2\text{max}$  test yields the most accurate results, but for many reasons, it is often not possible. In order to conduct a true  $\text{VO}_2\text{max}$  test one needs access to a metabolic cart, as well as someone capable of running the test. Additionally, oftentimes less cardiovascular fit individuals will end the test prior to reaching a true  **$\text{VO}_2\text{max}$**  and thus not yielding accurate results. Because it is not always safe or practical to conduct a true  **$\text{VO}_2\text{max}$**  test, there are other valid and reliable tests to measure cardiovascular endurance.



Figure 4: Two individuals taking a break during a bike ride.

## Practical Applications/Laboratory Activities

For this activity you will estimate your cardiovascular fitness level by completing the **Cooper 1.5 mile walk/run test** (Cooper Institute, 2009). Both assessments are explained below.

### Cooper 1.5 mile walk/run

Preparation:

1. Before beginning this assessment, make sure it is safe for you to do so (refer to PARQ)
2. Walk or jog to warm up.

Assessment:

1. Walk, jog, or run 1.5 miles as quickly as possible. The aim is to complete the 1.5 miles as fast as you can, and ideally you should use an indoor or outdoor track. If you do not have access to a track, a 1.5 mile (measured) relatively flat distance will work.
2. Using the chart below, you can determine your CV fitness category based on your time.

**Female Percentile Ranks for Cooper 1.5-Mile -  
Run/Walk**

<b>Percentile Age</b>	<b>90th</b>	<b>80th</b>		<b>70th</b>
<b>20-29</b>	10:59	11:56		12:53
<b>30-39</b>	11:43	12:53		13:58
<b>40-49</b>	12:25	13:38		14:43
<b>50-59</b>	13:58	15:14		16:29
<b>60-69</b>	15:32	16:46		18:01

Adapted from The Cooper Institute (2009)

**Male Percentile Ranks for Cooper 1.5-Mile Run/  
Walk**

Percentile Age	90th	80th		70th
20-29	9:34	10:08		10:42
30-39	9:52	10:38		11:12
40-49	10:09	11:09		11:42
50-59	11:09	12:08		12:42
60-69	12:10	13:25		14:42

Adapted from The Cooper Institute (2009)

You can also use your time to calculate your estimated **VO2max**!

1. Convert time for min:sec to a decimal.
2. **VO2max** =  $(483 / \text{time}) + 3.5$
3. Using the chart below you can determine your CV fitness category based on your calculated VO2max (hint, since you used the same time for the equation as you did for the above chart, your results should be similar.

**Female Estimated VO2max (ml.kg.min)  
percentile**

Percentile Age	90th	80th		70th
20-29	46.8	43.9		40.8
30-39	45.3	42.4		39.3
40-49	43.1	39.6		36.5
50-59	38.8	36.7		33.6
60-69	35.9	32.7		30.6

Adapted from The Cooper Institute (2009)

**Male Estimated VO2max (ml.kg.min) percentile**

Percentile Age	90th	80th		70th
20-29	54.0	51.1		47.0
30-39	51.7	48.3		46.0
40-49	49.6	46.4		43.0
50-59	46.8	43.3		41.0
60-69	42.7	39.6		37.0

Adapted from The Cooper Institute (2009)

Note: The Cooper 1.5 mile walk/run test is just one method of estimating cardiovascular fitness. There are other assessments available if this test is not a safe, practical option. A few other options are linked below:

[Astrand Bike Test](#)

[Harvard Step Test](#)



## Self Reflection

- What was your VO<sub>2</sub>max estimation from the Practical Application/ Laboratory activities section above?
- Compare your value to standards.

**Note:** Because of physiological differences across the sexes the category standards for VO<sub>2</sub>max are broken down by sex. Please see "[Sex and Gender In This Text](#)" at the beginning of this text for more clarification.

- If you were interested in increasing your cardiovascular endurance, what would you do?
- Go back to **Measuring Aerobic Exercise Intensity** using either method to calculate your THR zone for either moderate intensity or vigorous cardiovascular exercise (Reminder- this is a range so

there is an upper and lower end).

## Chapter Overview

In Chapter 5, you learned about cardiovascular endurance, why it is important, and how to measure it. Cardiovascular endurance is the ability of the body to transport oxygen to working muscles (Kenny et al., 2015). In Chapter 5, you learned about changes that occur when you go from a resting state to a cardiovascularly active state. These changes include an increase in heart rate, breathing rate, blood flow to the working muscles, and systolic blood pressure. When determining how hard you are exercising, one way to determine this is to calculate your target heart rate zone and measure your exercise heart rate (pulse), while another simple way to estimate cardiovascular exercise intensity is the **talk test**. Finally, in Chapter 5, you were able to estimate your

current cardiovascular fitness level and reflect on those findings.

### **Key Terms/Phrases**

- **Cardiovascular Endurance**
- **Oxygen transportation**
- **Heart Rate**
  - **Bradycardia**
  - **Tachycardia**
- **Blood pressure**
  - **systolic blood pressure**
  - **diastolic blood pressure**
- **Breathing rate**
- **Target Heart Rate**
- **Age predicted Maximum heart rate**
- **VO2max**

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6.

# MUSCULAR STRENGTH AND ENDURANCE

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Figure 1: An image of dumbbells and resistance bands.

## Chapter Objectives

At the end of this chapter, the student should be able to..

1. define **muscular endurance**.
2. define **muscular strength**.
3. understand the differences between training for muscular strength and endurance.
4. explain the importance of participation in **resistance training**.
5. assess their own muscular endurance and strength.

## The Basics of Muscular Strength and Endurance

**Muscular strength** and **endurance** are two health-related components of fitness that fall under the heading of resistance training type exercises, or exercises that improve muscular fitness. While this chapter will focus specifically on muscular endurance and muscular strength, there are also two other types of resistance training subgroups we can mention, which include training for muscular hypertrophy and training for muscular power. As defined in Chapter 3, muscular strength is the ability of skeletal muscles to overcome resistance, and

muscular endurance is the ability of skeletal muscle to resist fatigue (ACSM, 2013). In Chapter 3, we also defined muscular power as it is a skill-related component of fitness. **Muscular power** is the ability to overcome a force at speed. Training for **muscular power** would certainly have benefits, specifically in sport (consider Olympic lifts). Muscular power, for the most part, is beyond the scope of this text. We can also mention training for **muscular hypertrophy**, which is training for the goal of increasing muscular size. While training for muscular endurance and/ or muscular strength will also lead to muscular hypertrophy, if someone's primary goal is to increase muscular size (think bodybuilder or figure competitor) there would be some variations that will be mentioned below.



Figure 2: An individual in a fitness center carrying an exercise ball.



## Types of Muscle Contractions

Muscle contractions can be dynamic or static (Kenny et al., 2015). Dynamic contractions cause joint movement. **Dynamic contractions** include concentric contraction and eccentric contractions. **Concentric contractions** are caused by muscle fiber (cell) shortening, while **eccentric contractions** are caused by muscle fiber lengthening. Many movements have a concentric and eccentric phase. Muscle contractions can also occur without movement at the joint, and muscle fiber length doesn't change. These contractions are called static, or isometric contractions. For example, during a bicep curl, the raising of the weight is a concentric contraction, and the lowering of the weight is an eccentric contraction. A common core exercise that yields isometric contractions is a plank.

## Why Participate in Resistance Training

There are many benefits of participation in **resistance training** that go beyond sport performance. For starters, having greater muscular strength and endurance makes performing everyday tasks easier (ACSM, 2013). These everyday tasks are often referred to as activities of daily living, or ADL's. Besides making activities of daily living less stressful,

the other main goal of a health related resistance training program is to prevent, manage, and/or slow the progression of various chronic diseases (ACSM, 2013). Three primary chronic conditions that resistance training can be particularly beneficial in doing this, include osteoporosis, obesity, and diabetes. As we age, we lose muscle mass and bone density. Age related loss in bone mass is referred to as osteopenia (Kenny et al., 2015), and a severe decrease in bone mass that leads to bone fragility and fractures is termed Osteoporosis.

Weight bearing exercise is important to maximize bone density early in life, and prevent its loss in middle aged and older adults. It is particularly important that females participate in weight bearing activities as there is a much steeper decrease in bone mineral density in older women due to menopause in comparison to age matched males (Kenny et al., 2015). Resistance training is also important for managing body composition. Fat-free tissue is more metabolically active than fatty tissue (Kenny et al., 2015). Thus, if we can increase our muscle mass (part of our fat-free mass), we can increase our resting energy expenditure (also called resting metabolic rate). This would lead to our expending more energy at rest than prior to the increase in muscle mass. We will dive deeper into the topic of body composition in Chapter 8.

### **Class Activity**

Open the linked ACSM webpage below. Select one of the conditions listed (not one of the three mentioned above) in the center green box titled “Resistance Exercise Can Help Manage and Treat Many Conditions Including.” Choose one of the conditions, define the condition, and explain how resistance training can be beneficial to someone with the condition. You will likely need to use additional resources to find the information you need (some recommended sources include the American College of Sports Medicine, National Strength and Conditioning Association, Center for Disease Control and Prevention, and the National Institute of Health).

Students should share/ present their findings with the class!

[Guidelines for Strength Training Infographic](#)

## Recommendations

The ACSM (2013) recommends participating in full-body resistance training at least 2-3 times a week (when there are no contraindications to resistance training). This would include resistance training for muscular strength or muscular

endurance (or possibly muscular hypertrophy or power). Again, these are the minimum recommendations, and based on someone's goals and interests completing resistance training more than 2-3 times per week may be ideal. While doing more can be great, it is also important to make time for muscle recovery. Doing so will help you reach your goals and also prevent injury. If you want to resistance train more often, the general rule is to avoid working the same muscle groups on back-to-back days, or giving 48 hours between working the same muscle group. Again, you can resistance train on back-to-back days, just make sure you work different muscle groups! If you are doing a full-body resistance training workout, you should give 48 hours rest between sessions.

## Number and type of Exercises

The number of exercises you complete depends on your goals. **Resistance training** programs should first target multi-joint and compound movements (activating more than one muscle group) (ACSM 2013). Examples of these include chest presses, squats, back extensions, and crunches. While the first focus should be these multi-joint and compound movements, it is also alright to add single-joint movements such as the bicep curl and calf raises.

## Sets And Repetitions

Ideally, each muscle group should be trained for 2-4 **sets**, which are bouts of exercise. Four sets per muscle group (whether it is the same movement or not) would be more beneficial than less. Still, once again, something is always better than nothing in the absence of contraindications, so even a single **set** is beneficial (ACSM 2013)!

Regardless of what your goals are, you will repeat each movement multiple times within each **set**. The number of complete movements within a set are **repetitions**. How many repetitions you complete will largely depend on your goals and how heavy the weight you are moving is (the resistance). For someone aiming to increase muscular strength, they would move relatively heavy weights with a low number of **repetitions** (1-5 repetitions). The weight would be somewhere between 60-80% of the individual's one-repetition maximum or **1RM** (more on **1RM** under [Intensity](#), below) (ACSM, 2013). When lifting heavy weights, depending on experience, 1-3 min should be given between sets (Kenny et al., 2015). For someone aiming to increase muscular endurance, they would move relatively lighter weight but for more repetitions (15-25 repetitions). The lighter weight would translate to a weight of roughly 50% of someone's 1RM. In addition, rest between sets should be less when training for muscular endurance (ACSM, 2013).

## Intensity

When we talk about heavy vs moderate vs lightweight, or resistance, these are relative terms. For example, what is light for one person could be heavy for another! Also, what feels heavy to move one way might feel light to move another way. Typically, people can move more weight with their lower body vs. upper body. Often the resistance moved is expressed as a percentage of someone's **one repetition maximum (1RM)** as mentioned above. A 1RM is a weight someone can correctly lift (specific to the movement) with one effort (Kenny et al., 2015). For example, if someone can bench press 100lb one time (and only one time), and they want to move 75% of their 1RM, they would bench press 75lb. To assess **1RM**, an individual should warm up and select a weight they feel comfortable lifting at least one time. Weight is continuously added until the individual reaches a weight they can only move one time. An assessment of multiple RMs can also be used to assess strength (Reynolds et al., 2006). Some individuals should not perform an 1RM test or a low RM test. According to the ACSM (2013), if an individual has metabolic disease, pulmonary disease, or is at risk for cardiovascular disease, a 15 RM would be a better option for assessing 1RM. Other conditions may also be contraindications to heavy lifting.

# Assessing Muscular Fitness

## Muscular Strength

As mentioned above, a **1RM** is the weight someone can correctly lift (specific to the movement) with one maximal effort (Kenny et al., 2015). A 1 RM test is a common way to measure **muscular strength**. According to the ACSM (2013), an assessment of multiple RMs can also be used to assess strengths. The chart linked below from the National Strength and Conditioning Association can be used to estimate 1RM based on a multiple RM test. For example, if someone can move 80 lb for 8 repetitions (and cannot complete more than 8 repetitions), their estimated 1RM is 100lb.

[Training Load Chart](#)

## Muscular Endurance

Tests to assess **muscular endurance** are assessments that require repeated muscle contractions or holding a sustained muscle contraction. One example of a test for muscular endurance is the YMCA bench press test (ACSM, 2013). The YMCA bench press test requires individuals to complete as many correct repetitions as possible at the speed or rate of 30

repetitions per minute. The weight used for this assessment is 80 lb (36.3 kg) and 35 lb (15.9 kg) for males and females respectively. Other muscular fitness tests include the push-up and curl up test (ACSM 2013). Both of these assessments require individuals to complete the maximal number of correct repetitions possible without a break, and without breaking correct form (or in the case of the curl up test the individual reaches 75).

You will be completing these tests to assess your own muscular endurance. More information on the specifics of the push-up and curl up test can be found below under “Practical Applications/Laboratory Activities”



Figure 3: An image of an older individual completing a bench press exercise.



## Practical Applications/Laboratory Activities

### Muscular Endurance Assessments

Prior to beginning any of the below assessments it is important that you warm up.

[American Heart Association- warm up and cool down](#)

#### 1) Push-Up test

Male students should complete the ACSM Push-up test. Female students who fall within or close to the 18-24 age range can complete the ACSM push-up test or the Adams et al. (2022) Push-up test protocol for females 18-24. The ACSM push-up test requires female participants to complete modified push-ups vs traditional push-ups. Many females are capable of completing standard push-ups, and research by Adams et al. (2022) compared the modified push-up results with standard push-up results among college age students to develop standard push-up norms. While Adams et al (2022) state their research is only a small step in the effort to decrease prevalent

gender biases in fitness, and more research is needed to validate their developed standard scale, it is a great step, and thus the author wants to present the option to female students utilizing this text.

Note: Additionally, for anyone, regardless of sex, who struggles to complete pushups, the modified method is a great place to start your training!

### **ACSM push-up test**

Start Position:

#### **Males**

- down position (elbows bent), palms on the group and fingers facing forward/ under shoulders/ head up.
- Toes should be the only other part in contact with the ground.
- Back should be straight.

#### **Females (modified push-ups)**

- down position (elbows bent), palms on the group and fingers facing forward/ shoulder width apart/ head up.
- knees in contact with the ground
- legs close together, and lower leg in contact with the ground.

- feet are plantar-flexed.

### **Performing the assessment**

- The individual will raise their body by straightening out at the elbows. The back should stay straight.
- When returning to the down position (starting position), the chin should touch the ground (mat) but the stomach should not.
- The test will continue until the individual can not complete more repetitions, strains forcefully, or fails to maintain proper technique for 2 repetitions (verbal corrections can be given).
- The number of completed repetitions should be noted.

Utilize the chart below to determine your core muscular endurance fitness level based on push-up test results.

- Note: Because of physiological differences across the sexes the category standards are broken down by sex. Please see “Sex and Gender In This Text” at the beginning of this text for more clarification.

**Fitness Category for Modified push-ups by Age for Females**

Category by Age	Excellent	
20 – 29	30	
30 – 39	27	
40 – 49	24	
50 – 59	21	
60 – 69	17	

Adapted from Canadian Society of Exercise  
Physiology (CSEP), 2003

**Fitness Category for Modified push-ups by Age for Males**

Category by Age	Excellent	
20 – 29	36	
30 – 39	30	
40 – 49	25	
50 – 59	21	
60 – 69	18	

Adapted from CSEP (2003)

## **Push-up test by Adams et al. (2022) – for females 18-24.**

### **Position**

- Consistent with the standard (male) push-up described for the ACSM assessment.

### **Performing the assessment**

- The individual will raise her body by straightening out at the elbows while keeping her back straight and aligned.
- On the down movement, the elbow should bend 90 degrees and the chest should nearly touch the mat.
- The test will continue until the individual cannot complete more repetitions or fails to maintain proper technique for 2 repetitions in row (verbal corrections can be given).
- The number of completed repetitions should be noted.
- Compare your results to the standards in Table 7 in the article linked below.
- Table 7 Predicted scale: <https://pmc.ncbi.nlm.nih.gov/articles/PMC9362895/table/t7-ijes-15-4-820/>
- Full article: [Development of a Standard Push-](#)

[up Scale for College-Aged Females](#)

## **2) Curl up test ACSM curl-up test**

### **Preparation**

- Measure 12 cm on the floor or mat (wherever you will be performing the assessment) for individuals under 45 years of age. For individuals 45 years and older, measure 8 cm. Put a piece of tape on either side of the distance measured.

### **Position**

- individuals should lay on their backs, knees bent at a 90 degree angle, and their fingertips should be by their sides touching the first of the two tape lines. This is the “down” position.
- set a metronome to 40 beats per minute.

### **Performing the assessment**

- Curl up/ forward 30 degrees so hands slide across the floor until they reach the second piece of tape.
- From the laying down position to the up

position is the time between 1 beat on the metronome (beeps on the bottom, curl up, beep at the top, back to the bottom for beep 3).

- Every time the individual goes back to the “down” position, the repetition should be noted.
- The test is complete when the cadence is broken, or they complete 75 curl-ups while they maintain the cadence.

Utilize the chart below to determine your core muscular endurance fitness level based on curl-up test results.

- Note: Because of physiological differences across the sexes, the category standards are broken down by sex. Please see “Sex and Gender In This Text” at the beginning of this text for more clarification.

### **Fitness Category for Partial Curl by Age for Females**

Percentile by Age	90	80
20-29	70	45
30-39	55	43
40-49	55	42
50-59	48	30
60-69	50	30

Reference

- Well Above Average: 90th Percentile
- Above Average: 80th and 70th Percentile
- Average: 60th and 50th Percentile
- Below Average: 40th and 30th Percentile
- Well Below Average: 20th and 10th Percentile

Adapted from CSEP (2003)

Fitness Category for Partial Curl by Age for Males



Percentile by Age	90
20-29	75
30-39	75
40-49	75
50-59	74
60-69	53

### Reference

Well Above Average: 90th Percentile

Above Average: 80th and 70th Percentile

Average: 60th and 50th Percentile

Below Average: 40th and 30th Percentile

Well Below Average: 20th and 10th Percentile

Adapted from CSEP (2003)

## Practical Applications/Laboratory Activities

### Muscular Strength Assessments

As mentioned above, a 1RM test is a common test for muscular strength. Because of the equipment and knowledge needed to safely and effectively conduct the assessment, the hand grip strength test will be conducted as an assessment of overall muscular strength vs. a 1 RM assessment. Grip strength assessments can be used to estimate overall muscle strength (Bohannon, 2008; Trosclair, Bellar, Judge, Smith, Maxerat, Brignac, 2011).

Individuals with elevated blood pressure or hypertension SHOULD NOT participate in this assessment.

Follow instructions to calibrate/ fit the **handgrip dynamometer**.

When measuring grip strength, there are different protocols that are used (Ha, Yoo, Park, Lee & Park, 2018; Ha, Hwang, Song, Lee, Park & Yoo 2018). One common protocol is as follows:

1. Standing position – Hold a handgrip dynamometer down to your side. The elbow

should be fully extended and the wrist neutral.

- A common alternative includes holding the elbow at 90 degrees.
2. Squeeze the dynamometer as hard as possible.
  3. Release and record your results.
  4. you should complete the assessment 3 times using each hand (give 30 seconds between repetition), and take the highest score for each hand.

To use the chart below, add your highest left-hand score and highest right-hand score together.

**Note:** Because of physiological differences across the sexes the category standards are broken down by sex. Please see “[Sex and Gender In This Text](#)” at the beginning of this text for more clarification.

**Fitness Category for Isometric Hand Grip  
Strength (Kg) by Age for Females**

Age	Excellent	Very Good
15-19	> 68	60-67
20-29	> 70	63-69
30-39	> 71	63-70
40-49	> 69	61-68
50-59	> 61	54-60
60-69	> 54	48-53

Adapted from CSEP (2011)

**Fitness Category for Isometric Hand Grip  
Strength (Kg) by Age for Males**

Age	Excellent	Very Good
15-19	> 108	98-107
20-29	> 115	104-114
30-39	> 115	104-114
40-49	> 108	97-107
50-59	> 101	92-100
60-69	> 100	91-99

Adapted from CSEP (2011)

### Self Reflection

1. Based on your **muscular strength** and **endurance** assessment, are you surprised by how your scores compare to norms (if yes, explain).
2. What are your goals related to muscular strength and endurance?
3. Explain how you would improve muscular endurance.
4. Explain how you would improve muscular strength.

### Chapter Overview

In Chapter 6 you learned about resistance training. Benefits of resistance training include making ADL's (activities of daily living) easier, as well as prevent,

manage, and/ or slow the progression of various chronic diseases (ACSM, 2013).

Specifically Chapter 6 focused on muscular endurance and strength. Muscular strength is the force a muscle or group of muscles can exert, while muscular endurance is the ability of a muscle or muscle group to resist fatigue (ACSM, 2013). When training for muscular strength high intensity (resistance) and low repetition is the aim. When training for muscular endurance, low intensity (resistance) and high repetitions is the aim.

### **Key Terms/Phrases**

- **Resistance training**
- **Muscular endurance**
- **Muscular strength**
- **Muscular hypertrophy**
- **Muscular power**
- **Repetitions**
- **Sets**
- **One repetition maximum (1RM)**

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7.

# FLEXIBILITY

---





Figure 1: Image depicting a person stretching their hamstring by grasping the bottom of their foot while their leg is flat on the ground.

## Chapter Objectives

At the end of this chapter, the student should be able to...

1. define **flexibility**.
2. define **range of motion**.
3. understand the importance of flexibility.
4. identify different types of stretches.
5. explain the importance of flexibility.
6. assess their own flexibility.

## The Basics Of Flexibility

**Flexibility** is defined by the ACSM (2013), as the “ability to move a joint through its complete ROM” (ACSM 2013).

**ROM or range of motion** is the complete mobility possible (Fahey et al., 2020). Flexibility is specific to each joint, meaning that stretching, and improving flexibility in one joint, won’t translate to another joint. Which is why a full body flexibility program is important in order to get ideal ROM at all your major joints. According to the ACSM (2013) the flexibility

of each joint will depend on both the stretchability and distensibility of the joint capsule itself, how warm the associated muscles are, the viscosity of the muscle, as well as the tightness of the tissues, ligaments, and tendons associated with the joint. Other factors that influence flexibility include age, physical activity level, sex, previous injuries, and genetics (Porcari et al. 2015).

## Why is Good Flexibility Important

Adequate flexibility is important for many reasons. For starters, poor flexibility can lead to poor joint health by putting too much stress on the joint, leading to issues like joint deterioration and joint pain (Fahey et al. 2020). Adequate joint ROM is important for athletics, maintaining ADLs (ACSM 2013), preventing arthritis, maintaining or improving stability and balance, prevention of low back pain, relief of some aches and pains, relief of muscle cramps, improvement in body position and postures, relaxation, and potentially improvement in impaired mobility (Fahey et al., 2020). It likely does not come as a surprise that a low level of flexibility increases one's risk of injury, but it is also important to note that having an overly high level of flexibility can also increase injury risk due to decreased joint stability. The term **hypermobile** is used to describe someone who has a greater than normal ROM, while **hypomobile** could be used to

describe someone with below normal levels of ROM (Porcari et al. 2015).

## Stretching

Participation in a regular and consistent stretching program (at least 2-3 times a week) will improve flexibility. Some transient ROM improvements can be seen immediately after stretching, while chronic improvement can be noted in as little as 3-4 weeks (ACSM 2013).

## Types Of Stretching

One of the most prescribed forms of stretching is **static stretching**. This form of stretching is commonly recommended because it is both effective, safe, and easy to do (Fahey et al. 2020). **Static stretching** is stretching to an end point and holding (ACSM 2013). A single static stretch is typically held for 10-30 seconds per stretch. The stretch should be felt, but should not be painful.



Figure 2: An individual completing static stretching on a track.

Another form of stretching is **dynamic stretching**. **Dynamic stretching** is moving a joint through its ROM during the stretch. It is important to note that with dynamic stretching the movement is slow and controlled, and often exaggerated (Fahey et al. 2020). Dynamic stretching differs from static stretching in that instead of stretching to an end point and holding the stretch, you are in motion with the goal of increasing the ROM covered in that motion with each movement. **Dynamic stretching** is safe and effective but requires more coordination and balance.

A less commonly prescribed type of stretching is **ballistic stretching**. Ballistic stretching uses a bouncing motion to create a force behind the stretch (Fahey et al. 2020). **Ballistic**

**stretching** has an increased likelihood of injury and thus is not a commonly recommended form of stretching for the general population. According to ACSM (2013) when properly performed, ballistic stretching may be an effective choice for individuals who participate in sports and activities that utilize ballistic movements.

Another type of stretching is **proprioceptive neuromuscular facilitation (PNF)**. The most common form of this is a contract relax type of stretching. **PNF** stretching typically involves the assistance of another person. With PNF stretching there is typically an isometric contraction (muscle contraction without a change in muscle length) phase, followed by a static stretch phase (ACSM, 2013). The contract phase can then be repeated followed by another stretch phase. During the second stretch phase the individual is likely able to stretch further. There are variations of PNF stretching. See the video linked below for **an example of PNF stretching**.



*One or more interactive elements has been excluded from this version of the text. You can view them online here:*

<https://rotel.pressbooks.pub/health-and-fitness3/?p=74#oembed-1>

## Recommendations

It is important that muscles are warm prior to beginning a stretching session. If you are only going to be stretching and not doing other forms of physical activity, begin with a warm up. A warm up will raise the temperature of the muscles and increase blood flow. If you are participating in other forms of exercise or physical activity, it is recommended that you stretch immediately after your cool down, while your muscles are still warm. According to the ACSM (2013), flexibility exercises should be performed after exercise because there may be a possibility that stretching can decrease power and strength for a short time period after the stretching session. By completing stretching after other forms of exercise, this is not an issue.

Stretching should be performed at least 2-3 times per week, but it is ideal to stretch more often. Stretching up to 7 days a week is safe (Fahey et al., 2020). Stretching should target major muscle-tendon units and ideally be repeated 2 to 4 times (Porcari et al., 2015).

Any of the above stretching techniques (see **Types Of Stretching** ) can be used, but ballistic stretching is not ideal for everyone. Dynamic stretching can also be challenging for individuals who lack balance and coordination. The most common stretching for most individuals is static stretching. With static stretching, it is recommended that each stretch is held for 10-30 seconds (or 30 -60 seconds in older adults) and

repeated 2-3 times (ACSM 2013). The goal is to have a total of 60 seconds of combined stretching.

Use the link below to find a beginner's guide to static stretching by NASM (National Academy of Sports Medicine).

## [Stretches for Beginners: 10 of the Best Movements for Those Just Starting](#)

### **Practical Applications/Laboratory Activities**

As mentioned above, flexibility is specific to each joint, meaning that stretching and improving flexibility in one joint won't translate to another joint. This is also true in assessing the joint flexibility of a different muscle-tendon unit. Below are two different flexibility assessments. The first (V sit and reach) is used to assess hamstring and lower back flexibility, and the second (Apley's Scratch Test) is used to assess shoulder girdle mobility.

#### **YMCA V Sit and Reach Test**

The sit-and-reach test assesses hamstring and lower back flexibility. A sit-and-reach box, tape, and



a yardstick or tape measure can be used (as explained below).

### **Preparation**

- Put a piece of tape along the floor (about a foot in length)
- Put a ruler in the center of the tape, running perpendicular to the starting end meeting the tape.

### **Starting position**

- Sitting on the floor without shoes on
- Feet should be about 8- 12 inches apart
- The heels of the feet should be touching the tape line.
- A yardstick or tape measure should be centered at the midline of the body with 15 inches intersecting the tape, and the increasing numbers should move away from the body.

### **Performing the test**

- palms face down and hands parallel to each other
- keeping legs straight, slowly reach forward as far as possible and hold for 2 seconds.

- repeat two times
- record the best score

Note: Because of physiological differences across the sexes, the category standards are broken down by sex. Please see “Sex and Gender In This Text” at the beginning of this text for more clarification.

**Fitness Category for YMCA Sit-and-Reach for Females (in inches)**

Percentile by Age	90
18 – 25	24
26 – 35	23
36 – 45	22
46 – 55	21
56 – 65	20
> 65	20

**Reference**

Well Above Average: 90th Percentile  
Above Average: 80th and 70th Percentile  
Average: 60th and 50th Percentile  
Below Average: 40th and 30th Percentile  
Well Below Average: 20th and 10th Percentile

Adapted from YMCA of the USA, 2000

**Fitness Category for YMCA Sit-and-Reach for Males (inches)**

Percentile by Age	90
18 – 25	22
26 – 35	21
36 – 45	21
46 – 55	19
56 – 65	17
> 65	17

**Reference**

- Well Above Average: 90th Percentile
- Above Average: 80th and 70th Percentile
- Average: 60th and 50th Percentile
- Below Average: 40th and 30th Percentile
- Well Below Average: 20th and 10th Percentile

Adapted from YMCA of the USA, 2000

**Apley’s Scratch Test for shoulder mobility**

This test aims to assess shoulder girdle ROM (Range of Motion).

First: warm up your muscles (for example, do arm circles and jumping jacks)

### **Starting position**

- either sitting or standing

### **Performing the test, Part 1**

1. Raise one arm up, bend the elbow, rotate the arm outwards, and reach for the opposite shoulder blade/ scapula (or down the spine if the scapula can't be reached).
2. How far the individual is able to reach should be noted (reach the spine, reach the shoulder blade, reach the middle of the shoulder blade, etc. )
3. Repeat the test with the opposite arm.

NOTE: The trunk should not rotate, and there should not be excessive arching of the lower back

### **Performing the test, Part 2:**

1. Put one arm behind the back (low), bend the elbow and rotate the arm inward with the palm out and reach up the back as far as possible. Reach toward the shoulder blade/ scapula on the opposite side (or up the spine

if the scapular can't be reached).

- 2. How far the individual is able to reach should be noted (reach the spine, reach the shoulder blade, reach the middle of the shoulder blade ect. )
- 3. Repeat the test with the opposite arm.

**NOTE:** The trunk should not rotate and there should not be excessive arching of the lower back.

**Determine shoulder girdle flexibility limitations:**

Good shoulder mobility	Limitation/ Further evaluation needed
ROM is close to the same on both sides	ROM is not close to the same on both sides
If the middle of the shoulder blade is reached. (both overhead – part 1, and up the back- part 2).	If the middle of the shoulder blade is not reached. (both overhead – part 1, and up the back- part 2).

(Adapted from Kendall et al., 2005)

### **Self Reflection**

1. Based on the two flexibility assessments, are you surprised by the outcomes (if yes, explain)?
2. What are your goals related to flexibility?
3. Explain how you might improve your flexibility, if you wanted to (be specific).

### **Chapter Overview**

In Chapter 7, you learned about flexibility. Flexibility is the “ability to move a joint through its complete ROM” (ACSM 2013). Flexibility is specific to each joint, meaning that stretching and improving flexibility in one joint won’t translate to another joint. Poor flexibility can lead to poor joint health by putting too much stress on the joint, leading to issues like joint deterioration and joint pain (Fahey et

al., 2020). This is why a full body flexibility program is important in order to get ideal ROM at all your major joints. Participation in a regular and consistent stretching program (at least 2-3 times a week) will improve flexibility (ACSM 2013) . Static stretching is a commonly prescribed form of stretching, but other types of stretching include dynamic stretching, ballistic stretching, and proprioceptive neuromuscular facilitation (PNF). Before beginning any stretching bout, it is important to make sure that muscles are properly warmed up.

### **Key Terms/Phrases**

- **Flexibility**
- **ROM (Range of motion)**
- **hypermobility**
- **hypomobility**
- **static stretching**
- **ballistic stretching**
- **dynamic stretching**
- **proprioceptive neuromuscular facilitation (PNF)**

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8.

# BODY COMPOSITION

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Figure 1: Anatomical image of human anatomy (bones and muscles). Bones and muscles are two components of body composition.

## Chapter Objectives

At the end of this chapter, the student should be able to...

1. define **body composition**.
2. understand the difference between fat mass and fat-free mass.
3. explain why body fat is a better indicator of health than **body weight**.
4. understand the limitations of **BMI**.
5. explain why there is a recommended range for “ideal” body composition.
6. identify ways to measure body composition.
7. understand that body composition is only a single factor and does not give us a full picture of one’s health, wellness, or activity level.

## The Basics of Body Composition

**Body composition** is the ratio of fat mass to fat-free mass (ACSM, 2013). Body composition is often expressed as the

percentage of total body fat one has, while the remainder is everything else (bone, muscle tissue, organs, teeth, connective tissue, body water etc.) (Kenny et al., 2015). It is important to note that while the term “fat” often comes with a negative connotation, body fat is incredibly important. While excess body fat comes with an increased risk for various chronic illnesses (more on this in the section titled Body Fat), body fat is necessary for various functions (ACSM, 2013). The risk of low body fat and high body fat will be discussed in more detail below.

## Body weight

According to the National Center for Biotechnology Information (n.d), **body weight** can be defined as “The mass or quantity of heaviness of an individual. It is expressed by units of pounds or kilograms.” The term overweight is defined by Fahey et al. (2020) as “total body weight above the recommended weight for good health as determined by large-scale population surveys.” **Body weight** norms, or the range of healthy body weights, are typically based on height. It is not uncommon for individuals to be concerned about their weight. The problem with focusing too much on weight is that weight alone doesn’t tell us anything about what our body composition is. Excess weight due to excess fat tissue is very different from excess body weight due to muscle mass. The former has the potential to increase one’s risk of certain

chronic diseases, while the latter is often a result of skeletal muscle training.

## Body fat

**Adipose tissue**, often called body fat, is the body tissue where we store fat (Fahey et al., 2020). As mentioned above, body fat is typically expressed as a percentage (Kenny et al., 2015). This is a percentage of the whole body. So if someone's **body fat percentage** is 25%, that means 25% of their body is fat tissue, and 75% is made up of everything else. Body fat is necessary for bodily function. It is needed for various organs and systems in our body to function properly. For example, our nervous system needs fat tissue, as well as our brain, heart, lungs, and mammary glands. Body fat is needed for the protection of body organs, thermoregulation, and energy storage (Fahey et al., 2020) and is a component of our cell membranes. Essential fat, or the bare minimum fat our body needs to function, is 3-5% in males and 8-12% in females. This percentage is higher in females due to fat deposits necessary for reproduction, including the uterus and breasts (Fahey et al., 2020). Ideal body fat, separated by sex and age as defined by (Gallagher et al., 2000) in the American Journal of Clinical Nutrition, is as follows:

Females

Age 20-39: 21-33%

Age 40-59: 23-34%

Age 60-79: 24-35%

Males

Age 20-39: 8-19%

Age 40-59: 11-21%

Age 60-79: 13-24%

See [Practical Applications/Laboratory Activities](#) for the American Council on Exercise body fat standards.

If you are below these ranges, you would fall into the category of **underfat**, and above these ranges as the overfat and obese categories. According to ACSM (2013), too much body fat is associated with chronic diseases, including hypertension (high blood pressure), metabolic syndrome, dyslipidemia (unbalanced lipids/ cholesterol), type 2 diabetes, cardiovascular disease, and events including stroke and heart attack. Being underweight increases various risks including, but not limited to, the risk of stunted growth, respiratory infection and other infections in children, osteoporosis and bone fractures, cardiovascular disease, hormonal imbalance leading to fertility issues in both males and females, ovulation dysfunction, and amenorrhea in females, depression, and finally, evidence exists that individuals who are underweight may have an increased risk of premature death when compared to individuals of a healthy weight (Roh et al., 2014; Park et al., 2023; Park et al., 2017; Jung et al., 2017; Park et al., 2023; WHO, 2024; Dobner & Kaser, 2017; Lim & Park, 2016).

## Overweight vs Obese

According to Fahey et al. (2020), overweight is a bodyweight that falls above the recommended range that is based on one's height. As mentioned, weight (typically measured in lb or kg) in itself does not give us information about body composition. Excess weight due to excess fat tissue is very different from excess body weight due to muscle mass. The former can lead to disease, while the latter is often a result of muscular training. It is especially important for athletes to pay less attention to overall body weight or body size, and it can be reasonable for them to give more attention to body composition (Kenny et al., 2015). Two individuals of the same sex, age, weight, and height can have very different body composition. With that said, spending too much time focusing or concerning yourself with body composition can be unhealthy as well. Too much attention and concern may lead people down various negative pathways that could include overtraining, disordered eating, and relative energy deficiency in sport.

Various definitions of obesity exist. **Obesity** can be viewed as “a more serious degree of overweight that carries multiple major health risks” (Fahey et al., 2020). The concern with this definition, and similar ones, is that it does not address body fat but rather just overall weight. As mentioned above, weight in itself (without distinguishing if it is excess fat weight) is not the problem. Any potential negative consequences of excess body weight come when the weight is caused by fat.

An arguably better definition is “a complex disease involving having too much body fat.” (Mayo Clinic Staff, n.d.). The latter definition addresses the disease concern, which is excess adipose tissue. Moving forward in this text, we will assume overweight relates to someone outside the “ideal” weight range based on their height, and obesity is an excess of adipose (fat) tissue.

## BMI

**Body Mass Index (or BMI)** is a tool used to compare weight to height (ACSM 2013). The formula to determine BMI is weight in Kg (to go from lb to kg, divide by 2.2) divided by height in meters squared (1 inch is 2.54 cm and 1 cm is .01 meters).

$$\text{BMI} = \text{Weight (in kg)} / \text{Height}^2 \text{ (in meters)}$$

According to the ACSM (2013), health problems related to obesity increase after a BMI of 25 kg/m<sup>2</sup>. A BMI of 25 begins the overweight category, and a BMI of 30 or above suggests one is obese. It is once again important to note that BMI does not address body composition, and thus two individuals with the same BMI could have very different body compositions. BMI is a noninvasive tool that is often used, but it is important to note its limitations, which are more pronounced in individuals who are athletic and have a higher-than-normal muscle mass.

$$\text{BMI (Kg./m}^2\text{)}$$

**Underweight:** <18.5

**Normal:** 18.5-24.9

**Overweight:** 25.0-29.9

**Obesity:** >30.0

Adapted from Executive Summary of the Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults, (1998).

## Waist Circumference

Hopefully, at this point, it is clear that body fat percentage yields information about a person's general fitness, while body weight in itself gives us very little insight. Where body fat is stored is important to address. Visceral fat is fat that is located around organs, while subcutaneous fat is fat that is located under the skin (Fahey et al., 2020). More visceral fat distribution is linked to a greater risk of metabolic syndrome in comparison to subcutaneous fat. Additionally, excess body fat that is primarily around the torso/ trunk region is more detrimental to overall health than fat that is distributed in the hip and thigh region of the body (ACSM, 2013). Excess fat tissue in the abdominal region is termed android obesity, while excess fat tissue in the hips and thighs is termed gynoid obesity. Having android obesity puts someone at higher risk of developing the chronic illnesses associated with obesity (hypertension, metabolic syndrome, dyslipidemia, type 2 diabetes, and cardiovascular disease) than those with gynoid obesity.



Because of this, waist circumference measurements can be another tool to assess disease risk related to excess adipose tissue. Waist circumference measurements can be taken with a cloth tape. According to the ACSM (2013), waist measurements should be taken directly above the iliac crest. Measurements should be taken without compressing the skin. Ideally, two measurements should be taken, and provided there is not more than a 5mm difference between the two measurements, the average of the two should be used. According to the Center for Disease Control and Prevention (n.d.), a circumference greater than 40 inches in males and 35 inches in females increases one's risk of obesity-related illnesses.

More information on BMI and waist circumference can be found on the [CDC BMI Website](#).

## Assessing Body Fat

Different methods exist to measure body fat. Below, these methods will be briefly summarized.

Each method of measuring body fat has different benefits. Some measurements are more precise but others are more convenient. Ways to assess body composition include Densitometry, Dual-energy X-ray absorptiometry, skinfold fat thickness measurements, and bioelectrical impedance procedures (Kenny et al., 2015). Densitometry is measuring an individual's body density, and then using that to determine

body composition. In order to do this body volume and body mass is needed. Body volume can be measured via hydrostatic weighing (or underwater weighing) which assess water displacement, and body mass is simply body weight. Air plethysmography is another way to measure body volume, in this case air displacement is used instead of water displacement. Dual-energy X-ray absorptiometry (DEXA) uses a DEXA machine to measure bone density as well as overall body composition. Densitometry and Dual-energy X-ray absorptiometry are both highly accurate ways to assess body composition. With that being said, they require more equipment than other methods. Skinfold fat thickness assessments use skinfold calipers to measure the thickness of skinfold fat. This equipment needed for this is far less expensive, but training is necessary in order to perform the assessment accurately. Finally a bioelectrical impedance uses a current to measure the electrical conductance through the body (Kenny et al., 2015). Water is a conductor, and the majority of body water is stored in our fat free mass, so fat free mass increases the speed of conduction, and fat mass slows it. This method requires very little training, and is relatively inexpensive compared to other methods. bioelectrical impedances can be simple hand held devices, and now can even be found in some bathroom scales.

## Acknowledging The Obesity Epidemic

The term “obesity” is certainly something you have heard about prior to reading this chapter. It is well known the US has a high prevalence of obesity. In 2022, the Center for Disease Control and Prevention (n.d.), reported that every state and territory in the US had a greater than 20% adult obesity prevalence, with 19 states having a prevalence between 35% and 40%, and 3 states with a prevalence over 40%. More specifics about states, and other variables, including education level breakdowns as well as differences across race and ethnicity, can be found at the CDC website linked below. It is important to note that BMI is the tool used to categorize individuals as obese ( $\text{BMI} > 30.0 \text{ Kg. m}^{-2}$ ). While it is well known that BMI is not the best measure of obesity, it is beneficial when we are looking at data for a large group, and the results are more accurate with non-athletic individuals (as athletic individuals tend to have a greater percentage of muscle mass in comparison to non-athletes). So while BMI is not the greatest measure, it is still very clear that obesity as well as the chronic illnesses associated with it (that were discussed above) are major health concerns. It is also important to note that while obesity is a problem in the United States, it is also a problem that is not restricted to the US or even to more industrialized countries. According to the World Health Organization (n.d.), it is estimated that 115 million individuals

in developing countries are also dealing with health issues directly related to obesity.

Resources related to the obesity epidemic:

[CDC Adult Obesity Prevalence Maps](#)

[World Health Organization \(WHO\) on Controlling the global obesity epidemic](#)

## Acknowledging Weight and Body Fat As Just One Component of Health

While the obesity epidemic is not a problem that should be ignored, it is also important to acknowledge that being overly concerned about body weight or body fatness to the point that it is all-consuming is not healthy either. Body composition is one indicator of disease risk, and we must also consider physical activity, nutrition, and other areas of fitness as well as mental health. It is important to note that there is not one ideal body weight, shape, or size. As mentioned previously, too much attention and concern may lead people down various negative pathways that could include overtraining, disordered eating, and RES-S (relative energy deficiency in sport).

Using the resources provided, spend some time defining, and familiarizing yourself with the terms overtraining, disordered eating, and RED- S.

## Relative Energy Deficiency in Sport (REDs)

### What Is Disordered Eating?

### Overtraining: What It Is, Symptoms, and Recovery

#### Practical Applications/Laboratory Activities

Different labs activities can be conducted for body composition. Some options include calculating BMI, measuring waist circumference, or using BIA to determine estimated body composition. With that said the author strongly believes if doing a body composition activity will have a negative effect on an individual (mentally, emotionally, or behaviorally) then the assessment should not be completed.

Optional Activities:

##### 1) **BMI Calculation and Classification:**

**BMI** = Weight (in kg) / Height<sup>2</sup> (in meters)

**BMI** (Kg/m<sup>2</sup>)

**Underweight:** <18.5

**Normal:** 18.5-24.9

**Overweight:** 25.0-29.9

**Obesity:** >30.0

Adapted from Executive Summary of the Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults, (1998).

## 2) **Waist Circumference Measurement and Classification:**

Equipment: Cloth tape

Take measurements:

- 1) Measurements should be taken directly above the iliac crest.
- 2) Measurements should be taken without compressing the skin.
- 3) Take two measurements.
- 4) Average the results of the two measurements (as long as there is not more than a 5mm difference between the two measurements).
- 5) Use the chart below to determine waist circumference health risk

Note: Because of physiological differences across the sexes, the category standards are broken down by sex. Please see “Sex and Gender In This Text” at the beginning of this text for more clarification.

**Waist Circumference Risk Criteria for Adult Females**

Very Low Risk	Low Risk	
<70cm (<28.5in)	70-89 cm (28.5-35.0in)	

Adapted from Bray (2004)

**Waist Circumference Risk Criteria for Adult Males**

Very Low Risk	Low Risk	
<80cm (<31.5in)	80-99 cm (31.5-35.0in)	

Adapted from Bray (2004)

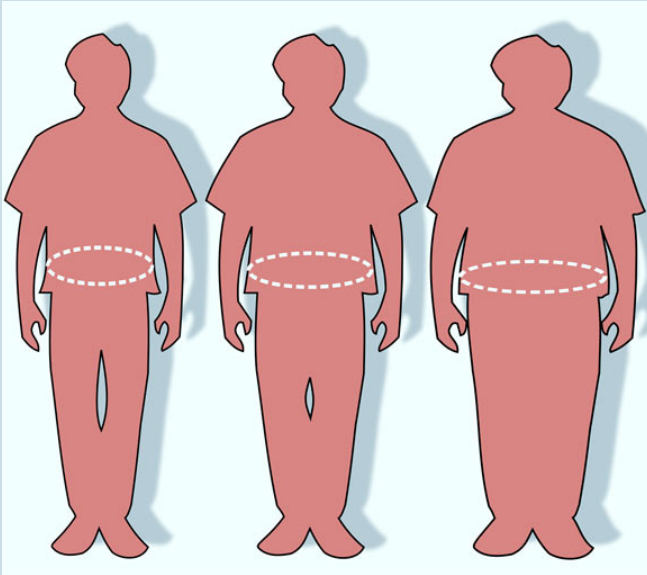


Figure 2: This figure illustrates waist circumference.

3) If you have access to a BIA (bioelectrical Impedance), follow the specific instructions that are provided with the instrument. Once you have results, then you can compare them with the “ideal body fat range” (see above: **Body fat**) or those below from the American Council on Exercise (ACE).

Note: Because of physiological differences across the sexes, the category standards are broken down by sex. Please see “Sex and Gender In This Text” at the beginning of this text for more clarification.



### Body Fat % for Adult Females

Essential Fat	Athletic
10-13%	14-20%

Adapted from ACE (acefitness.org)

### Body Fat % for Adult Males

Essential Fat	Athletic
2-5%	6-13%

Adapted from ACE (acefitness.org)

**NOTE: No less than 10-13% body fat in females and 3% in males is recommended (The Cooper Institute, 2009)**

### Self Reflection

If you completed one or more of the above assessments. You should reflect on your results.

In addition, and even if you chose not to complete the above assessments, reflect on the importance of body fat and the potential risks of too little or too much. What are lifestyle choices that can promote a healthy body composition?

## Chapter Overview

In this chapter, you learned about body composition. Body composition is the ratio of fat mass to fat-free mass (ACSM, 2013). Typically, when we are assessing body composition, we look to measure body fat, which is then expressed as a percent of the overall body that is made up of adipose (fat) tissue. The difference between looking at body composition or body fat percentage vs. body weight was discussed in detail. According to the National Center for Biotechnology Information (n.d), body weight can be defined as “The mass or quantity of heaviness of an individual.” It is expressed by units of pounds or

kilograms and thus does not take composition into account.

Overweight and obese have become commonly used terms and talked about conditions that affect many individuals not only in the US but worldwide. It is important to understand that someone who is overweight has a body weight that is above the recommended range for the individual's height (Fahey et al. 2020), while "obesity is a complex disease involving having too much body fat." (Mayo Clinic Staff n.d.). The associated health concern is linked less to weight and more to an excess in body fat. It is also important to note that while too much body fat is unhealthy and increases one's risk of many chronic illnesses, being underfat is also extremely unhealthy. Additionally, it is also important to mention that too much focus on weight and appearance can lead to some negative outcomes as well.

Body Mass Index is a widely used tool to indicate when an individual is underweight, a normal weight, overweight, or obese, but certainly has limitations. Body Mass Index (or BMI) does not assess body composition and only compares weight to height

(ACSM 2013). It is going to be less reliable as a tool for individuals with higher muscle mass. Looking at waist circumference can be helpful to determine if someone stores a high amount of fat in the torso/trunk region (android obesity) as storing adipose tissue in this region is associated with more disease risk (ACSM, 2013). Many methods to assess body fatness exist.

Each method of measuring body fat has different benefits. Some measurements are more precise, but others are more convenient. Ways to assess body composition include Densitometry, dual-energy X-ray absorptiometry, skinfold fat thickness measurements, and bioelectrical impedance procedures (Kenny et al. 2015).

Obesity is a problem in the US, as well as in other developed and developing countries ( World Health Organization, n.d.),. While the obesity epidemic is not a problem that should be ignored, it is also important to acknowledge that being overly concerned about body weight or body fatness to the point that it is all-consuming is not healthy either. Body composition is only one indicator of disease risk.

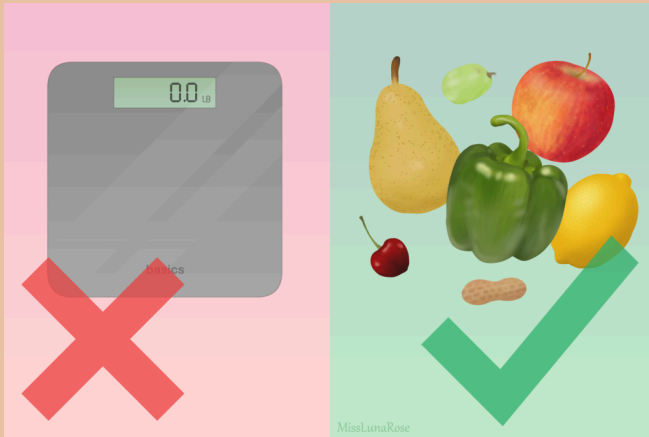


Figure 3: This figure shows a crossed-out scale and a checkmark next to healthy whole foods. This work aims to deter people from giving the scale too much power and instead focus on healthy habits such as healthy eating. There is more to health than body weight alone.

### Key Terms/Phrases

- **body composition**
- **body weight**
- **overweight**
- **adipose tissue**
- **body fat percentage**
- **obese**
- **underfat**
- **body mass index**

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9.

# STRESS, SELF-CARE, AND SLEEP

---



Figure 1: Man sitting on a sofa with hand on his head. He appears to be under stress.

## Chapter Objectives

At the end of this chapter, the student should be able to...

1. define stress.
2. understand the difference between eustress and distress.
3. understand the difference between acute and chronic stress.
4. explain ways to deal with stress.
5. explain what self-care is and what it can look like.
6. understand the importance of sleep.
7. explain how circadian rhythms influence sleep.
8. explain how homeostatic sleep drive influences sleep.

# The Basics of Stress, Self-Care, and Sleep

## Stress

**Stress** is defined by the WHO as “a state of worry or mental tension caused by a difficult situation.” (World Health



Organization n.d.) The situation or cause for the state of worry can be called the “stressor.” Chrousos et al. (2009) explain this stressor as something that threatens one’s homeostasis, and the stress response is how a reaction responds to the stressor in an effort to regain homeostasis. Stressors come in different forms. Something major like a natural disaster or the sudden loss of a loved one are stressors, and things that are relatively minor in the grand scheme of things such as running late can be a stressor. While stressors vary greatly, the systems within our body that respond are the same.

## Response to Stress

When we are faced with a stressor, the body responds with what is often referred to as the “fight-or-flight” response (Cleveland Clinic, 2023). When we perceive a stressor, the sympathetic nervous system is activated. This is also the system activated during exercise, and the neurotransmitter norepinephrine (noradrenaline) is released. Additionally, the sympathetic nervous system triggers the endocrine (hormonal) system. The endocrine system releases the hormones epinephrine (adrenaline), norepinephrine (noradrenaline ) (Cleveland Clinic, 2023), and cortisol (Fahey, 2020). The following are downstream responses to the neural and endocrine response. The initial trigger is from the neurotransmitter norepinephrine, but the hormones tell your

systems to continue with the reaction. This continues until the stressor is no longer present (Cleveland Clinic, 2023).

**Downstream responses** (Cleveland Clinic, 2023)

- Increased heart rate
- Increased blood pressure
- Increased breathing rate
- Airway dilation
- Dilation of Pupils in the eye
- Blood is diverted to muscle and away from the skin (skin may appear pale)
- The liver converts glycogen (stored glucose) into glucose so we can utilize it to yield energy!

These responses occur regardless of whether the threat is real or perceived.

Brainstorm why the above responses are important in a stressful situation.

## Types of Stress

**Stress** can be both short-term and long-term. According to

The American Psychological Association (n.d.), we are well equipped to manage small doses of stress, but stress that lasts long-term can have more serious effects on the body. Short-term stress is often referred to as “**acute**” stress and long-term stress is called “**chronic**” stress. The above response (found under **Responding to Stress**) is how we respond to acute stress. **Acute stress** could come from a vehicle coming toward you, a loud noise, having to speak in public, or an upcoming exam. **Chronic stress** may include things like living or working in a tumultuous home environment, as well as long-term medical or financial stress. Chronic stress causes a continuous activation of the nervous system that can lead to tension headaches, inflammation of the circulatory system, hypertension, heart attack, stroke, impaired immune system function, changes in appetite, gastrointestinal changes, decreased sexual drive, and fertility issues for both males and females as well as menstrual dysfunction in females (American Psychological Association, n.d.).

Not all stress is bad. Stress can be categorized as **distress** or **eustress**. According to the American Psychological Association (n.d.), **distress** is the result of “being overwhelmed by demands, losses, or perceived threats.” On the other hand, **eustress** is stress that is a result of “challenging but attainable and enjoyable or worthwhile tasks.” For example, you may feel stress before giving a presentation, but it is likely a good opportunity and something you will likely feel good

about when it is over. However, an argument with a friend may leave you in distress.

We are all going to be faced with stressful situations throughout life. It is important that we have tools to deal with it. Below are some methods that may be helpful to deal with stress. With that said, if you are struggling to deal with your stress, it is important to reach out to a professional for help.

Ways you can deal with stress:

- Doing physical activity
- Getting enough sleep
- Meditating
- Making sure you are eating well
- Doing things you enjoy doing
- Talking to someone you trust
- Connecting with other people (family, friends, community or faith connections)
- Taking a break from what is causing you the stress when possible ( for example, don't watch the news over and over if it causing you stress)

(Center for Disease Control and Prevention, n.d.)

Avoid using alcohol or drugs to deal with stress. Using these substances may make you feel better in the short term, but in the long term they will make your stress worse.

## Sleep

When individuals are considering lifestyle changes to improve health, quality of life, and well-being, it is not uncommon to hear ideas regarding nutrition, physical activity, or even quitting habits such as smoking or drinking. One habit that likely doesn't get mentioned as often as it should, is sleep. According to the U.S. Department of Health and Human Services (n.d.), roughly 33% of adults do not get enough sleep, and an even greater percentage of adolescents are lacking sleep. Long term sleep deprivation as well as sleep disorders (such as chronic insomnia, sleep apnea, and restless leg syndrome) may be linked to an increased risk of hypertension, diabetes, obesity, depression, heart attack, and stroke (Institute of Medicine, 2006) as well as a decrease in productivity, increased healthcare needs, and an increased chance of injury. Additionally, serious disasters have been caused by individuals who were severely sleep deprived. According to the National Highway Traffic Safety Administration (n.d.), in 2021, there were 682 deaths associated with “drowsy-driving.”

## Circadian Rhythms

Our drive to sleep is impacted by circadian rhythms and our homeostatic sleep drive. According to the National Institute of General Medical Science (2023) **Circadian Rhythms** are “ the physical, mental, and behavioral changes an organism

experiences over a 24-hour cycle.” Many things can influence our circadian rhythm such as eating and physical activity, but the biggest influence is the light and dark cycle. Our bodies naturally want to wake during the light hours, and sleep during the dark hours. We produce the hormone melatonin when it is dark, which triggers different systems in the body to get ready for sleep (Fahey et al. 2020). Individuals who work overnight, or even those who choose to stay up very late can cause disruption to the circadian rhythm. According to Brum et al. (2022), the sleep changes due the night shift work can cause one to lose connection with the light dark cycle and thus alter their circadian rhythms.

Take a moment and think about how artificial light from lamps or tech devices may alter your sleep/wake cycle.

## Homeostatic Sleep Drive

As mentioned earlier, in addition to circadian rhythms, **homeostatic sleep drive** also impacts our sleep. From the time we wake up, to the time we go to sleep, sleep pressure builds up ([The National Institute for Occupational Safety and Health](#), n.d.). This pressure is our homeostatic sleep drive.

The longer we are awake, the more pressure there is. After a good night's sleep, sleep pressure is low and will begin to increase again through the waking hours. The sleep pressure or drive is caused by a buildup of adenosine in the brain (Fahey et al., 2020). The best way to maintain a strong homeostatic sleep drive is to wake at and then stay awake until you are ready for bed. Daytime naps will decrease your sleep pressure and potentially make it hard to go to bed at night. Additionally, consuming caffeine can alter the sleep drive because it blocks the adenosine receptors (Fahey et al., 2020).

Use the link below to see how much sleep you need based on your age, and learn about sleep debt.

## [Recommended Amount of Sleep](#)

## Allostatic Load

It is important to acknowledge that stress can build up over time. Have you ever reacted, or seen someone react to a seemingly minor acute stressor, in what appeared to be a disproportionate way? For example, maybe something such as a change in plans, that would normally induce a small amount of stress, triggers a more major reaction. This seemingly disproportionate reaction may be the result of allostatic load.

**Allostatic load** is the compilation of chronic stress that builds up over time (Guidi et al. 2020; Fava et al. 2019; McEwen, & Stellar 1993). If the compilation of life stressors is greater than

one's ability to deal with them, allostatic overload may result, causing continuous activation of the body's stress response. **Allostatic Load** can have a negative impact on health (Maestripieri & Hoffman, 2011). Maestripieri and Hoffman (2011) refer to allostatic load as the physical "wear and tear" from chronic stress.

## Self-Care

**Self-care** is a somewhat vague term, as it can encompass many different things. According to Martinez et al. (2021) the exact explanation of self-care is unclear because of the "difficulty integrating the diverse definitions developed over time across disciplines." Martinez et al. (2021) reviewed 31 different articles regarding self-care and developed the following definition "the ability to care for oneself through awareness, self-control, and self-reliance in order to achieve, maintain, or promote optimal health and well-being." At its essence, it relates to taking care of yourself. While some may view a visit to a spa or a lavish trip as self-care, it is not always relaxing, fun and/or extravagant. Self-care could be making time to schedule necessary appointments, or go for a walk to reduce stress. Self-care could be getting some tasks completed that have been weighing on your mind, learning time management skills, or getting enough sleep. If you note the definition above incorporates "well-being," and thus work towards improving any of the areas of wellness could be considered self-care. If





Note whether it was distress or eustress:

Explain how you felt:

Link your feelings to the responses discussed above:

Explain how you handled the situation and whether you would do anything differently if you could go back (knowing what you know now):

## Chapter Overview

In Chapter 9, you learned about stress, sleep, and self-care. Stress is defined by the WHO as “a state of worry or mental tension caused by a difficult situation.” (World Health Organization n.d.) The stressor is the situation or cause of the stress. Stressors come in different forms. Something major, such as a natural disaster or the sudden loss of a loved one, are stressors, and things that are

relatively minor in the grand scheme of life, such as running late, can also be stressors. Acute stress elicits the fight-or-flight response (Cleveland Clinic, 2023), which triggers many bodily responses. According to the American Psychological Association (n.d.), we are well equipped to manage small doses of stress. Still, stress that lasts long term can have more serious effects on the body. It is important to note that not all stress is bad. Stress can be categorized as distress or eustress. According to the American Psychological Association (n.d.), distress is the result of “being overwhelmed by demands, losses, or perceived threats.” While eustress is stress that is a result of “challenging but attainable and enjoyable or worthwhile tasks.” We are all going to be faced with stressful situations throughout life. In Chapter 9, some (but not all) methods of dealing with stress were listed.

Sleep is incredibly important for one’s health. According to the U.S. Department of Health and Human Services (n.d.), roughly 33% of adults do not get enough sleep, and an even greater percentage of adolescents lack sleep. Long-term sleep deprivation, as well as sleep disorders, may be linked to an increased risk for various diseases and conditions

(Institute of Medicine, 2006). The two biggest impacts on sleep are circadian rhythms and our homeostatic sleep drive. Circadian rhythms are “the physical, mental, and behavioral changes an organism experiences over a 24-hour cycle” (National Institute of General Medical Science, 2023), while homeostatic sleep drive is the sleep pressure that we build up throughout the day ([The National Institute for Occupational Safety and Health](#), n.d.).



Self-care was the last concept discussed in Chapter 9. Martinez et al. (2021) define self-care as “the ability to care for oneself through awareness, self-control, and self-reliance in order to achieve, maintain, or promote optimal health and well-being.” Improving one’s self-care often encompasses working within the various dimensions of wellness.

### **Key Terms/Phrases**

- **Stress**
- **Eustress**
- **Distress**
- **Acute Stress**
- **Chronic Stress**
- **Circadian Rhythm**
- **homeostatic Sleep Drive**

- **Self-Care**

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# GRANT INFORMATION

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For more information about the ROTEL Project, please visit our [project website](#).

# VERSION HISTORY

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Below is the version history for The Basics of Health, Wellness, and Fitness.

Version	Publication Date	Changes
First Edition: <a href="#">link to the first edition</a>	August 30, 2024	—
Revised Edition: <a href="#">link to revised edition</a>	January 21, 2025	<b>Added:</b> Chapter 4 – Intermittent Fasting Chapter 4 – Food Deserts Chapter 9 – Allostatic Load <b>New References:</b> To support additional quoted material <b>Stylistic improvements</b> throughout

# GLOSSARY - KEY TERMS

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## Acute Stress

Acute Stress is short term stress.

## Adipose tissue

Adipose tissue, often called body fat, is the body tissue where we store fat (Fahey et al., 2020).

## Age predicted maximum heart rate

Age predicted maximum heart rate is calculated by:  $220 - \text{age} = \text{predicted HR max}$

## Agility

The ability to move quickly with changes in direction and/ or other movements (ACSM, 2013; Porcari et al., 2015).

## Allostatic Load

Allostatic load is the compilation of chronic stress that builds up over time (Guidi et al. 2020; Fava et al. 2019; McEwen, & Stellar 1993).



## Balance

The ability to maintain equilibrium when stationary or moving (ACSM, 2013; Porcari et al., 2015).

## Ballistic stretching

Ballistic stretching uses a bouncing motion to create a force behind the stretch (Fahey et al. 2020).

## Blood pressure

Blood pressure is the pressure put on the blood vessels by the blood traveling through them (Kenny et al., 2015).

## BMI

Body Mass Index (BMI) is a tool used to compare weight to height (ACSM 2013).

## Body Composition

The ratio of fat vs fat free mass (ACSM, 2013; Porcari et al., 2015).

## Body fat percentage

Body fat percentage is a percentage of the whole body that is made up of fat (Kenny et al., 2015).

## Body weight

Body weight: “The mass or quantity of heaviness of an individual. It is expressed by units of pounds or kilograms.” (National Center for Biotechnology Information, n.d)

## Bradycardia

Bradycardia is a heart rate that is less than 60 bpm (Kenny et al., 2015).

## Breathing rates

Breathing rate is the number of breaths taken per minute. At rest, a typical breathing rate is roughly 15 breaths per minute (Breathe, 2020).

## Calorie

A unit of energy within biological systems (Kenny et al., 2015).

## Carbohydrates

Carbohydrates are a macronutrient with a main role of providing energy. Carbohydrates also have a role in the synthesis of nonessential amino acids (Kumar et al., 2017). Carbohydrates yield 4 kcal/gram.

## Cardiovascular endurance

The ability of the body to transport oxygen (ACSM, 2013; Porcari et al., 2015).

## Cardiovascular Fitness

The ability of the body to transport oxygen (ACSM, 2013; Porcari et al., 2015).

## Chronic Stress

Chronic Stress is long lasting stress.

## Circadian Rhythm

Circadian Rhythm is “the physical, mental, and behavioral changes an organism experiences over a 24-hour cycle.” (National Institute of General Medical Science (2023)

## Concentric contraction

Concentric contraction is a muscle contraction where, while force is being produced to overcome a resistance, the muscle shortens in length (Porcari et al. 2015).

## Controllable health factors

Factors that influence our health that we have control over.

## Cooper 1.5 mile walk/run

Cooper 1.5 mile walk/run test- An assessment of cardiovascular fitness level.

## Cooper 1.5 mile walk/run test

## Coordination

The ability to move with control and accuracy (ACSM, 2013; Porcari et al., 2015).

## Diastolic blood pressure

Diastolic blood pressure is the pressure during ventricular (lower heart chambers) relaxation (Kenny et al. 2015).

## Dimensions of Wellness

There are 8 dimensions of wellness, which include emotional wellness, physical wellness, occupational wellness, social wellness, spiritual wellness, intellectual wellness, environmental wellness, and financial wellness (Stoewen, 2015: 8 Dimensions of well-being).

## Distress

Distress is the result of “being overwhelmed by demands, losses, or perceived threats.” (American Psychological Association n.d.)

## Dynamic contraction

Dynamic contraction is a muscle contraction where there are changes in muscle length (Porcari et al. 2015). Also referred to as isotonic contractions.

## Dynamic stretching

Dynamic stretching is moving a joint through its ROM. It is important to note that with dynamic stretching the movement is slow and controlled, and often exaggerated (Fahey et al. 2020).

## Eccentric contractions

Eccentric contraction is a muscle contraction where the resistance is greater than the force and the muscle lengthens (Porcari et al. 2015).

## Essential nutrients

Essential nutrients are those that we need to consume because we cannot make sufficient quantities fast enough or at all on our own (Fahey et al., 2020).

## Eustress

Eustress is a result of “challenging but attainable and enjoyable or worthwhile tasks.” (American Psychological Association n.d.)

## Exercise

Exercise is “a type of physical activity consisting of planned, structured, and repetitive bodily movement done to improve or maintain one or more of the components of physical fitness (ACSM, 2013).”

## Fad diets

A fad diet is

“a weight loss plan that promises dramatic results over a short-term period” (Gui, 2008).

## Fat

Fat, or Lipid, is a macronutrient that yields energy, specifically during rest and low intensity activities (Fahey et al., 2020), is important for insulation, protection, and the absorption of fat-soluble vitamins. Fat yields 9 kcal/gram.

## Fitness

Fitness is “a set of attributes or characteristics that

individuals have or have achieved that relates to their ability to perform physical activity (ACSM, 2013).”

## Flexibility

Flexibility is the available range of motion at a joint (ACSM, 2013; Porcari et al., 2015).

## Food desert

A food desert is a low income community where there is limited access to food that is considered both affordable and healthy (Ver Ploeg et al., 2011).

## Gender

“Gender is a multidimensional construct that links gender identity, which is a core element of a person’s individual identity; gender expression, which is how a person signals their gender to others through their behavior and appearance (such as hairstyle and clothing); and cultural expectations about social status, characteristics, and behavior that are associated with sex traits (National Academies of Sciences, Engineering, and Medicine, 2022).”

## Handgrip dynamometer

Handgrip dynamometer is an instrument used to measure grip strength.

## Health

Health is “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.” (World Health Organization, n.d.)

## Health disparities

*Healthy People 2030* defines a health disparity as “a particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage”(U.S. Department of Health and Human Services, n.d.)

## Health literacy

*Healthy People 2030* defines personal health literacy as “the degree to which individuals have the ability to find, understand, and use information and services to inform health-related decisions and actions for themselves and others.” (U.S. Department of Health and Human Services, n.d.)

## Health-related components of fitness

The health-related components of fitness include cardiovascular fitness, muscular strength, muscular endurance, flexibility, and body composition (ACSM, 2013).



## Heart rate

The number of times your heart contracts or beats every minute (Kenny et al. 2015). Healthy individuals typically have a resting heart rate between 60 and 80 bpm.

## Heart Rate Reserve (HRR)

Heart Rate Reserve (HRR) is found by taking the the Maximum Heart Rate and subtracting the Resting Heart Rate ( $HR_{max} - HR_{rest}$ ) (Kenny et al., 2015).

## Homeostatic Sleep Drive

Homeostatic Sleep Drive is a sleep pressure that builds up from the time we wake up until we go to sleep (National Institute of General Medical Science (2023).

## Hypermobile

Hypermobile is a term used to describe someone who has a greater than normal ROM (Porcari et al. 2015).

## Hypertension

Hypertension is high blood pressure: (Porcari et al. 2015).

## Hypomobile

Hypomobile is a term used to describe someone with below normal levels of ROM (Porcari et al. 2015).

## Karvonen Method

Karvonen method is also called the percentage of Heart Rate Reserve method (Porcari et al. 2015) used to calculate target heart rates.

## Locus of control

Locus of control pertains to how an individual perceives their personal level of control or lack thereof over situations (Fahey et al., 2020). The two ends of the spectrum include internal locus of control and external locus of control.

## Macronutrient

Macronutrients are nutrients that we need to consume in relatively large amounts (Faley et al., 2020).

## Micronutrient

Micronutrients are nutrients we need in small quantities (Kumar et al. 2017).

## Micronutrients

## Minerals

Minerals are micronutrients that aid in growth, regulating various body functions and assisting in the release of energy (Fahey et al., 2020). There are 17 essential minerals, which, like vitamins, all have differing roles. Minerals can be separated into two groups, major minerals and trace minerals.

## Moderate-intensity aerobic exercise

Moderate-intensity exercise is physical activity or exercise such as brisk walking (Porcari et al. 2015).(64%-76% of Max HR (ACSM, 2021))

## Muscular Endurance

The ability of skeletal muscle to resist fatigue (ACSM, 2013; Porcari et al., 2015).

## Muscular hypertrophy

Muscular hypertrophy is increasing muscle size (Kenny et al., 2015).

## Muscular power

Muscular power is the ability to overcome a force at speed (ACSM, 2013; Porcari et al., 2015).

## Muscular Strength

The ability of skeletal muscles to overcome resistance (ACSM, 2013; Porcari et al., 2015).

## Non-essential nutrients

Nonessential nutrients are nutrients that the body can make on its own (Kohlmeier, 2015).

## Obese

Obese is “a complex disease involving having too much body fat.” (Mayo Clinic Staff, n.d.)

## One repetition maximum

One repetition maximum (also written as 1RM) is a weight someone can correctly lift (specific to the movement) with one effort (Kenny et al., 2015)

## One repetition maximum (1RM)

## Overweight

Overweight is a bodyweight that falls above the recommended range that is based on one's height (Fahey et al., 2020).

## Oxygen is transported

## Oxygen transportation

Oxygen is transported via the blood throughout the body. The majority of this oxygen is transported through the blood bound to hemoglobin (found in red blood cells) (Kenny et al., 2015).

## Physical activity

Physical activity is “any bodily movement produced by the contraction of skeletal muscles that results in a substantial increase in caloric requirements of resting energy expenditure (ACSM, 2013).”

## Physical Fitness

### Power

The ability to overcome a force at speed (ACSM, 2013; Porcari et al., 2015).

## Proprioceptive Neuromuscular Facilitation (PNF)

Proprioceptive Neuromuscular Facilitation (PNF) is a contract/relax type of stretching. PNF stretching typically involves the assistance of another person. With PNF stretching there is typically an isometric contraction (muscle contraction without a change in muscle length) phase, followed by a static stretch phase (ACSM, 2013).

## Protein

A macronutrients that plays a key component of the body's structure. Proteins have structural roles in the blood (Kumar et al. 2017) bone and muscle (Faley et al. 2020) and aid in the synthesis of enzymes, cell membranes, and some hormones. Proteins yield 4 kcal/gram.

## Pulse

Pulse is a rhythmical throbbing of the arteries (reflecting the heart beat) as blood is propelled through them, typically as felt in the wrists or neck.

## Range of motion

Range of motion / ROM is the complete mobility possible (Fahey et al., 2020).

## Reaction Time

The time it takes to respond to a stimulus (ACSM, 2013; Porcari et al., 2015).

## Repetitions

Repetitions are the number of completed movements/exercises within a set (Heyward 2006).

## Resistance training

Resistance training is training for muscular health, including muscular strength, endurance and power (Kenny et al., 2015).

## ROM (Range of motion)

## Self-Care

Self-care is “the ability to care for oneself through awareness, self-control, and self-reliance in order to achieve, maintain, or promote optimal health and well-being.” (Martinez et al., 2021)

## Self-efficacy

Self-efficacy has been defined as “People’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances.” (Bandura, A. 1986)

## Sets

Sets are the number of times a group of repetitions is completed (Heyward 2006).

## Sex

“Sex is a multidimensional construct based on a cluster of

anatomical and physiological traits that include external genitalia, secondary sex characteristics, gonads, chromosomes, and hormones (National Academies of Sciences, Engineering, and Medicine, 2022).”

### Skill Related Components of Fitness

Skill-related components of fitness include agility, coordination, balance, power, speed, and reaction time (ACSM, 2013).

### Skill-related components of fitness

Skill-related components of fitness include agility, coordination, balance, power, speed, and reaction time (ACSM, 2013).

### SMART goal design

SMART criteria include making sure a goal is specific, measurable, attainable, realistic and time-frame specific (Fahey et al., 2020).

### Social determinants of health

According to Healthy People 2030 “Social determinants of health are the conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and



quality-of-life outcomes and risks.” (U.S. Department of Health and Human Services n.d.)

## Speed

The ability to move quickly from one point to another (ACSM, 2013; Porcari et al., 2015).

## Stages of Change Model (Transtheoretical Model)

Stages of Change Model (also called the Transtheoretical Model) is a model used to help understand behavior change and the steps one must go through. It is broken down into five stages, including pre-contemplation, contemplation, preparation, action, maintenance, and termination (Fahey et al., 2020).

## Static stretching

Static stretching is stretching to an end point and holding (ACSM 2013).

## Stress

Stress is “a state of worry or mental tension caused by a difficult situation.” (World Health Organization n.d.)

## Systolic blood pressure

The pressure during ventricular (lower heart chambers) contraction (Kenny et al. 2015).

## Tachycardia

Tachycardia is a heart rate that is above 100 bpm (Kenny et al., 2015).

## Talk Test

Talk Test is a method used to estimate cardiovascular exercise intensity. It is based on the concept that if one is exercising at an intensity that increases breathing frequency, speech will be compromised (Porcari et al. 2015).

## Target HR

Target Heart Rate is a heart rate range relative to how fast your heart should beat for given cardiovascular exercise intensities.

## Uncontrollable health factors

Factors that influence our health that we do not have control over.

## Underfat

Underfat is when the percentage of body fat is below what is considered healthy for a specific individual.

## Vigorous intensity

Vigorous intensity is physical activity or exercise that is relatively hard for an individual. With respect to cardiovascular exercise or physical activity, this would cause a high heart rate, deep rapid breathing, and difficulty holding a conversation (Porcari et al. 2015). Examples would include jogging or running. (77%- <95% of MaxHR (ACSM 2021))

## Vitamins

Vitamins are micronutrients that play a role in different body processes. There are 13 different vitamins (A, C, D, E, K and the eight B vitamins) (Fahey et al., 2020).

## VO2max

VO2max is the maximal oxygen consumption. The maximal amount of oxygen the body can consume during maximal exercise (Kenny et al., 2015).

## Water

Water is a macronutrient that does not yield calories, but

is incredibly important. We are able to survive much longer without food (potentially up to 50 days) than without water (a couple of days) (Fahey et al, 2020). Proper hydration is important in order to maintain blood volume, cellular functions, and body temperature.

## Wellness

Wellness is a holistic compilation of dimensions that enhance one's quality of life and enable them to reach their full potential (Stoewen, 2015).