A Guide to Physical Activity

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Eydie Kramer

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Contents

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Eydie Kramer

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Chapter 1: Physical Activity Foundations

1.1 An Introduction to Physical Activity Foundations

Welcome to the University of Minnesota Physical Activity Programs! The University of Minnesota provides an array of 1-credit exercise-based courses which are designed to encourage lifetime involvement in physical activity. These courses also serve the University's mission to prepare students to be lifelong learners, well-rounded individuals, and engaged and active citizens. Furthermore, Physical Activity Program (PAP) courses offer students an opportunity to improve sport and fitness skills, build confidence, and develop friendships in an active environment. The upcoming semester will offer various opportunities to increase practical knowledge of, and confidence in, physical activity behaviors.

As each PAP instructor at the University of Minnesota provides invaluable sport and fitness expertise within their respective fields, the following content is designed to serve as a supplementary source of knowledge which will enhance overall physical activity literacy and competence. The following modules will cover: physical activity foundations, benefits of regular participation in physical activity, and an overview of current nutrition, stress reduction, and sleep literature. Your instructor will provide information on how to proceed through each module, and may provide additional assignments based upon the provided content.

Thank you for your participation. Let's get started!

1.2 Physical Activity Terminology

Physical activity literacy begins with a clear understanding of the terminology utilized within the field. While some terms are used interchangeably, it is important to recognize the nuanced differences which exist in physical activity vocabulary. Review the following terms, and complete the accompanying comprehension checks.

Physical Activity: Any bodily movement that is produced by skeletal muscles and requires energy expenditure (calories "burned"). Physical activity is often divided into four domains: Domestic/household, transportation, occupational, and leisure-time (Caspersen, Powell, & Christenson, 1985; Physical Activity Guidelines Advisory Committee, 2008). Examples of the various domains of physical activity are as follows:

- Domestic/household: vacuuming, completing yardwork, clearing the dishes
- Transportation: biking to work, walking to school, rollerblading to the store
- Occupational: lifting or hauling weights for work or engaging in exerting physical activity during a work-related task
- Leisure-time: physical activity which is completed in an individual's leisure-time (i.e., swimming, jogging, hiking, dancing, participating in weight-training regimens, etc.)

Note: Exercise is a subcategory of physical activity, and is included in leisure-time activity.

Comprehension check:

Provide an example of physical activity in each of the four domains mentioned above. Could you increase your physical activity in one of the domains?

ADL: ADLs are **a**ctivities of **d**aily **l**iving, which often involve physical activity. ADLs may often be interchanged with the term "lifestyle activities." Some examples of ADL's include: gardening, doing dishes, mowing the lawn, or walking to school (Centers for Disease Control and Prevention, 2015).

Exercise: A subcategory of physical activity that is planned and structured. Exercise involves repetitive bodily movement, and is performed with the goal to improve or maintain one or more components of physical fitness (Caspersen, Powell, & Christenson, 1985; Centers for Disease Control and Prevention, 2015). Two broad categories of exercise include aerobic and anaerobic exercise.

Exercise involves repetitive bodily movement, and is performed with the goal to improve or maintain one or more components of physical fitness.

Aerobic and anaerobic activities are subcategories of physical exercise. Aerobic exercise may include activities such as cycling, swimming, or running. Photo by Greg Rakozy on Unsplash

Aerobic Exercise (Oxygen is utilized in the energy-generating process for muscle contraction):

Exercise which:

1. primarily uses the large muscle groups of the body
2. is typically performed continuously

3. can be maintained for a longer duration of time than anaerobic exercise
4. improves cardiorespiratory endurance (Physical Activity Guidelines Advisory Committee, 2008).

Several examples of aerobic exercise include jogging, rowing, and biking.

Anaerobic Exercise (Oxygen is not utilized in the energy-generating process for muscle contraction):

Exercise which uses muscles at high-intensity for shorter bursts of time (Physical Activity Guidelines Advisory Committee, 2008).

Several examples of anaerobic exercise include short sprints and heavy weight lifting.

Comprehension check:

List several exercises that may be defined as aerobic. Next, list several exercises that are considered anaerobic in nature. Provide evidence to support your categorization of each type of exercise

Resistance Training (Muscle-Strengthening Activities): Exercise which is primarily intended to increase skeletal muscle strength, endurance, power, and mass (Physical Activity Guidelines Advisory Committee, 2008).

Individuals who participate in resistance training strive to enhance muscular factors, such as: strength, endurance, power, or mass. Strength training may be completed utilizing body weight, machines, or free weights. Photo from Public Health Image Library.

Flexibility Exercise: Exercise which is designed to improve full range of motion of the body's joints (Physical Activity Guidelines Advisory Committee, 2008).

Physical Fitness: A specific set of attributes possessed by an individual, which allows her/him to perform physical activity with ease, and in the absence of undue fatigue. Physical fitness includes the following components:

- Cardiorespiratory Endurance (aerobic fitness)
- Skeletal Muscle Endurance
- Strength
- Power
- Flexibility
- Balance
- Movement Speed
- Reactionary Time
- Body Composition (Caspersen, Powell, & Christenson, 1985; Centers for Disease Control, 2015).

Note: Components of physical fitness will be covered further in upcoming content modules.

Physical Inactivity: A lack of physical activity; not meeting specific physical activity guidelines (Caspersen, Powell, & Christenson, 1985; Sedentary Behaviour Research Network, 2017).

Sedentary Behavior: As defined by the Sedentary Behavior Research Network (SBRN): any waking behavior characterized by an energy expenditure ≤1.5 metabolic equivalents (METs), while in a sitting, reclining or lying posture. The SBRN does not include sleep as a sedentary behavior Sedentary Behaviour Research Network, 2017).

Comprehension check:

In which situations do you believe sedentary behavior is not conducive to overall health? In which situations might some sedentary behaviors be positive? Please explain. Brainstorm several ways you can incorporate physical activity into your daily routine. (Hint: take a physical activity break, such as a quick walk around the library, during your studying sessions).

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1.3 Measures of Physical Activity

Measuring physical activity and fitness is a vital step in better understanding one's overall health. Various measurement strategies may be utilized when assessing your own level, or others' level, of physical activity participation. Often, measurement strategies differ dependent upon whether the environment is **field-based** (i.e., sport performance) or **research-based**.

Several frequently used field-based assessment methods include:

- Intensity Rating
- Heart Rate
- Rating of Perceived Exertion (RPE)
- Energy Cost
- Step-Count Data.

Assessment methods commonly used in research include:

- Metabolic Equivalents (METs)
- Activity Monitor Data (i.e., Accelerometers)

Field-Based Physical Activity Assessment Methods

Intensity: Refers to work or effort exerted to perform activity or exercise. *Relative intensity* may be determined by focusing on heart rate and breathing patterns while engaging in activity. Intensity ratings are as follows: Sedentary, light intensity, moderate-intensity, vigorous intensity (Centers for Disease Control and Prevention, 2015a). *Note: Absolute intensity is determined by metabolic equivalent (MET) methodology.*

Heart Rate: A common method of monitoring physical activity intensity is by calculating heart rate, and determining if the target heart rate zone has been reached.6 The equations below may be utilized to determine resting heart rate, maximum heart rate, and target heart rates for moderate-intensity and vigorous-intensity physical activity (Centers for Disease Control and Prevention, 2015c; American College of Sports Medicine, 2013).

A common method of monitoring physical activity intensity is by calculating heart rate, and determining if the target heart rate zone has been reached

Individuals may easily check their heart rate in "real-time" with the assistance of wearable technology. However, it is highly recommended to manually calculate metrics such as maximum heart rate or target heart prior to beginning an exercise regimen. Setting target parameters for heart rate will assist an individual in meeting fitness goals.
Photo by Philip Lindvall.

Resting Heart Rate: The number of heart beats per minute (bpm) when the body is not engaged in physical activity. An individual may take their resting heart rate at the neck, wrist, or chest. The recommended location is to place the index and middle finger lightly on the radial pulse on the wrist. Count the number of heartbeats within sixty seconds, or count the number of heartbeats in thirty seconds and multiply this answer by two (Centers for Disease Control and Prevention, 2015c). For the most valid measurement of resting heart rate, it is advised the individuals take this measurement in the morning prior to getting out of bed.

Maximum Heart Rate: the age-related number of beats per minute of the heart when working at its maximum; usually estimated at 220 minus the individual's age (Centers for Disease Control and Prevention, 2015c; American College of Sports Medicine, 2013).

Note: New Maximum Heart Rate formulas have been utilized in recent years. Several alternatives to the aforementioned formula are: 206 – (0.67 x individual's age); 208 – (0.7 x individual's age).

Heart Rate Reserve: the Karvonen Method of Heart Rate Reserve (HRR) is utilized to determine an individual's target training heart rate by incorporating resting heart rate into the formula; thus, reducing risk of undertraining or overtraining. HRR is calculated by subtracting resting heart rate from maximum heart rate (American College of Sports Medicine, 2013).

Example:
Heart Rate Reserve (HRR) = maximum heart rate (max HR) – resting heart rate (resting HR).
A 30-year-old individual; 220 – 30 = maximum heart rate (max HR) of 190 bpm. Resting heart rate (resting HR) is 60 bpm.
HRR (190 – 60) = 130 bpm.

Target Heart Rate: An individual's target heart rate is a calculation of HRR multiplied by a target intensity level (a percentage), in addition to the individual's resting heart rate. The following calculation is an example of a training heart rate for a 25-year-old individual; resting HR = 65 bpm; intensity level of 60-70%.7

Example:
Target Heart Rate = ((max HR − resting HR) × %Intensity) + resting HR.
220- 25 (age) = 195.
195 – 65 (resting HR) = 130 (HRR).
(130 x .60) (minimum target intensity) + 65 (resting HR) = 143 bpm.
(130 x .70) (maximum target heart rate) + 65 (resting HR) = 156 BPM.
Target heart rate for training session = 143-156 bpm.

Comprehension check:

Calculate your resting heart rate, maximum heart rate, heart rate reserve, and target heart rates for 60% and 80% intensity level.

Rating of Perceived Exertion: RPE is a measure of physical activity intensity level which relies upon the individual's personal perception of how much effort is being exerted during activity. Although this measure is somewhat subjective, the Borg Rating of Perceived Exertion Scale (Figure 1) appears to be a reasonably accurate estimate of heart rate during physical activity (Centers for Disease Control and Prevention, 2015b; Norton, Norton, L & Sadgrove, 2010). The scale ranges from 6-20, with 6 representing "no exertion" and 20 representing "maximal exertion." A range of 12-13 on the Borg Scale generally represents "moderate-intensity" physical activity (Centers for Disease Control and Prevention, 2015b).

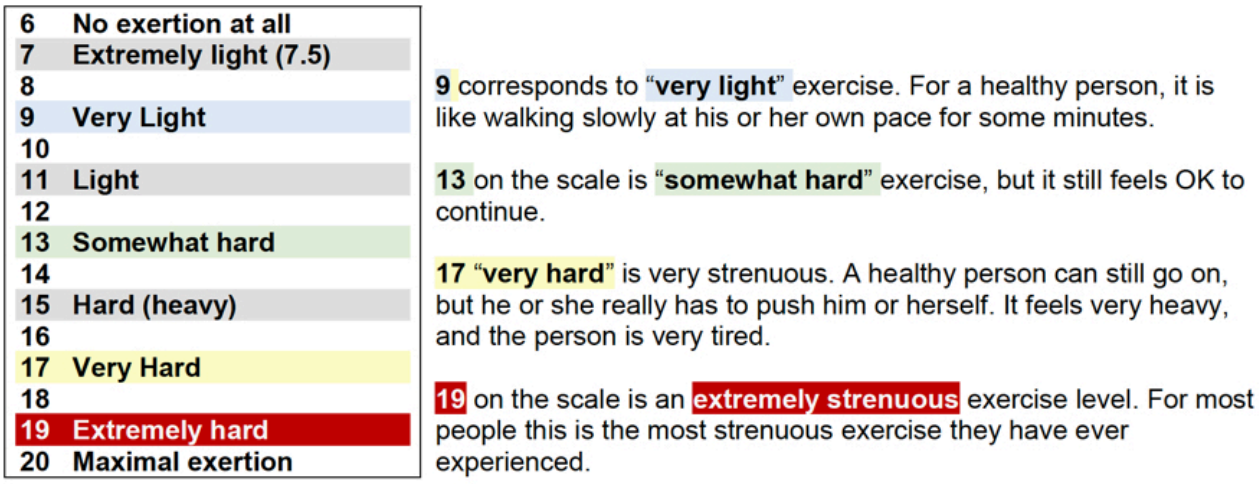

Figure 1: Physical Activity Guidelines Advisory Committee. (2008). Physical activity guidelines advisory committee report, 2008. Washington, DC: US Department of Health and Human Services, 2008, A1-H14. Image from CDC Perceived Exertion document.

Comprehension check:

What exercise would a RPE of 10-11 represent for you? Could you alter or adapt this exercise to reach an RPE which signifies vigorous-intensity physical activity?

Energy Cost: Energy expenditure (calories "burned") may be estimated by taking into account the individual's body weight, activity type, and physical activity intensity level (Ainsworth et. al., 2011; Ainsworth et. al., 2016). *Note: Current compendiums of physical activity energy expenditures are available at:* https://sites.google.com/site/compendiumofphysicalactivities/

Step-Count Data: Physical activity may be measured by wearable devices which record step-count data, such as pedometers. Wearable devices which provide immediate feedback regarding step-count data have been associated with increases in physical activity (Bravata et. al., 2007). A common minimum recommendation for health is to aim for at least 10,000 steps-per-day (Bravata et. al., 2007). However, upcoming physical activity guidelines may increase the recommendation for daily step count to 15,000 steps-per-day.

> *Note: Pedometers are devices which measure steps or count data, and specific step count cutoffs may be utilized to approximate intensity levels. However, pedometers cannot directly measure physical activity intensity.*

Physical activity guidelines recommend a minimum of 10,000 steps per day; however, greater benefits to fitness may be achieved at the 15,000+ steps per day cut-point. Photo by Bruno Nascimento on Unsplash

Research-Based Activity Assessment Methods

Metabolic Equivalents: METs are commonly utilized in physical activity research to measure intensity levels (American College of Sports Medicine, 2013). METs measure these exercise intensity levels based upon oxygen consumption of the body. MET intensity level cut-points are categorized as follows:

1 MET = Resting Metabolic Rate
1.0-1.5 MET = Sedentary Behavior
1.6-2.9 MET = Light Intensity
3.0-5.9 MET = Moderate Intensity
≥6.0 MET = Vigorous Intensity
(American College of Sports Medicine, 2013; Ainsworth et. al., 2011).

Comprehension check:

How are MET measures and the Borg Rating of Perceived Exertion (RPE) Scale similar? In what ways do these two measures of physical activity differ?

Accelerometer: A movement monitor which has capabilities to record step-count data, as well as physical activity intensity levels (Troiano, 2008). Accelerometers measure an individual's acceleration forces on one, two, or three planes (axis) of motion. Accelerometers are often utilized in physical activity research studies.

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1.4 Exploring the Benefits of Physical Activity

Engagement in physical activity and exercise may provide numerous health benefits to an individual, with optimal health often paralleling adequate levels of activity (Physical Activity Guidelines Advisory Committee, 2008). A brief overview of the benefits incurred from regular physical activity are as follows:

1. **Physical benefits**: reduced risk for a variety of diseases and conditions (i.e., cardiovascular disease, diabetes, hypertension, some types of cancer, etc.), improvements in mobility and fitness, and overall enhancement of quality of life.
2. **Cognitive benefits**: heightened academic performance, improved brain function, and reduced risk of age-related cognitive impairment and disease.
3. **Psychological benefits**: enhanced mood, reductions in stress, anxiety, and depression, and increased self-esteem and body image.

Furthermore, participation in physical activity regimens which increase an individual's cardiovascular or muscular fitness may result in lifestyle enhancements, such as:

- ability to complete activities of daily living (i.e., climbing the stairs or catching the bus) without becoming winded
- ability to engage in recreational activities (i.e., playing with a young child or performing a sport) for extended periods of time
- ability to easily move or lift a heavy load (i.e., carry grocery bags or move furniture)

You may explore Chapter 2 at your leisure if you are interested in examining the specific physical, cognitive, and psychological benefits of physical activity in combination with the topics presented in Chapter 1. Utilizing the information presented in each chapter simultaneously may enhance your ability to incorporate the content into daily lifestyle behaviors.

The benefits of regular participation in physical activity include enhanced physical, cognitive, and psychological health. Individuals should consider their current health status in each domain (physical, cognitive, and psychological) when starting an exercise regimen in order to assess any changes that may occur in overall wellness.
Photo by rawpixel on Unsplash

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1.5 Physical Activity Guidelines and Recommendations

Various professional associations have published physical activity guidelines which may assist individuals in designing personal fitness programs. Selected publications which will be comprehensively examined include: Physical Activity Guidelines Advisory Committee Report, 2008, American College of Sports Medicine Position Stand, and recommendations from the American Heart Association and the President's Council on Fitness, Sport, and Nutrition.

2008 Physical Activity Guidelines for Americans

A review of current scientific literature was examined in the Physical Activity Guidelines Advisory Committee Report, 2008 in order to provide the public with information regarding the effects of physical activity in reducing chronic disease risk and all-cause mortality, while improving health. The report provides in-depth information detailing the impact physical activity has upon: cardiorespiratory health, metabolic health, energy balance, musculoskeletal health, functional health, cancer, mental health, and a variety of related topics. The results have been stratified for a variety of diverse populations, and age ranges (Physical Activity Guidelines Advisory Committee, 2008).

The following physical activity guidelines for healthy, adult populations have been provided by the Physical Activity Guidelines Advisory Committee Report, 2008. The guidelines include specific recommendations for both aerobic physical activity and resistance training.

1. Individuals should avoid physical inactivity. Engaging in small amounts of physical activity is preferable to no activity, with minimal engagement in exercise still resulting in some health benefits (Physical Activity Guidelines Advisory Committee, 2008; Office of Disease Prevention and Health Promotion, 2016).
2. For substantial health benefits, it is recommended that adults engage in at least **150 minutes** (2 hours, 30 minutes) of **moderate-intensity aerobic physical activity** per week, or **75 minutes** (1 hour, 15 minutes) of **vigorous-intensity aerobic physical activity** per week. An equivalent combination of moderate- and vigorous intensity aerobic activity may be done to meet the recommendations (Physical Activity Guidelines Advisory Committee, 2008; Office of Disease Prevention and Health Promotion, 2016).

...it is recommended that adults engage in at least 150 minutes (2 hours, 30 minutes) of moderate-intensity aerobic physical activity per week, or 75 minutes (1 hour, 15 minutes) of vigorous-intensity aerobic physical activity per week.

Current physical activity guidelines recommend that healthy adults engage in at least 150 minutes of moderate-intensity, or 75 minutes of vigorous-intensity, physical activity on a weekly basis. Moderate and vigorous intensities are often determined utilizing an individual's heart rate (Section 1.2). Photo by aquachara on Unsplash.

> *Note: Aerobic activity may be separated into bouts of at least 10 minutes in order to meet the total number of minutes per week. If aerobic activity is done in short bouts, these bouts should be spread out evenly throughout the week.*

Comprehension check:

How could you personally reach the recommendations for minutes engaged in moderate- or vigorous-intensity aerobic physical activity per week? Create a weekly calendar which outlines your plan.

3. For additional health benefits, it is recommended that adults increase engagement in aerobic physical activity to **300 minutes** (5 hours) of **moderate-intensity aerobic physical activity** per week, or **150 minutes** (2 hours, 30 minutes) of **vigorous intensity aerobic physical activity**. An equivalent combination may be done to meet the recommendations, and further health benefits attained by engaging in physical activity exceeding this amount (Physical Activity Guidelines Advisory Committee, 2008; Office of Disease Prevention and Health Promotion, 2016).
4. Adults should engage in **resistance training** (muscle-strengthening activities) on **2 or more days** throughout the week. These muscle-strengthening activities should be moderate or high intensity, and involve all major muscle groups of the body (Physical Activity Guidelines Advisory Committee, 2008; Office of Disease Prevention and Health Promotion, 2016). In-depth resistance training guidelines are

provided within the ACSM Position Stand and Recommendations section of this chapter.


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Engaging in regular resistance training is an important part of any fitness plan. Recommendations call for 2 or more days of resistance training per week, with lifts/exercises targeting all the major muscle groups of the body. Photo by Maria Fernanda Gonzalez on Unsplash.

Examples of moderate-intensity aerobic physical activity: brisk walking, dancing, swimming, cycling, and yard work. Jogging or running activities are often categorized as vigorous-intensity aerobic physical activity. Resistance training could include a variety of activities, such as training with body weight exercises, free weights, or resistance bands.

Comprehension check:

What resistance training exercises could you personally do to reach the recommendations? Create a weekly calendar which outlines your plan.

Notably, these recommendations are appropriate for the majority of the healthy, adult population. However, each individual may have unique health concerns which impact their level of engagement in physical activity. The full Physical Activity Guidelines Advisory Committee Report, 2008 is available for the interested student at: https://permanent.access.gpo.gov/gpo23524/CommitteeReport.pdf.

ACSM Position Stand and Recommendations

The American College of Sports Medicine Position Stand: The American College of Sports Medicine (ACSM) provides recommendations which are consistent with the Physical Activity Guidelines Advisory Committee Report, 2008 regarding aerobic physical activity and resistance training guidelines. However, the ACSM position stand provides additional recommendations for flexibility and neuromotor exercise (Garber, et. al., 2011).

1. Flexibility exercise: Healthy adults should engage in **flexibility exercises** at least **2-3 days per week**. Each stretch should be held 10-30 seconds each, repeated 2-4 times for a total of 60 seconds (Garber, et. al., 2011).
2. Neuromotor exercise: Healthy adults should engage in exercises which **enhance motor skills** (i.e. balance, agility, coordination) **2-3 times per week**, for a duration of 20-30 minutes each bout (Garber, et. al., 2011).

Comprehension check:

Create a weekly physical activity calendar which includes flexibility and neuromotor exercises, meeting the ACSM recommendations.

Resistance Training Factors: Resistance training (engaging in muscle-strengthening activities) is most effective when a variety of major muscle-groups are targeted. Several major muscle-groups include (but are not limited to): chest, back, shoulders, biceps, triceps, abdominals, quadriceps, and hamstrings (American College of Sports Medicine, 2013a; American College of Sports Medicine, 2013b).

ACSM resistance training guidelines recommend that each resistance exercise should be performed for 8-12 repetitions, for a volume of 1-4 sets depending on specific goals of the muscle-strengthening program. Rest periods should be observed in-between sets (American College of Sports Medicine, 2013a; American College of Sports Medicine, 2013b). These recommendations apply to healthy, adult populations.

Resistance training programs may differ greatly depending upon an individual's specific goals related to muscular strength, muscular power, muscular hypertrophy (growth), or muscular endurance. The frequency of training must be closely monitored in order to avoid overtraining (American College of Sports Medicine, 2013a; American College of Sports Medicine, 2013b).

Resistance training programs may differ greatly depending upon an individual's specific goals related to muscular strength, muscular power, muscular hypertrophy (growth), or muscular endurance.

An example of a resistance training program which targets major muscle groups utilizing free weights, machines, or body weight is demonstrated in Figure 2.

Examples of typical resistance exercises that can be performed using free-weights, machines, or body weight for the major muscle groups are:

	Free-Weight	Machine-Based	Body Weight
Chest	Supine Bench Press	Seated Chest Press	Push-ups
Back	Bent-over Barbell Rows	Lat Pulldown	Pull-ups
Shoulders	Dumbbell Lateral Raise	Shoulder Press	Arm Circles
Biceps	Barbell/Dumbbell Curls	Cable Curls	Reverse Grip Pull-ups
Triceps	Dumbbell Kickbacks	Pressdowns	Dips
Abdomen	Weighted Crunches	Seated "Abs" Machine	Crunches, Prone Planks
Quadriceps	Back Squats	Leg Extension	Body Weight Lunges
Hamstrings	Stiff-leg Deadlifts	Leg Curls	Hip-ups

Figure 2: American College of Sports Medicine (2013b). Resistance training for health and fitness [Brochure]. Retrieved December 20, 2016 from https://www.acsm.org/docs/brochures/resistance-training.pdf

Additional Physical Activity Recommendations:

American Heart Association: The American Heart Association (AHA) provides recommendations which are consistent with aforementioned physical activity guidelines from the Physical Activity Guidelines Advisory Committee Report, 2008 for overall health benefits. The AHA recommends additional minutes of moderate- or vigorous-intensity aerobic physical activity be performed per week to reduce blood pressure and cholesterol (American Heart Association, 2014).

President's Council on Fitness, Sport, and Nutrition: The President's Council on Fitness, Sport, and Nutrition is an additional free resource for the interested student.18 This resource provides the public with information on: why physical activity is important, ways to be active, the Sport for All initiative, the Physical Activity Initiative, and a summarization of the 2008 Physical Activity Guidelines for Americans.

The above information may be accessed at: https://www.fitness.gov/be-active/.

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1.6 Physical Activity in the United States: Trends

How is physical activity adherence monitored in the United States, and are the physical activity guidelines being met by the general population? These are important questions which require in-depth answers, considering the diverse needs, behaviors, and abilities of each individual. First, several key terms, concepts, and current trends will be addressed.

Physical Activity Epidemiology: The study of how a physical activity behavior is distributed in various populations, including what factors influence or determine this distribution pattern (Dishman, Heath, & Lee, 2004).

... the majority of the United States population (more than 80%) does not meet physical activity guidelines and recommendations.

Several national surveys which track and monitor the physical activity habits of adults include: National Health Interview Survey (NHIS), the National Health and Nutrition Examination Survey (NHANES), and the Behavioral Risk Surveillance System (BRFSS) (Pleis, Lucas, & Ward, 2009; National Center for Health Statistics (US), 2011). Results from these national surveys indicate the majority of the United States population (more than 80%) does not meet physical activity guidelines and recommendations (Pleis, Lucas, & Ward, 2009; National Center for Health Statistics (US), 2011). Additionally, current statistics indicate a high prevalence of overweight and obesity in the United States (Centers for Disease Control and Prevention, 2016). More than a third of the adult population in the United States is obese, and many suffer from additional obesity-related conditions such as: heart disease, stroke, type 2 diabetes, and specific types of cancer (Pleis, Lucas, & Ward, 2009; National Center for Health Statistics (US), 2011; Centers for Disease Control and Prevention, 2016; Benjamin, 2010).


ARTERY INDEX MARKER
Welch Allyn
mm Hg

Lack of sufficient participation in physical activity may contribute to concerning health conditions, such as: overweight and obesity, cardiovascular issues, and type 2 diabetes. Photo from Public Health Image Library.

In response to the low engagement of the adult population in physical activity endeavors and the subsequent trend in increases in obesity, many public health institutions have created programs with clearly defined goals for enhancing physical activity.

Healthy People 2020: A government initiative which aims to "improve health, fitness, and quality of life through daily physical activity." Several strategies and interventions provided by Healthy People 2020 focus on investing in building physical activity-friendly structures in the environment (i.e. sidewalks and biking trails), and altering local legislative policies to improve opportunities for exercise in various United States communities (Office of Disease Prevention and Health Promotion, 2016; Gordon-Larsen, Nelson, Page, & Popkin, 2006).

Healthy People 2020 is a government initiative that strives to improve the health and well-being of Americans by providing greater access to physical activity. One goal of Healthy People 2020 is to reduce physical activity disparities within the population.

In particular, Healthy People 2020 strives to reduce **health disparities** (lack of equal access and opportunity) which exist for physical activity participation in the United States. Several groups which suffer these disparities include the socio-economically disadvantaged, peoples of color and minority groups, the elderly population, female adolescents and individuals who identify as gay, bisexual, or transgender.

The above information may be accessed at: https://www.healthypeople.gov/

Comprehension check:

Visit the Healthy People 2020 website and identify 3 separate health disparities for leading health indicators. Are any of these health indicators or health disparities associated with participation in physical activity, or lack thereof?

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1.7 Components of Physical Fitness

Undoubtedly, there is a need to reduce physical activity and health disparities, and improve adherence to physical activity recommendations within the United States population. One strategy to improve adherence to the aforementioned physical activity guidelines is to ensure individuals are focusing upon a wide variety of mechanisms which enhance overall physical fitness, including the **health-related** and **performance-related** components.

Physical fitness components include: cardiorespiratory endurance, body composition, muscular strength, muscular endurance, and flexibility.

Physical fitness has been previously defined as "a specific set of attributes possessed by an individual, which allows her/him to perform physical activity with energy, and in the absence of undue fatigue." While physical fitness encompasses a wide range of physical attributes (components), five **health-related** components are primarily discussed in the physical activity literature. These physical fitness components gauge approximations of an individual's health status, and include: cardiorespiratory endurance, body composition, muscular strength, muscular endurance, and flexibility (American College of Sports Medicine, 2013).

Individuals may enhance their heart health through regular participation in cardiorespiratory exercise. What activities (other than running or jogging) may enhance cardiorespiratory endurance? Photo by Razvan Chisu on Unsplash.

Cardiorespiratory (Aerobic) Endurance: The ability to perform prolonged, dynamic exercise using large muscle groups at a moderate-to-high-intensity level.

Body Composition: The proportion of fat and fat-free mass (muscle, bone, and water) in the body.

Muscular Strength: The amount of force a muscle can produce in a single maximum effort.

Muscular Endurance: The ability to resist fatigue and sustain: (1) a given level of muscle tension, or (2) repeated muscle contractions against resistance for a given time period.

Flexibility: The ability to move the joints through their full range of motion.

Comprehension check:

How do the physical activity guidelines outlined in Chapter 1 impact the five health-related components of physical fitness?

Furthermore, an individual's physical fitness includes *performance-related* components. These six components measure specific skill-sets, and include: (1) agility, (2) coordination, (3) balance, (4) power, (5) reaction time, and (6) speed (American College of Sports Medicine, 2013).

An individual's physical fitness may be assessed by health-related and performance-related components. Performance may be measured according to: agility, coordination, balance, power, reaction time, or speed. Photo by rawpixel on Unsplash.

Furthermore, an individual's physical fitness includes *performance-related* components. These six components measure specific skill-sets, and include:

- agility,
- coordination,
- balance,
- power,
- reaction time,
- and speed (American College of Sports Medicine, 2013).

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1.8 Training Principles

Participating in regular physical activity and exercise throughout on a weekly basis may positively impact an individual's overall health, and improve various components of physical fitness. However, an individual's specific physical fitness goals may not be achieved if their physical activity program is not designed with respect to major exercise training principles. Adherence to specific principles of exercise training may aid in the development of an intentional and successful physical activity regimen. The core training principles which will be subsequently discussed include:

Adherence to specific principles of exercise training may aid in the development of an intentional and successful physical activity regimen.

- Specificity
- Overload
- Progression
- Reversibility
- FITT
- Individual Differences

Specificity Principle: Only the body parts, muscles, or systems involved in a workout will be experiencing training (American College of Sports Medicine, 2013). For example, upper body weight training will only facilitate improvements to muscles groups which were engaged (i.e. shoulders, arms, back muscles). Therefore, an individual must evaluate the specific type of workout that will provide the greatest likelihood of physical activity and fitness goal achievement.

Comprehension check:

Will doing push-ups improve one's abdominal/core strength? Will swimming laps improve one's time when biking 10 miles? Please provide your rationale for your answer.

Overload Principle: Overload (i.e., "greater than normal workload or exertion") is required to improve components of health-related fitness: cardiorespiratory (aerobic) endurance, muscular strength, muscular endurance and flexibility. According to the principle of overload, an individual must work ("load") the body using a step-by-step increase in physical activity duration, time, and/or intensity in order to facilitate optimal

fitness improvements (American College of Sports Medicine, 2013). This step-by-step increase is often known as **progression**.

Comprehension check:

How might an individual utilize the Overload Principle to enhance cardiorespiratory (aerobic) endurance while training for a marathon? *Hint: Exertion of "greater than normal load" by progressively increasing total weekly mileage during the training regimen.*

The overload training principle refers to an individual adding workload to their current exercise regimen in order to improve fitness. An example of the overload principle is when one increases the weight of equipment lifted in a resistance training plan. Photo by Danielle Cerullo on Unsplash

Reversibility Principle: Individuals may lose the beneficial effects of training when participation in an exercise program is terminated (i.e., fitness gains are reversed; colloquially known as "use it or lose it"). Conversely, as an individual's fitness level improves, s/he will be required to adjust the exercise program in order to procure further

improvements (i.e., the previous work exerted to reach overload may no longer be sufficient) (American College of Sports Medicine, 2013a).

Comprehension check:

How might you alter or adjust your workout program to account for the possibility of reversibility?

FITT Principle: The exercise training principle which outlines how an individual may design and monitor their individualized exercise program (American College of Sports Medicine, 2013).

1. **Frequency**: How often the individual performs the targeted exercise or physical activity.
2. **Intensity**: How much work or effort is exerted during a physical activity period (may be measured in a variety of ways such as heart rate, RPE, MET value, etc.).
3. **Time**: Duration of physical activity or exercise bout.
4. **Type**: Specific physical activity mode or exercise which an individual chooses to engage in (i.e. aerobic exercise, resistance training, sports-specific activity, etc.).

Individual Differences Principle: All individuals are unique in their exercise programming needs. Personal, environmental, and behavioral factors should be considered and assessed when planning to engage in a physical fitness training regimen (American College of Sports Medicine, 2013).

Comprehension check:

What personal, environmental, and behavioral factors should you personally consider when planning your own workout program?

The individual differences training principle describes how each person holds unique needs and preferences regarding their physical activity participation and fitness plans. For example, individuals may select specific physical activity modalities due to current health status and abilities, environmental access to the chosen activity, or their personal desire to engage in a particular exercise. Photo by Evan Kirby on Unsplash

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1.9 Conclusion

Many future challenges exist within the field of physical activity in the United States on an individual and community level. Current trends indicate a lack of physical activity and ever-increasing obesity rates; presenting a serious public health concern. Statistics also reveal that many individuals within the population suffer from health disparities related to low levels of physical activity. However, areas for growth are possible. The first step in eliminating health disparities is understanding where, why, and how they exist in your personal life, social sphere, and community. Striving to regularly engage in physical activity may positively impact personal fitness and overall health, and may engender a culture of wellness in your community at-large.

On an individual level, healthy adults should aim for 150 minutes of moderate-intensity, or 75 minutes of vigorous-intensity activity, each week. Muscle-strengthening activities should be performed on two or more days per week. Physical activity and fitness progression may be assessed using a variety of measures, such as: intensity-level, heart rate, perceived exertion, energy cost, and daily step-count. Training principles (i.e., targeting specific muscles or striving to achieve overload) will assist you in setting and achieving appropriate fitness goals in your personalized exercise program. Further strategies to enhance your physical activity engagement, and to improve individual health and wellness, will be addressed in subsequent chapters.

Chapter 2: The Benefits of Physical Activity

2.1 An Introduction to the Benefits of Physical Activity

Regular participation in exercise may improve an individual's physiological, cognitive, and psychological health. Many decades of research illustrate the positive effect physical activity has on the body and mind. When practiced across the lifespan, physical activity may result in greater overall health, and a reduced risk for many chronic diseases.

Despite the aforementioned benefits, many Americans do not currently meet national recommendations for physical activity participation. College students in particular may face unique challenges to participating in regular physical activity, often due to perceived and environmental barriers. However, many college students report a deep desire to maintain physical fitness and wellness in the midst of hectic academic schedules.

Chapter 2 will present an overview of the numerous benefits incurred from physical activity participation, after which the underlying factors influencing participation in exercise (or lack thereof) in college-aged populations will be reviewed. Finally, several behavioral strategies which may aid an individual's initiation and maintenance of a physical activity regimen will be explored.

2.2 Physiological Benefits

The physiological benefits associated with regular physical activity participation range from risk reductions for several diseases and health maladies, to improvements in mobility, fitness, and overall quality of life (Kravitz, 2007). The following summary of health benefits associated with participation in physical activity is a broad overview drawn from scientific studies conducted in adult populations, and does not take into account individual differences. Please refer to a healthcare professional for further information, especially regarding your individual needs and medical background before beginning an exercise regimen.

Reduced Risk of Premature Death

Inflammation in the body is strongly related to future risk for chronic diseases and conditions which may jeopardize health. Physical activity results in a reduction of systemic inflammation in the body and has been linked to a reduction in all-cause risk of premature death. Further, research indicates that the protective benefits of physical activity may improve with additional time spent in exercise. In one recent study, individuals with the highest levels of physical activity participation and fitness had the lowest risk of premature death (Warburton, Nicol, & Bredin, 2006).

Physical activity results in a reduction of systemic inflammation in the body and has been linked to a reduction in all-cause risk of premature death.

However, individuals should be aware that overtraining (i.e., participating in physical activity to the point where risks outweigh benefits) may occur. Therefore, adhering to the physical activity guidelines (Chapter 1) is a wise strategy for students beginning a physical activity regimen.

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Reduced Risk for Cardiovascular Disease

Cardiovascular disease (CVD), such as heart attack and stroke, is the leading health-related cause of death in U.S. adult men and women (American Heart Association, 2014). Improvements in cardiorespiratory fitness have been associated with risk reductions for CVD (Garber et al., 2011). Specifically, participating in the recommended duration of physical activity as outlined in the Physical Activity Guidelines for Americans has been found to provide the greatest health benefits, which include but are not limited to: improved coronary blood flow, decreased blood coagulation, and enhanced cardiac function (Nocon et al., 2008).

Participation in aerobic physical activities (such as swimming, running, or cycling) may improve cardiorespiratory fitness, and protect against the development of cardiovascular disease. Cardiorespiratory fitness is best improved when the selected activity is performed continuously and for an extended duration of time.
Photo by Mia Gracia Tabili on Unsplash

Reduced Risk for Diabetes

Physical activity and exercise also play a role in metabolic functions such as the body's insulin sensitivity (how responsive the body is to insulin) and subsequent ability to balance blood glucose levels. Decreased insulin sensitivity and elevated insulin and blood glucose levels have been linked to diabetes. Regular physical activity participation increases insulin sensitivity and glucose metabolism, with both aerobic and resistance exercise associated with a risk reduction for type 2 diabetes (Steyn et al., 2004).

Improved Blood Pressure Control

Hypertension, or an abnormal elevation in blood pressure, is a risk factor for heart attack, stroke, and congestive heart failure (American Heart Association, 2014). A variety of physical activity types have been associated with decreased blood pressure, such as habitual aerobic exercise and dynamic resistance training (Kravitz, 2007; Fagard & Cornelissen, 2007). Notably, recent studies have even examined and cited the numerous health benefits of regular yoga practice among hypertensive individuals (Hagins, Selfe, & Innes, 2013).

A variety of physical activity types have been associated with decreased blood pressure, such as habitual aerobic exercise and dynamic resistance training.

Improved Cholesterol Levels

Elevated levels of low-density lipoprotein cholesterol (LDL; the "bad" cholesterol) and depressed levels of high-density lipoprotein cholesterol (HDL; the "good" cholesterol) have been linked to a variety of health risks, such as heart disease (Kravitz, 2007). Regular aerobic exercise has the ability to alter lipid protein levels and reduce triglyceride levels in the body, resulting in increased HDL and decreased LDL (Kodama et al., 2007).

Reduced Risk for Stroke

Participation in aerobic and anaerobic exercise is recommended to reduce the risk of stroke. Studies indicate that individuals who participated in a moderate amount of physical activity reduced their risk of stroke by up to 20%, compared with those who participated in a greater amount of activity increasing this risk reduction to 27% (Lee, Folsom, & Blair, 2003; Sacco et al., 2006).

Reduced Risk for Some Types of Cancer

Numerous studies have shown associations between reduced risk for colon and breast cancer and physical activity participation. In detail, physically active men and women exhibited a 30%–40% risk reduction for colon cancer, and physically active women presented with a 20%–30% risk reduction for breast cancer compared with their inactive counterparts (Samad, Taylor, Marshall, & Chapman, 2005; Wolin, Yan, Colditz, & Lee, 2009; Marcell, 2003). Systematic reviews spanning decades of research indicate that moderate-intensity physical activities produce a greater protective effect than low-intensity activities (McNeely et al., 2006; Samad et al., 2005; Wolin et al., 2009).

…..physically active men and women exhibited a 30%–40% risk reduction for colon cancer, physically active women presented with a 20%–30% risk reduction for breast cancer compared with their inactive counterparts.

Improved Bone Health and Musculoskeletal Fitness

Just as resistance training improves muscle strength, weight-bearing resistance training and aerobic physical activity may stimulate bones to increase in strength (Kravitz, 2007). Research indicates that participation in physical activity across the lifespan may positively impact factors related to bone health, such as bone mineral density, mass, or strength. Bone mass accruement predominantly occurs within childhood and early adulthood (Gunter, Almstedt, & Janz, 2012). However, individuals may improve bone health in later years by participating in specific types of physical activity. Resistance exercises (i.e., weight-lifting programs) appear to have the greatest effects on bone mineral density (Kravitz, 2007), with this type of activity recommended at least twice weekly (Nikander et al., 2010). Risk for osteoporosis, an age-related bone disease characterized by loss of bone density and increased risk for bone fractures, may therefore be decreased through habitual weight-bearing physical activity participation–particularly among postmenopausal women (Kravitz, 2007).

Musculoskeletal health is also impacted by age-related factors and can be mediated by engagement in resistance training and other weight-bearing activities. Sarcopenia is the age-related loss of muscle mass and strength; rates of sarcopenia are relatively consistent at approximately 1%–2% per year starting at age 50 (Nikander et al., 2010). Of note, greater levels of musculoskeletal fitness are positively associated with feelings of independence and autonomy related to one’s mobility, balanced blood glucose, improved bone health, decreased risk of fall and injury, and enhanced overall quality of life (Nikander et al., 2010). Nonetheless, it is clear that physical activity facilitates similar beneficial effects on bone density and musculoskeletal health no matter an individual’s age, but it is critical to commit to lifelong physical activity regimens in order to experience the greatest benefits.

Participating in weight-bearing physical activities in childhood improves overall bone health. Adults may continue to positively impact bone strength by engaging in resistance training as least twice per week.
Photo by Adrià Crehuet Cano on Unsplash

Improved Joint Health

Arthritis is a serious health condition characterized by pain, stiffness, and possible loss of joint function (Kravitz, 2007). Regular physical activity participation may be effective in treating symptoms of arthritis. However, one must first concentrate on gradually increasing cardiovascular fitness, with progressive overload of resistance exercises following thereafter. It is also critical to slowly increase flexibility and enhance joint stability through activities requiring increased range of motion and balance (Lin, Davey, & Cochrane, 2004; Maes & Kravitz, 2004).

Improved Ability to Maintain Healthy Body Composition and Weight Status

Currently, obesity rates among adults in the United States are approximately 35-36%, with approximately 17-18% of youth also classified as obese (Smith & Smith, 2016). Overweight and obesity are often categorized according to body mass index (BMI). Body mass index calculates an individual's mass in kilograms, and divides this number by the individual's height in meters-squared (BMI = kg/m2). According to BMI criteria, overweight is defined as a BMI ≥ 25 to 29.9 kg/m2, while obesity is defined as a BMI ≥ 30 kg/m2 and severe obesity including values ≥ 35

kg/m2 (Smith & Smith, 2016). Individuals should be aware that BMI does not account for body composition (i.e., lean muscle mass or body fat percentage), and thus is in some ways a flawed measure. However, it is relatively easy and inexpensive to evaluate an individual's height and weight, and thus BMI is a personal metric commonly utilized in determining health trends within the population.

Each individual possesses unique needs related to exercise prescription...

Comorbidities common to obesity are numerous and include, but are not limited to: increased risk of cancer, cardiovascular disease, decreased mobility, diabetes, hypertension, arthritis, and stroke (Smith & Smith, 2016). Additionally, obese individuals suffer from increased risk for psychological comorbidities and all-cause mortality compared to their healthy-weight counterparts, with obesity implicated as the fifth highest cause of all deaths globally (Smith & Smith, 2016). Fortunately, studies indicate that regular physical activity participation may result in reduced body fat and improved weight control (Slentz et al., 2004). Prior to starting an exercise regimen with a goal of weight loss, individuals are encouraged to consult with their healthcare provider to create an appropriate program. Each individual possesses unique needs related to exercise prescription for weight control, with these unique needs important to consider when implementing the exercise regimen.

Comprehension check:

Which of the aforementioned physiological benefits of physical activity relate to you personally? Consider your current physical activity habits, and which chronic diseases or comorbidities you may be at risk for based on your current behavior and family history. Please explain your answer. (Hint: think of your health status today, 10 years in the future, 20 years in the future, etc.).

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2.3 Cognitive Benefits

In addition to the physiological benefits of regular physical activity participation, there are also numerous benefits related to cognitive functioning. Such benefits include, but are not limited to: heightened academic performance, improved brain function, and reduced risk of age-related cognitive impairment and disease.

Improved Academic Performance

Research has shown a consistent relationship between physical activity participation and enhanced academic performance (i.e., learning and cognitive outcomes) in children, with aerobic exercise producing the greatest benefits (Fedewa & Ahn, 2011). Several cognitive outcomes positively impacted by physical activity throughout childhood and young adulthood include: perceptual skills, intelligence quotients, and verbal and mathematical tests (Hillman, Erickson, & Kramer, 2008). However, further research is needed to examine the potential academic benefits in college-age and older populations.

Enhanced Brain Function

Oxidative stress, caused in part by the buildup of harmful free radicals within the body, may result in damage to brain functions. Current research indicates that regular physical activity participation increases the body's ability to resist oxidative stress. Optimal protection is provided via increased antioxidant activity when exercise is performed at specific intensity levels. Notably, habitual engagement in moderate-intensity aerobic physical activity appears to provide the greatest benefit for brain function (Camiletti-Moirón, Aparicio, Aranda, & Radak, 2013).

Oxidative stress, caused in part by the buildup of harmful free radicals within the body, may result in damage to brain functions…..regular physical activity participation increases the body's ability to resist oxidative stress.

Regular participation in physical activity may improve the following components of cognitive health: academic performance, brain function, and resiliency to age-related impairment and disease. Photo by jesse orrico on Unsplash

Decreased Incidence and Risk for Age-Related Cognitive Impairment and Disease

Several studies have found a reduced risk for Alzheimer's disease and dementia in individuals who engage in greater amounts of physical activity versus those who are more sedentary (Kramer & Erickson, 2007). Frequency of exercise engagement appears important, as older adults who engage in three or more sessions of physical activity per week are significantly less likely to be diagnosed with dementia than their counterparts who engage in fewer sessions per week (Larson et al., 2006). When examining only adults who have not been diagnosed with Alzheimer's or dementia, a reduction in risk for cognitive decline is apparent when physical fitness levels are improved (Barnes, Yaffe, Satariano, & Tager, (2003).

Comprehension check:

Provide an example of how participation in physical activity may enhance your cognitive functioning and brain health? Please be specific.

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2.4 Psychological Benefits

The psychological benefits of exercise complement the aforementioned cognitive and physiological benefits. Several psychological benefits include, but are not limited to: enhanced mood, reduced stress, anxiety, and depression, and improved self-esteem and body image.

Enhanced Mood

Mood, one's state of mind or feeling, may be positively impacted by a variety of physical activity types. Resistance training programs have been associated with improved mood states in healthy adult populations (McLafferty, Wetzstein, & Hunter, 2004). Other research utilizing aerobic training programs also show promising results. Notably, even participation in light aerobic activities, such as leisurely walking, may result in overall increased positive mood (Janisse, Nedd, Escamilla, & Nies, 2004). Indeed, enhanced mood state following physical activity has been well-documented throughout decades of literature and is collectively known as the "feel-good" effect (Hyde, Conroy, Pincus, & Ram, 2011).

Engaging in physical activity may result in improved mood state. Notably, mood may be enhanced following participation in resistance training or aerobic exercise. The "feel-good" effect is even experienced by individuals who participate in light, recreational activities such as a leisurely walk.
Photo by Bonnie Kittle on Unsplash

Stress Relief

Participation in physical activity may decrease perceptions of stress. In a study examining leisure-time activity choice, participants who increased their physical activity engagement reported a reduction in stress levels (Schnohr, Kristensen, Prescott, & Scharling, 2005). Numerous studies also indicate the association between regular yoga practice and decreased stress levels (Field, 2011; Li & Goldsmith, 2012; West, Otte, Geher, Johnson, & Mohr, 2004). Further, participation in many types of physical activity may prove especially effective in reducing stress in college students and decreasing the number of day-to-day happenings that students perceive to be inconveniences or difficulties (i.e., "life hassles") (Nguyen-Michel, Unger, Hamilton, & Spruijt-Metz, 2006).

….participation in many types of physical activity may prove especially effective in reducing stress in college students…..

Comprehension check:

What factors/situations do you believe present the most significant sources of stress for college students? Do you believe that physical activity may alleviate or reduce stress? Why, or why not? Please provide a detailed answer.

Reduced Anxiety

Physical activity participation may play an important role in decreasing an individual's fears and sensations associated with anxiety. Research indicates that anxiety-related symptoms may be reduced following physical activity interventions as short as two weeks in length (Smits, et al., 2008). Multiple studies also suggest that increased adherence to physical activity programs results in reduced anxiety, especially when exercise is combined with other treatment options such as therapy and medication (Jayakody, Gunadasa, & Hosker, 2013). Of note, both aerobic and anaerobic exercise regimens reduce symptoms of anxiety (Jayakody, Gunadasa, & Hosker, 2013).

Reduced Risk for Depression

Depression is a significant health issue, with major depressive disorder ranking as the most prevalent clinically-diagnosed mental disorder (Kessler et al., 2005). National guidelines recommend physical activity as an important component of a depression treatment program (National Institute for Clinical Excellence, 2009; WHO, 2016). A recent in-depth analysis examining the effects of various physical activity interventions on depression indicated that exercise is effective in reducing depressive symptoms, with the positive effects observed when physical activity is delivered both as a stand-alone treatment or in addition to medication (Kvam, Kleppe, Nordhus, & Hovland, 2016). Notably, when combined with prescribed medication, regular physical activity participation over time may be superior in preventing depression relapse when compared to medication alone (Babyak et al., 2000).

National guidelines recommend physical activity as an important component of a depression treatment program.

Improved Self-Esteem

Physical activity participation positively impacts self-esteem. Individuals who identify as "exercisers" report more positive body image than individuals who do not identify as "exercisers" (i.e., do not participate in regular physical activity) (Hausenblas & Fallon, 2006). Further, research has also indicated that body image can be enhanced in both inactive and active individuals following a physical activity intervention (Hausenblas & Fallon, 2006). These are noteworthy findings as self-esteem may be an important factor for college-aged students in particular. Students who engage in educational programs which promote physical activity report increased

physical self-esteem and subsequently increased quality of life indices (Joseph, Royse, Benitez, & Pekmezi, 2014).


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Participation in physical activity may improve an individual's self-esteem. Research indicates that individuals who identify as regular exercisers report more positive body image indices than those who do not identity as regular exercisers.
Photo by Trust "Tru" Katsande on Unsplash

> *Note: Physical activity should never replace medically prescribed treatment or therapies for mental wellness; physical activity regimens should be cleared with your healthcare provider.*

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2.5 Barriers to Physical Activity

The physiologic, cognitive, and psychological benefits that may be gained from regular participation in physical activity are vast. However, many individuals experience barriers to habitual exercise.

Personal, Environmental, and Behavioral Barriers

The degree to which an individual feels barred from participating in physical activity may be influenced by personal factors, environmental aspects, and behavioral characteristics–too numerous to be reviewed in Chapter 2 alone. The perceived barriers to physical activity reviewed below relate to college students, as well as the general population.

Personal: Several reasons individuals give for avoiding participation in regular physical activity are personal in nature. Personal factors include, but are not limited to: insufficient time, inconvenience, lack of enjoyment or increased boredom with physical activity, fear of injury, and feelings of self-consciousness or shame when being physically active (CDC, 2016).

Environmental: Environmental aspects which may influence an individual's physical activity participation are both physical and psychosocial in nature. Physical barriers in the environment include: lack of access to gyms and workout facilities, inadequate sidewalk coverage, few parks/green spaces, or deficiency in walking/biking trails that are safe and in a convenient location (CDC, 2016). Psychosocial barriers in the environment include: lack of encouragement, social support, or companionship with family and friends when trying to initiate a physical activity program (CDC, 2016). The aforementioned factors may particularly impact those within academic environments, as college students report a lack of social support networks or campus environmental/facility-related obstacles as major barriers to physical activity (Brown, Huber, & Bergman, 2006).

...college students report a lack of social support networks or campus environmental/facility-related obstacles as major barriers to physical activity...

Behavioral: Behavioral characteristics play an important role in shaping perceptions of physical activity participation. Individuals who struggle with self-management skills may not set effective personal health goals or engage in proper goal monitoring and progression (CDC, 2016). Further, low confidence and low self-efficacy (i.e., one's situational self-confidence for a behavior) in their ability to be physically active may prove to be a significant deterrent to exercise (CDC, 2016). Moreover, lack of motivation appears to exert a major negative effect on physical activity participation in both the general population and college student population (Brown, Huber, & Bergman, 2006; CDC, 2016). College students indicate that low motivation and increased fatigue play a role in prevention of exercise (Brown, Huber, & Bergman, 2006).


SCARPA

Many factors may play a role in an individual's participation in, or lack thereof, physical activity. College students report numerous personal, environmental, and behavioral barriers to exercise engagement. However, each of these factors may be appropriately addressed if an individual is aware of which barrier is most important in preventing their participation in physical activity. For example: if a busy class schedule prevents a college student from exercising, the student may plan activity into their daily schedule by enrolling in a specialty physical activity class from the academic course listings such as rock climbing, etc. Photo by roya ann miller on Unsplash

Common Barriers to Physical Activity for College Students

Perceived barriers to physical activity may significantly impact an individual's behavior choices, and prevent the individual from engaging in exercise. College students face unique challenges to being physically activity, as they strive to balance academic, professional, and social opportunities and duties. A sample of full-time college students between the ages of 18-24 identified student-specific factors which may either be considered beneficial, or detrimental, to physical activity participation. The common perceptual factors identified by these students are listed below, and are categorized as either a barrier to, or benefit of, physical activity participation (Brown, Huber, & Bergman, 2006).

Barriers to Physical Activity	**Benefits of Physical Activity**
Low motivation	Psychological improvement
Lack of peer interest	Social benefits
Inconvenience (challenging gym/facility location or no equipment availability)	Physical appearance
Time constraints (exercise interrupts work/school/social duties)	Feeling of productivity
Lack of confidence in using equipment	Identity improvement (enhanced self-concept and attitude)

Comprehension check:

What you do believe is the most significant barrier to participation in physical activity in your own daily routine? Is your most significant barrier found on the list of factors above? What benefits can be gained from physical activity? Are these benefits listed above? How might you overcome perceived barriers to physical activity? (Hint: your perceived benefits must outweigh any perceived barriers).

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2.6 Engaging in Healthy Behavior Change

Considering the numerous barriers to physical activity reviewed above, healthy behavior change and adoption of a habitual physical activity regimen into an individual's lifestyle may seem like a daunting task. College students may feel particularly challenged in implementing a regular physical activity plan into their schedule, given the need to balance school, work, and social lives. Thus, an individual must weigh his or her current "readiness" to make a behavior change in order to effectively plan and implement desired behavioral changes into their daily routine.

The Transtheoretical Model of Behavior Change

The Transtheoretical Model of Behavior Health Behavior Change (TTM) proposes the concept of healthy behavioral change as a series of stages an individual must progress through to achieve success in altering his or her behavioral patterns (Prochaska & Velicer, 1997). Numerous studies support using this model for healthy eating and physical activity behavior change endeavors (Marshall & Biddle, 2001). The TTM stages are as follows:

1. Precontemplation
2. Contemplation
3. Preparation
4. Action
5. Maintenance

The five stages of change correlate to the statements of: "I won't/I can't", "I may", "I will", "I am", and finally, "I still am." Consider the following example of a college student beginning a new exercise regimen in order to visualize the stages of the TTM.

Transtheoretical Model of Behavior Health Behavior Change (TTM)

- **Precontemplation**: The student believes that s/he is not capable of jogging a mile continuously; therefore s/he does not engage in any physical activity.
- **Contemplation**: The student begins to contemplate the target behavior (completing a 1-mile jog), and s/he is now open to the possibility of future success. However, the student has not yet definitively set a date to begin training.
- **Preparation**: The student has now firmly committed to start training for the target behavior, and has joined a local jogging group in order to stay accountable. At this stage, the student may be participating in short jogging bouts, but has not yet attempted to run continuously for 1 mile.

- **Action**: The student is now participating in regular training, and has completed several 1-mile jogs. The student feels as if s/he has achieved their behavioral goal.
- **Maintenance**: The student has continued to train by engaging in multiple distance runs. Perhaps the student has progressed to a fitness level where s/he may target an advanced goal (for example: completing a 5K race), and therefore s/he may cycle through the TTM stages again with this new goal in mind.

The image above depicts the five stages of the TTM in detail.

Creating Healthy Physical Activity Habits: Increasing Self-Efficacy and Goal-Setting

Strategies which may assist an individual in overcoming physical activity barriers– thus, facilitating successful progression through the TTM stages of change – include increasing self-efficacy for physical activity, and engaging in effective goal-setting.

Physical Activity Self-Efficacy: Self-efficacy is defined as the belief that one has the ability to initiate or sustain a desired behavior (Bandura, 1994). Self-efficacy refers to an individual's beliefs that s/he will be successful in performing a specific behavior, whereas self-confidence refers to a more global sense of personal worth. Studies indicate that increased self-efficacy may positively impact an individual's motivation to participate in a particular behavior, the performance achievements gained from participation in said behavior, and overall well-being (Bandura, 1994). Notably, self-efficacy can be developed for a variety of human behaviors. However, for the purpose of the current Chapter, physical activity self-efficacy will be exclusively reviewed. It is

Self-efficacy refers to an individual's beliefs that s/he will be successful in performing a specific behavior, whereas self-confidence refers to a more global sense of personal worth.

important to note that improvements in physical activity self-efficacy may reduce an individual's negative perceptions of exercise, a commonly cited barrier to physical activity (CDC, 2016).

Factors that may enhance an individual's self-efficacy for physical activity include:

...improvements in physical activity self-efficacy may reduce an individual's negative perceptions of exercise...

- Experiencing **positive physiological states** (i.e., mood)
- Receiving **verbal encouragement** for physically active behavior
- **Observing** others successfully performing physically active tasks (i.e., role model)
- **Mastering** physical activity skills on an individual level (Moore & Tschannen-Moran, 2010).

Comprehension check:

How may you increase your self-efficacy for physical activity? Please provide a detailed answer. (Hint: do you acknowledge positive physiological cues during or after exercise (i.e. calm breathing, relaxed state)? Do you surround yourself with individuals who voice their support for your exercise endeavors?)

Physical activity self-efficacy can be strengthened in three areas which correlate with personal, environmental, and behavioral factors.

1. **Personal (Mood)**: Noticing and acknowledging positive physiological states (i.e., feelings of calmness and enjoyment) during physical activity may increase self-efficacy for future physical activity participation.
2. **Environmental (Surrounding oneself by a healthy environment)**: Speaking positively about physical activity participation (verbal encouragement) and observing and being mindful of the physical activity behaviors of those individuals in one's social group (watching role-models in exercise and sport) may positively impact an individual's self-efficacy for future physical activity participation.
3. **Behavioral (Engaging in exercise – "doing"!)**: Engaging in consistent, successful efforts related to physical activity (mastery experiences) may increase physical activity-related self-efficacy.

Goal-Setting for Physical Activity: The first step in creating and maintaining a regimen for lifelong participation in physical activity is to identify desired outcomes. Perhaps the desired outcome is to embrace a healthy lifestyle, enhance mental wellbeing, and improve self-esteem. Research clearly indicates that exercise may produce numerous positive outcomes; however, the challenge lies in overcoming perceptual and environmental barriers in order to consistently follow an exercise plan. Often, an individual will revert to old habits of inactivity (despite his or her desired outcomes) if clear goals are not set regarding physical activity participation.

Participation in habitual physical activity requires a clear vision for oneself, effective goal-setting, and self-monitoring of progress.

Participation in habitual physical activity requires a clear vision for oneself, effective goal-setting, and self-monitoring of progress. A review of how to best create a vision, set appropriate goals, plan for adversity, and self-monitor is the final step in this Chapter's overview of the benefits of physical activity, perceived barriers, and healthy behavior change sections. Research indicates that the following methods may be effective in planning, monitoring, and adhering to a personal health and fitness program (Locke & Latham, 2002).

1. **Create a compelling vision**: Before beginning your behavior change journey, take a moment to create a vision of a "healthier you." What is driving you to engage in behavior change? Why do you wish to create new health habits? How will this improve your life? How will this positive change benefit those close to you? What behaviors do you wish to consistently engage in to become your "best self?"
2. **Design behavioral goals for your exercise plan**: Create S.M.A.R.T. goals for your health regimen. The most powerful goals are specific, measurable, achievable, realistic, and time-bound. Goals may be short-term, or long-term.
3. **Plan for setbacks**: Mentally acknowledge that you will encounter setbacks on your behavior change journey. Discern how you will best overcome these setbacks, and write down a "game plan" for challenging situations. How will you react and respond to adversity?
4. **Track and measure progress**: Keep a journal of your progress, and self-monitor any adjustments you need to make in order to be successful in maintaining your plan. Once you have achieved several of your short-term goals, you may wish to reassess your long-term goals. Perhaps your goals will change slightly, or you will discover that you have exciting, new goals. Therefore, it is important to complete a "goal check-in" with yourself on a regular basis, and to track your achievements/areas for improvement.

Note: Please review the following example of a S.M.A.R.T. goal for a student who wishes to complete a short-course triathlon race (750-meter swim, 12-mile bike, 3.1-mile run).

S.M.A.R.T. Goal Example: Triathlon

- **Specific** – Student includes the specific factors s/he will target in training: endurance front crawl swimming sets, endurance cycling sessions, endurance and sprint running sessions.
- **Measurable** – Student identifies the amount of training s/he will engage in: 45-minutes of moderate-paced swimming once per week, 30 minutes of moderate-paced cycling twice per week, and 2 sessions of running (variable duration at either a moderate- or sprint-pace) per week.
- **Achievable** – Student creates goals which s/he feels confident that s/he can achieve.
- **Realistic** – Though the student may feel confident that s/he can successfully swim for 45-minutes continuously with proper training, s/he may start the training regimen to account for foundational fitness levels. In order to be realistic, the student may initially break the 45-minute swim into

15-minute bouts. As the student's fitness levels improve, s/he may gradually increase the duration of the swimming bouts.

- **Time-Bound** – In this example, assume the student starts training for the triathlon 6-months prior to the race. Therefore, the student decides to set timely goals for each part of her/his training regimen (i.e., achieve desired race-pace for swimming/cycling/running 1-month prior to the race; log a certain number of miles per week throughout the 6-month training program). It is important to note that each individual's S.M.A.R.T. goal will be highly personalized to her/his foundational fitness levels, abilities, and preferences.

Creating a S.M.A.R.T. goal is an effective strategy to keep oneself on-track to achieve the desired outcomes of a fitness plan or health regimen. These goals should be specific, measurable, achievable, realistic, and bound by a timeline. Photo by Estée Janssens on Unsplash

Comprehension check:

Provide an example of a S.M.A.R.T. physical activity goal. Is your goal specific? Can you measure and keep track of your progress? Is your goal achievable? Did you set a realistic goal? Did you indicate a time-frame in which you wish to achieve your goal by? (Hint: creating a goal that is too challenging to achieve in the time-frame specified may be discouraging. Remember, achieving short-term goals may assist you in achieving long-term goals. Set goals which can be reasonably attained, yet require your best efforts).

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2.7 Conclusion

Engaging in regular physical activity may produce improvements in an individual's physical health, cognitive performance, and psychological well-being. Physical benefits include, but are not limited to, reduced risk for diseases, and improvements in physical functioning, fitness, and overall quality of life. Literature supports a link between exercise and cognitive benefits related to academic performance, brain function, and aging. Psychological benefits incurred from physical activity pertain to improvements in mood and self-esteem, and potential reductions in stress, anxiety, and depression. Strong scientific evidence indicates that adopting a physical activity regimen may positively impact health. However, individuals react differently to exercise and may face unique challenges and barriers when beginning and maintaining an exercise program. One may engage in behavioral modification strategies to enhance physical activity. Useful strategies include: identifying personally perceived barriers to physical activity, increasing self-efficacy, effectively setting goals, planning for setbacks, and self-monitoring progress.

Chapter 3: Nutrition for Health and Physical Activity

3.1 An Introduction to Nutrition for Health and Physical Activity

An individual's wellness may be influenced by food and dietary choices. Indeed, a nutritious and balanced diet may positively impact health throughout the lifetime, prevent a variety of chronic diseases, and improve performance during exercise and physical activity participation. Chapter 3 will explore basic principles regarding balanced nutrition, and will emphasize the importance of healthy eating patterns for optimal wellness and physical activity performance. Additionally, common barriers to healthy eating will be identified, and nutritional education and meal planning resources will be provided for the busy college student.

Learning objectives include:

1. A foundational understanding of the role **macronutrients** and **micronutrients** play in an individual's balanced diet, and overall health.
2. An understanding of the **current dietary recommendations**, and how to read **nutrition labels**.
3. The ability to identify common **barriers** to healthy eating patterns.
4. The ability to utilize vetted **dietary resources** in order to create an individualized nutritional plan.

3.2 Nutrition 101

Six nutrients are considered essential in the human diet: carbohydrates, fats, proteins, vitamins, minerals, and water.

Nutrients are components found in food and dietary supplements. Nutrients provide an individual with energy needed for growth and movement (i.e., physical activity), and play a critical role in the maintenance of bodily functions. There are six nutrients which are considered necessary, or essential, in the human diet. These essential nutrients are: carbohydrates, fats, proteins, vitamins, minerals, and water (Williams, 1999). A brief overview of nutrition terminology follows below.

Essential Nutrients: Nutrients that cannot be synthesized in the body in adequate amounts; essential nutrients must be consumed in the diet (Williams, 1999).

Nonessential Nutrients: Nutrients that can be synthesized in the body; nonessential nutrients may also be found in food (Williams, 1999). Note: An example of a nonessential nutrient is creatine.

Macronutrients: Nutrients which the body requires in relatively large amounts; the daily requirement is generally measured in grams (Williams, 1999).

*Note: Carbohydrates, fats, proteins, and water are **macronutrients** (Williams, 1999).*

Micronutrients: Nutrients which the body requires in minute amounts; the daily requirement is generally measured in milligrams or micrograms (Williams, 1999).

*Note: Minerals and vitamins are **micronutrients** (Williams, 1999).*

Comprehension check:

Do you believe that each person's intake needs for macronutrients and micronutrients vary, dependent upon individual differences? Do you think variables such as genetics, level of physical activity, and other personal factors influence one's macro- and micronutrient intake needs?

Macronutrients

Carbohydrate: A molecule containing carbon, hydrogen, and oxygen. Carbohydrates are present in food in the form of sugar, starch, or fiber. Carbohydrates can be simple (i.e., Monosaccharide: a single sugar molecule) or complex (i.e., Polysaccharide: a chain of sugar molecules). Carbohydrates are converted into blood glucose, which serves as a major supply of energy for the body (Williams, 1999). Although dietary fiber is a type of carbohydrate and is essential for a balanced diet, it does not provide the body with caloric energy.

Fresh berries are rich in a type of simple carbohydrate sugar (i.e., fructose) that is found in fruit. Photo by Jonathan Mast on Unsplash

Dietary Fiber: A type of carbohydrate that cannot be broken down in the body; therefore, dietary fiber does not provide energy in the form of calories. However, consumption of dietary fiber is important for optimal gastrointestinal health, blood sugar and cholesterol control, and healthy weight maintenance. Sources of dietary fiber include: legumes, whole grains, fruits, and vegetables.

Common High-Carbohydrate Content Foods:

Fruits, vegetables, grains, beans, milk, and foods with added sugars.

Comprehension check:

Why do you believe it is important to include the macronutrient carbohydrate into a balanced diet if you are active in sports or exercise?

Protein: A complex structure containing carbon, hydrogen, oxygen, and nitrogen. Proteins can be broken down into amino acids (i.e., Amino acid: an organic compound consisting of at least one amino group [-NH2] and one carboxyl group [-COOH]) and peptides (i.e., Peptide: a short chain of two or more amino acids). Proteins are required for growth, function, and maintenance of body tissues, and are generally only utilized for energy if the body is not receiving enough calories from other dietary sources (i.e., carbohydrate or fat) (Williams, 1999).

Protein can be found in animal products (i.e., meat or dairy), but is also available in foods such as nuts, legumes, and some vegetables. Photo by Juan José Valencia Antía on Unsplash

> ***Common High-Protein Content Foods:*** *Animal products such as meat (i.e., beef, pork, lamb), poultry (i.e., chicken), fish, and dairy (i.e., milk, yogurt, cottage cheese). Plant products (i.e., grains, legumes, some vegetables [asparagus, broccoli, brussels sprouts]) also contain smaller amounts of protein.*

Comprehension check:

How can you include the macronutrient protein into a balanced nutritional plan if your diet does not include animal protein?

Fat: Dietary fats may be triglycerides (comprised of glycerol and fatty acids), cholesterol, or phospholipids. Fat provides the body with an important energy source, and also functions in cell structure formation and metabolic regulation. An association between certain types of fat (i.e., Saturated: a fat commonly found in animal products; Trans: a fat commonly found in processed foods) and risk for heart disease does exist, and therefore it is recommended that saturated fat be limited in the diet and trans fat intake be eliminated (Hooper, Martin, Abdelhamid, & Smith, 2015; Restrepo & Rieger, 2016; Williams, 1999) However, certain fats (i.e., Monounsaturated and Polyunsaturated: fats commonly found in plant-based oils) are beneficial to health if eaten in moderation (Williams, 1999).

Photo caption: Monounsaturated and polyunsaturated fats (such as olive oil) are liquid at room temperature. Conversely, saturated and trans fats are solid at room temperature. Photo by Roberta Sorge on Unsplash.

> ***Common High-Fat Content Foods:*** *Fats which are solid at room temperature (such as saturated and trans fats; animal fat, butter), fats which are liquid at room temperature (such as monounsaturated and polyunsaturated fats; olive oil, safflower oil, peanut oil) and omega-3 fatty acids (salmon, tuna, trout).*

Comprehension check:

Consumption of the macronutrient fat is important for a healthy and balanced diet. However, certain types of fats (saturated and trans fats) should be limited in the diet. Identify at least 2 foods in your current diet which are high in saturated or trans fats. Consider how you might reduce, or eliminate, these foods.

Micronutrients

Vitamin: A complex organic compound found in small amounts in most foods. Vitamins are an essential part of a healthy diet and are required for optimal functioning of the body (i.e., maintain healthy tissue, aid in nutrient absorption, etc.). However, vitamins are not an energy source and therefore do not contain calories (Williams, 1999).

Common Foods Rich in Vitamins:
Vitamin A – Carrots, sweet potatoes
Vitamin B, folate – Starches, grains, cereals
Vitamin C – Citrus fruits, bell peppers
Vitamin D – Milk, dairy products, mushrooms, egg yolks
Vitamin E – Sunflower seeds, almonds, spinach
Vitamin K – Kale, broccoli

Mineral: A chemical element found in nature; essential for living organisms. Many minerals are required for bodily functions (i.e., proper water balance in the body, bone health, etc.); however, some minerals are needed in larger amounts than others. The minerals needed in small quantities are known as "trace minerals." Minerals do not provide energy (i.e., calories) for the body (Williams, 1999).

Common Foods Rich in Minerals:
Calcium – Milk, dairy products, dark leafy green vegetables
Iron – Nuts, seeds, beef
Magnesium – Seafood, legumes, whole grains
Potassium – Potatoes, avocados, bananas

Comprehension check:

Different foods contain various amounts and types of essential vitamins and minerals (micronutrients). Therefore, why is it important to include a variety of foods in your balanced diet?

Photo caption: Food such as leafy vegetables, bell peppers, and avocados are high in both vitamins and minerals (micronutrients). Photo by Maarten van den Heuvel on Unsplash

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3.3 Energy Requirements and Dietary Health

Energy Derived from Nutrients

Nutrients in food provide an individual with energy input (energy derived from consumption), and fuel energy expenditure (energy which is utilized to maintain bodily functions and physical activity) (Williams, 1999).

Calorie: A unit of energy in food. In nutrition, the true unit of measure is a kilocalorie (kcal), but is often referred to simply as a "calorie" (Williams, 1999). Note: When referring to a Calorie as a measure of heat, the correct definition is, "The energy required to raise the temperature of 1 gram of water 1 degree Celsius."

The majority of energy (i.e., calories) contained in food (i.e., carbohydrates, proteins, fats) is absorbed into the body during digestion. The caloric value of 1 gram carbohydrate, protein, fat, and alcohol are listed, below. Minerals and vitamins do not provide a measurable source of energy for the body (Williams, 1999).

1 gram carbohydrate = 4 calories (kcal)
1 gram protein = 4 calories (kcal)
1 gram fat = 9 calories (kcal)
1 gram alcohol = 7 calories (kcal)

Comprehension check:

Consider your current diet and the aforementioned caloric values for macronutrients and alcohol. Where do you believe most of your caloric intake is coming from?

Estimated Energy Requirement (EER) Activity: *Each individual has vastly different nutritional and energy-intake needs based upon personal factors such as physical activity level and genetics. However, an equation to determine a generalized energy-intake range (i.e., an estimate of the daily calories needed to maintain current weight) may be found by inputting your personal data into the Estimated Energy Requirement (EER) calculator. You may complete the EER activity by clicking on the following link from the Institute of Medicine: http://www.globalrph.com/estimated_energy_requirement.htm*

Note: *The EER activity provides a general estimate of how energy-intake needs may change based upon physical activity level and is NOT intended as a diet plan; dietary recommendations may only be made by a licensed healthcare professional.*

Choosing Nutrient-Dense Foods

A nutrient-dense food is one that is high in nutrients, but comparatively low in calories. Nutrient-dense foods contain micronutrients (vitamins and minerals) and macronutrients (complex carbohydrates, protein, and healthy fats).

> ***Common Nutrient-Dense Foods:*** *Fruits and vegetables, whole grains, low-fat or fat-free milk products, seafood, lean meats, eggs, peas, beans, and nuts.*

Comprehension check:

The human body needs essential nutrients in order to function. Consuming a variety of nutrient-dense foods in your weekly diet is a simple strategy to ensure that you are getting the needed macronutrients and micronutrients for optimal health and wellness. Can you list at least 35 different nutrient-dense foods you consume in one week? If not, please take a moment to expand upon your weekly food list.

Nutrition and Reduction of Risk for Chronic Disease

An individual's diet may reduce the risk for certain conditions or diseases. Current literature suggests that dietary factors may play a role in the development of several chronic diseases, including but not limited to the following: diabetes, cardiovascular disease, and cancer (Fardet & Boirie, 2014). The World Health Organization (WHO) has identified several harmful health outcomes which may be meaningfully influenced by diet: excess weight and obesity, low bone mineral density and osteoporosis, and poor dental health (Nishida, Uauy, Kumanyika, & Shetty, 2004). Specific nutrients may combat harmful health conditions when they interact with metabolic processes. Metabolic pathways include the inactivation of carcinogens, reductions in inflammation, body fat, and insulin sensitivity, and improvements in the immune system (Williams, 1999). Recent research has focused upon an association between increased consumption of fruits and vegetables, and reductions in the risk for all-cause mortality and cardiovascular mortality (Wang, et al., 2014). However, the literature regarding potential correlations between diet, disease, and risk reduction is vast, and therefore will not be explored in great detail within the confines of this chapter. Rather, recommendations for interpreting the current dietary guidelines and developing healthy dietary behaviors will be discussed in upcoming sections of Chapter 3.

Recent research has focused upon an association between increased consumption of fruits and vegetables, and reductions in the risk for all-cause mortality and cardiovascular mortality.

Dietary habits may meaningfully impact an individual's health and influence risk for chronic disease (i.e., cardiovascular disease, diabetes, etc.). Increasing intake of nutrient-dense foods, such as fruits and vegetables, is a good strategy to optimize dietary health. Photo by Raquel Martínez on Unsplash

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Fardet, A., & Boirie, Y. (2014). Associations between food and beverage groups and major diet-related chronic diseases: an exhaustive review of pooled/meta-analyses and systematic reviews. *Nutrition reviews*, 72(12), 741-762.

Nishida, C., Uauy, R., Kumanyika, S., & Shetty, P. (2004). The joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases: process, product and policy implications. *Public health nutrition*, 7(1a), 245-250.

Wang, X., Ouyang, Y., Liu, J., Zhu, M., Zhao, G., Bao, W., & Hu, F. B. (2014). Fruit and vegetable consumption and mortality from all causes, cardiovascular disease, and cancer: systematic review and dose-response meta-analysis of prospective cohort studies. *Bmj*, 349, g4490.

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3.4 Dietary Recommendations and Nutrition Labels

Dietary Guidelines and Key Recommendations

The *2015-2020 Dietary Guidelines for Americans* recommend that individuals consume foods which are nutrient-dense from each of the major food groups.

Foods that are high in calories (i.e., foods that provide a large amount of energy for the body), but low in nutritional value are referred to as "calorie-dense" foods. Conversely, foods that are high in nutrients (i.e., foods containing an abundance of vitamins or minerals) but are low in calories are referred to as "nutrient-dense." The *2015-2020 Dietary Guidelines for Americans* recommend that individuals consume foods which are nutrient-dense from each of the major food groups for optimal health (DeSalvo, Olson, & Casavale, 2016; Dietary Guidelines Advisory Committee, 2016; Millen, et al., 2016).

The six major food groups identified in the 2015-2020 Dietary Guidelines for Americans are as follows:

1. Vegetables
2. Grains
3. Fruits
4. Dairy
5. Proteins
6. Oils

The *2015-2020 Dietary Guidelines for Americans* encourage individuals to make behavioral changes in their eating patterns by focusing on small, healthy dietary shifts or substitutions (such as choosing nutrient-dense foods and beverages in place of less healthy, calorie-dense options). The *Dietary Guidelines* claim that these healthy behavioral shifts may be achieved by following five overreaching Guidelines: (Dietary Guidelines Advisory Committee, 2016)

1. **Follow a healthy eating pattern across the lifespan.**
   All food and beverage choices matter. Choose a healthy eating pattern at an appropriate calorie level to help achieve and maintain a healthy body weight, support nutrient adequacy, and reduce the risk of chronic disease.
2. **Focus on variety, nutrient density, and amount.**
   To meet nutrient needs within calorie limits, choose a variety of nutrient-dense foods across and within all food groups in recommended amounts.

3. **Limit calories from added sugars and saturated fats and reduce sodium intake.**
   Develop an eating pattern low in added sugars (Note: added sugars are not naturally found in food, and have been added in the processing or preparation of food), saturated fats, and sodium. Cut back on foods and beverages higher in these components to amounts that fit within healthy eating patterns.
4. **Shift to healthier food and beverage choices.**
   Choose nutrient-dense foods and beverages across and within all food groups in place of less healthy choices. Consider cultural and personal preferences to make these shifts easier to accomplish and maintain.
5. **Support healthy eating patterns for all.**
   Everyone has a role in helping to create and support healthy eating patterns in multiple settings nationwide, from home to school to work to communities.

In addition to the aforementioned five Guidelines, the *2015-2020 Dietary Guidelines for Americans* outlines several Key Recommendations for how an individual may maintain healthy eating behaviors throughout the lifetime (Dietary Guidelines Advisory Committee, 2016).

1. **Consume a healthy eating pattern that accounts for all foods and beverages within an appropriate calorie level.**
2. **A healthy eating pattern includes:** A variety of **vegetables** from all of the subgroups—dark green, red and orange, legumes (beans and peas), starchy, and other. **Fruits**, especially whole fruits. **Grains**, at least half of which are whole grains. **Fat-free or low-fat dairy**, including milk, yogurt, cheese, and/or fortified soy beverages. A variety of **protein foods**, including seafood, lean meats and poultry, eggs, legumes (beans and peas), and nuts, seeds, and soy products. **Oils**.
3. **A healthy eating pattern limits: Saturated fats** and **trans fats, added sugars**, and **sodium**.

Key recommendations from the 2015-2020 Dietary Guidelines for Americans call for a balanced diet consisting of a variety of fruits and vegetables, grains, dairy and protein foods, and oils. Photo by Mariana Medvedeva on Unsplash

The *Dietary Guidelines'* Key Recommendations place a quantitative limit on several components of the diet which have been linked to particular public health concerns in the United States. These specified limits are as follows: (Dietary Guidelines Advisory Committee, 2016)

1. **Consume less than 10 percent of calories per day from added sugars.**
2. **Consume less than 10 percent of calories per day from saturated fats.**
3. **Consume less than 2,300 milligrams (mg) per day of sodium.**
4. **If alcohol is consumed, it should be consumed in moderation—up to one drink per day for women and up to two drinks per day for men—and only by adults of legal drinking age.**

In conclusion, the *Dietary Guidelines* recommend that all individuals also strive to meet the Physical Activity Guidelines for Americans (described in Chapter 1) in order to maintain a healthy body weight, promote health, and prevent chronic disease (Dietary Guidelines Advisory Committee, 2016).

Comprehension check:

Calculating your intake of added sugars and saturated fats may be challenging if you do not know how many calories you have consumed during the day. If you are unsure of your total daily caloric intake, you may follow several simple rules for limiting sugars and fats in the diet. (1) Aim for less than 6 teaspoons or approximately 25 grams (a teaspoon contains approximately 4 grams) of sugar per day (2) Follow the American Heart Association recommendations, and limit your intake of saturated foods to less than 16 grams per day. Do you know where you may find this nutritional information? (Hint: check the Nutrition Facts Label on every food product).

Dietary Reference Intakes (DRIs), Percent Daily Value (DV), and Nutrition Facts Labels

Dietary Reference Intakes (DRIs) are nutrient-based reference values which are utilized in planning and assessing diet components. DRIs include a variety of nutritional standards, and assess adequacy of nutrient intake (Williams, 1999). DRIs do not inform individuals of what specific foods should be consumed.

The Percent Daily Value (DV) is based upon several DRI values and can be found on nutrition labels. Daily Values are recommended averages, and are based upon a 2,000 calorie per day diet (Williams, 1999). Percent DV is for the entire day, not just one meal or snack. Some individuals may need more or less than 2,000 calories per day (e.g., varying physical activity levels), or may have special dietary requirements (e.g., high blood pressure, leading to potential recommendations from a

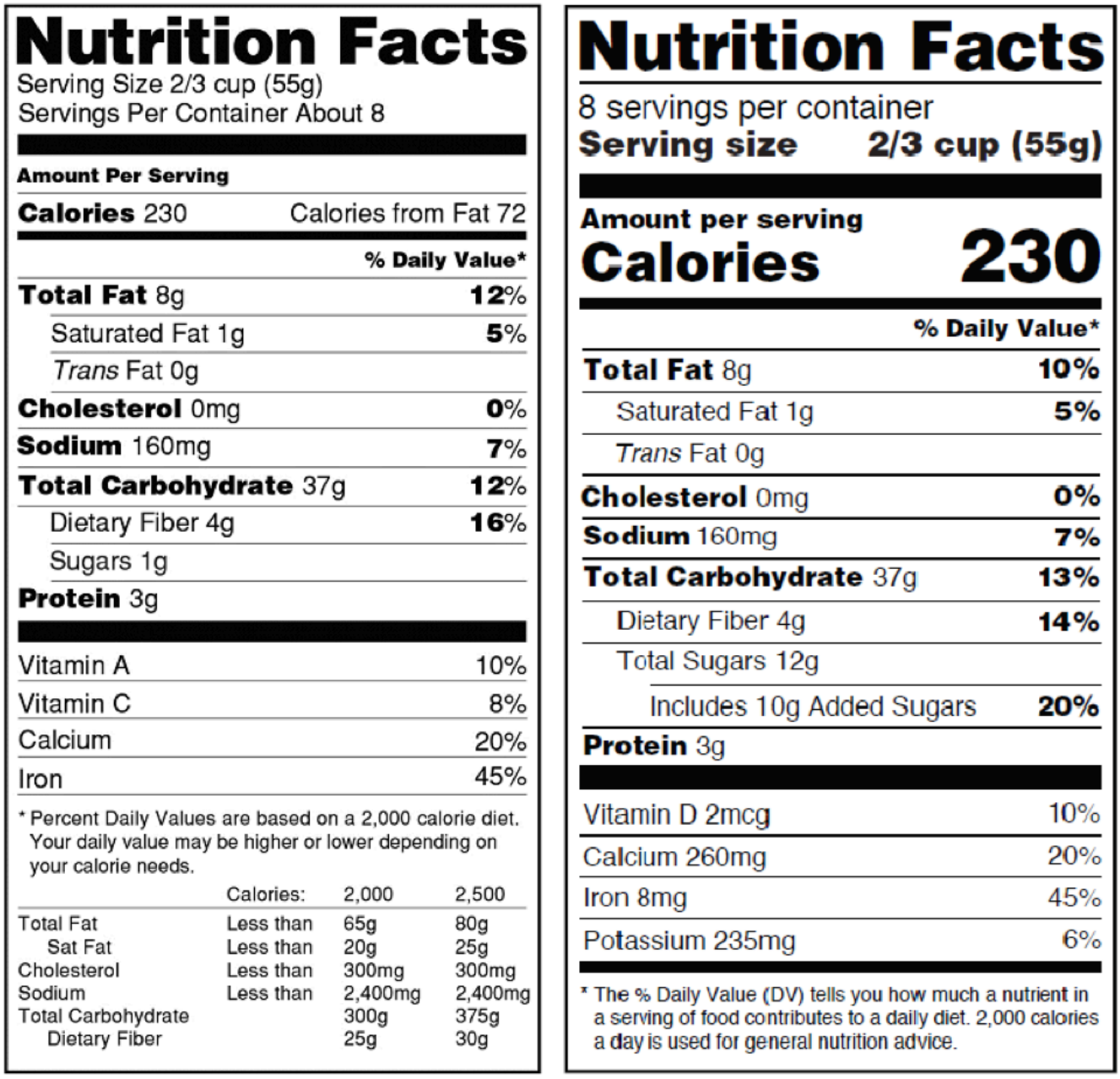
Daily Values are recommended averages, and are based upon a 2,000 calorie per day diet.

physician or dietician to limit sodium further and increase intake of magnesium and potassium). Therefore, percent DV may need to be adjusted for the unique needs of the individual.

Nutrition Facts Labels include DV, serving size information, total calories per serving, and an ingredient list. Processed or packaged foods often require a Nutrition Facts label; however, several exemptions include foods manufactured by small businesses and restaurants, ready-to-eat items (such as bakery items), or foods which do not contain a significant amount of nutrients (such as coffee) (Williams, 1999). Recently, the United States Food and Drug Administration (FDA) developed a new design for the Nutrition Facts labels, based upon current scientific evidence linking components of the diet, such as added sugars or saturated fats, to chronic diseases such as obesity and heart disease (U.S. Food and Drug Administration, 2018). This new label is intended to assist consumers in making healthier nutritional choices. The prudent individual will carefully examine a Nutrition Facts label to assess if a particular food product fits into their healthy eating plan.

Comprehension check:

The new Nutrition Facts label is on the right below. Do you believe the changes to the label are effective in helping consumers make prudent nutritional choices? Why, or why not?



Nutrition Facts

Serving Size 2/3 cup (55g)
Servings Per Container About 8

Amount Per Serving

Calories 230	Calories from Fat 72
	% Daily Value*
Total Fat 8g	**12%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160mg	**7%**
Total Carbohydrate 37g	**12%**
Dietary Fiber 4g	**16%**
Sugars 1g	
Protein 3g	
Vitamin A	10%
Vitamin C	8%
Calcium	20%
Iron	45%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs.

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Nutrition Facts

8 servings per container
Serving size **2/3 cup (55g)**

Amount per serving
Calories **230**

	% Daily Value*
Total Fat 8g	**10%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160mg	**7%**
Total Carbohydrate 37g	**13%**
Dietary Fiber 4g	**14%**
Total Sugars 12g	
Includes 10g Added Sugars	**20%**
Protein 3g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 8mg	45%
Potassium 235mg	6%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

The new Nutrition Facts label is pictured on the right (the older version is on the left). Several changes to the label can be seen when examining text size and content.

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Dietary Guidelines Advisory Committee. (2016). *Dietary Guidelines for Americans 2015-2020*. Government Printing Office.

Millen, B. E., Abrams, S., Adams-Campbell, L., Anderson, C. A., Brenna, J. T., Campbell, W. W., … & Perez-

Escamilla, R. (2016). The 2015 dietary guidelines advisory committee scientific report: development and major conclusions. *Advances in nutrition*, 7(3), 438-444.

Williams, M. H. (1999). *Nutrition for health, fitness and sport* (No. Ed. 5). WCB/McGraw-Hill.

U.S. Food and Drug Administration (2018, January). *The new and improved nutrition facts Label – key changes.* Retrieved from https://www.fda.gov/files/food/published/The-New-and-Improved-Nutrition-Facts-Label-%E2%80%93-Key-Changes.pdf

3.5 Nutrition for Physical Activity

A healthy diet and proper intake of essential nutrients is critical for physical activity performance. This section will include a brief overview of the literature regarding the importance of adequate hydration and consumption of carbohydrates, proteins, and fats for optimal physical activity.

Hydration and Physical Activity

Daily water intake requirements are individualized to each person's unique characteristics (i.e. body weight and sweat rate). However, general recommendations for daily water intake (assuming normal environmental temperatures and activity levels) for adults aged 19+ years have been set at 3.7 liters for males, and 2.7 liters for females (approximately 8-12 cups daily) (Williams, 1999). Gender differences in water intake requirements may be due to differences in body composition between males (water is approximately 60% of body weight) and females (water is approximately 50% of body weight) (Williams, 1999).

Dehydration in physical activity may be the result of insufficient fluid intake or excessive sweating during exercise.

When the body water levels drop below normal percentages, dehydration may occur. Dehydration in physical activity often occurs in prolonged endurance events, and may be the result of insufficient fluid intake or excessive sweating during exercise. Warm or hot weather conditions may increase sweat rates to as high as 3-4 liters per hour (Williams, 1999). Consequences of dehydration include, but are not limited to: degradation in performance, physiologic strain, reductions in mental/cognitive performance, and gastrointestinal distress (Williams, 1999). Dehydration due to excessive sweating may also result in loss of major electrolytes (i.e., substances which conduct an electric current in the muscles and play an important role in activating enzymes and regulating metabolism) from the body. Electrolytes are often replenished during physical activity through the consumption of carbohydrate-electrolyte solutions, such as Gatorade.

The American College of Sports Medicine released a position stand on Exercise and Fluid Replacement in regards to water and electrolyte intake during physical activity (Sawka, et al., 2007). The guidelines recommend rehydration as the most effective technique to maintain water balance throughout exercise. Rehydration is a technique which focuses upon ingesting small volumes of fluids which are moderate in temperature, in order to avoid gastric emptying (excretion of the fluids). Intake of either water or carbohydrate-electrolyte during physical activity may improve performance; however, combining these fluids may be the more effective method in enhancing performance outcomes (Sawka, et al., 2007; Williams, 1999). Further information on fluid replacement and proper hydration for physical activity may be found by exploring the link below.

ACSM Position Stand: Exercise and Fluid Replacement
http://journals.lww.com/acsm-msse/Fulltext/2007/02000/Exercise_and_Fluid_Replacement.22.aspx

Comprehension check:

Do you believe your hydration needs vary on a daily basis? Why or why not? (Hint: does your physical activity level change on a daily basis?).

Rehydration (i.e., ingesting small amounts of fluids) is critical during prolonged physical activity to avoid dehydration and subsequent human performance consequences. Photo by Clique Images on Unsplash

Energy Intake and Physical Activity

Appropriate intake of energy is vital in ensuring the body functions properly when at rest and during physical activity. A balanced intake of macronutrients may assist individuals in regulating a healthy body composition and achieving maximal physical activity outcomes (Thomas, Erdman, & Burke, 2016). Therefore, an understanding of the proper proportions for carbohydrates, proteins, and fats is essential. Acceptable macronutrient caloric proportions for the general population may be found by examining the chart, below (Manore, 2005).

Acceptable Macronutrient Distribution Ranges (AMDR):

Macronutrient	**AMDR**
Carbohydrates	45-65% of caloric intake
Fats	20-35% of caloric intake
Proteins	10-35% of caloric intake

However, each individual must carefully consider their unique personal characteristics and current physical activity participation level when determining diet. The following text briefly describes the role carbohydrates, proteins, and fats play in fueling physical activity.

The body utilizes carbohydrates as a fuel for both anaerobic and aerobic exercise.

Carbohydrates are essential for brain metabolism, and also serve as an excellent energy source for physical activity. Metabolic pathways for carbohydrates are very efficient, and the body utilizes carbohydrates as a fuel for both anaerobic (e.g., intermittent high-intensity exercises) and aerobic exercise (e.g., endurance races) (Williams, 1999). Carbohydrates may be consumed before, during, or after physical activity. Recommendations for athletes indicate that up to 50-60% of the diet may be derived from carbohydrates (Williams, 1999). However, adhering to a carbohydrate-rich diet may result in decreased intake of important macronutrients such as proteins or fats; therefore, monitoring and adapting dietary habits may be necessary.

Proteins are minimally utilized in the body as an energy source for physical activity (Williams, 1999). During endurance aerobic events, the body may switch from primarily using carbohydrates to proteins as a fuel source; this mechanism is hypothesized to preserve glucose for brain functions (Williams, 1999). It is crucial to note that protein is usually utilized as a fuel source only when carbohydrate and fat stores are depleted (i.e., starvation). The body is best served by preserving protein for essential functions (e.g., cell signaling, maintenance of muscle and cell structure, etc.).

Individuals who engage in weight-lifting activities often consume protein in an attempt to promote muscular gains (known as “hypertrophy”). It is recommended that the general population consume 0.8 grams of protein per

kilogram body weight; however, strength training athletes may exceed this guideline. Current literature indicates that consuming approximately 20% of daily energy intake from proteins (or approximately 1.6-1.7 grams of protein per kilogram body weight) is sufficient for hypertrophy goals (Williams, 1999).

A caloric proportion of 20% intake from proteins may be appropriate for individuals participating in strength training. Photo by Jesper Aggergaard on Unsplash

Fats provide a major source of energy for the body during lower intensity physical activites1 and when the body is at rest (i.e., sitting in class, sleeping, etc.). Chronic high-fat diets may impair endurance performance, and therefore it is recommended that athletes consume only 20-30% of daily energy intake from fats (Williams, 1999).

Further information describing the interplay between nutrition and physical activity is available within the ACSM's position stand on Nutrition and Athletic Performance (link below).

ACSM Position Stand: Nutrition and Athletic Performance
http://journals.lww.com/acsm-msse/Fulltext/2016/03000/Nutrition_and_Athletic_Performance.25.aspx

Comprehension check:

Do you believe your daily energy intake needs vary on a daily basis? Why or why not? (Hint: does your physical activity level change on a daily basis?).

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Manore, M. M. (2005). Exercise and the Institute of Medicine recommendations for nutrition. *Current sports medicine reports*, 4(4), 193-198.

Sawka, M. N., Burke, L. M., Eichner, E. R., Maughan, R. J., Montain, S. J., & Stachenfeld, N. S. (2007). American College of Sports Medicine position stand. Exercise and fluid replacement. *Medicine and science in sports and exercise*, 39(2), 377-390.

Thomas, D. T., Erdman, K. A., & Burke, L. M. (2016). American College of Sports Medicine Joint Position Statement. Nutrition and Athletic Performance. *Medicine and science in sports and exercise*, 48(3), 543.

Williams, M. H. (1999). *Nutrition for health, fitness and sport* (No. Ed. 5). WCB/McGraw-Hill.

3.6 Barriers to Healthy Nutrition

Approximately half of the United States population fails to meet the *Dietary Guidelines*.

Scientific studies which measure nutritional behaviors often derive findings from a survey known as the Healthy Eating Index (HEI). The HEI assesses the quality of an individual's diet, and determines whether or not the diet is in compliance with *Dietary Guidelines* (Guenther, et al., 2014). Current HEI results indicate that approximately half of the United States population fails to meet the *Dietary Guidelines* (Dietary Guidelines Advisory Committee, 2016; Guenther, et al., 2014). As previously noted, adherence to a balanced diet may improve health, and poor eating habits may contribute to the development of various chronic diseases and excess weight gain. Many individuals are aware of these consequences and desire to change their dietary behaviors, yet face daunting environmental and situational barriers to engaging in healthy eating patterns.

Common environmental and psychological barriers which college students cite include, but are not limited to, the following:

1. Limited time available to plan for and prepare healthy meals (Silliman, Rodas-Fortier, & Neyman, 2004).
2. High costs of healthy and nutritious food options (LaCaille, Dauner, Krambeer, & Pedersen, 2011).
3. Lack of options for healthy food/meals on college campuses (LaCaille, Dauner, Krambeer, & Pedersen, 2011).
4. Lack of social support, motivation, or self-control (Deliens, Clarys, De Bourdeaudhuij, & Deforche, 2014; LaCaille, Dauner, Krambeer, & Pedersen, 2011).

Indeed, the barriers to healthy nutrition in college are numerous and complex. Despite these barriers, developing a healthy eating pattern is possible – and can even be quite enjoyable! The following section provides an array of dietary resources and tools for the interested individual.

Comprehension check:

Identify your top three barriers to healthy nutrition. What can you personally do to reduce/eliminate these barriers in the next week? For each barrier, write a behavioral goal (see the Goal-Setting section in Chapter 2). Additionally, challenge yourself to keep a three-day food journal in the upcoming week. Are you eating at least 35 nutrient-dense foods per week? Are you limiting your added sugars and saturated fats?

Many college students cite the high cost of fresh fruits and vegetables as a barrier to establishing healthy eating habits. Several strategies to overcome this barrier are to price-compare/use coupons when grocery shopping, buy in bulk and share with roommates/friends, or to buy produce that is in season. Photo by Anne Preble on Unsplash

Works Cited

Deliens, T., Clarys, P., De Bourdeaudhuij, I., & Deforche, B. (2014). Determinants of eating behaviour in university students: a qualitative study using focus group discussions. *BMC public health*, 14(1), 53.

Dietary Guidelines Advisory Committee. (2016). *Dietary Guidelines for Americans 2015-2020*. Government Printing Office.

Guenther, P. M., Kirkpatrick, S. I., Reedy, J., Krebs-Smith, S. M., Buckman, D. W., Dodd, K. W., Casavale, K. O., & Carroll, R. J. (2014). The Healthy Eating Index-2010 is a valid and reliable measure of diet quality according to the 2010 Dietary Guidelines for Americans. The Journal of Nutrition, jn-113.

LaCaille, L. J., Dauner, K. N., Krambeer, R. J., & Pedersen, J. (2011). Psychosocial and environmental determinants of eating behaviors, physical activity, and weight change among college students: a qualitative analysis. *Journal of American College Health*, 59(6), 531-538.

Silliman, K., Rodas-Fortier, K., & Neyman, M. (2004). A survey of dietary and exercise habits and perceived barriers to following a healthy lifestyle in a college population. *Cal J Health Promot*, 18, 281.

3.7 Dietary Resources

Numerous resources are available for the interested individual regarding healthy nutritional choices, and meal planning. Below is a non-comprehensive list of several of these helpful resources, and links to online tools.

Academy of Nutrition and Dietetics – Planning and Prep
http://www.eatright.org/resources/food/planning-and-prep

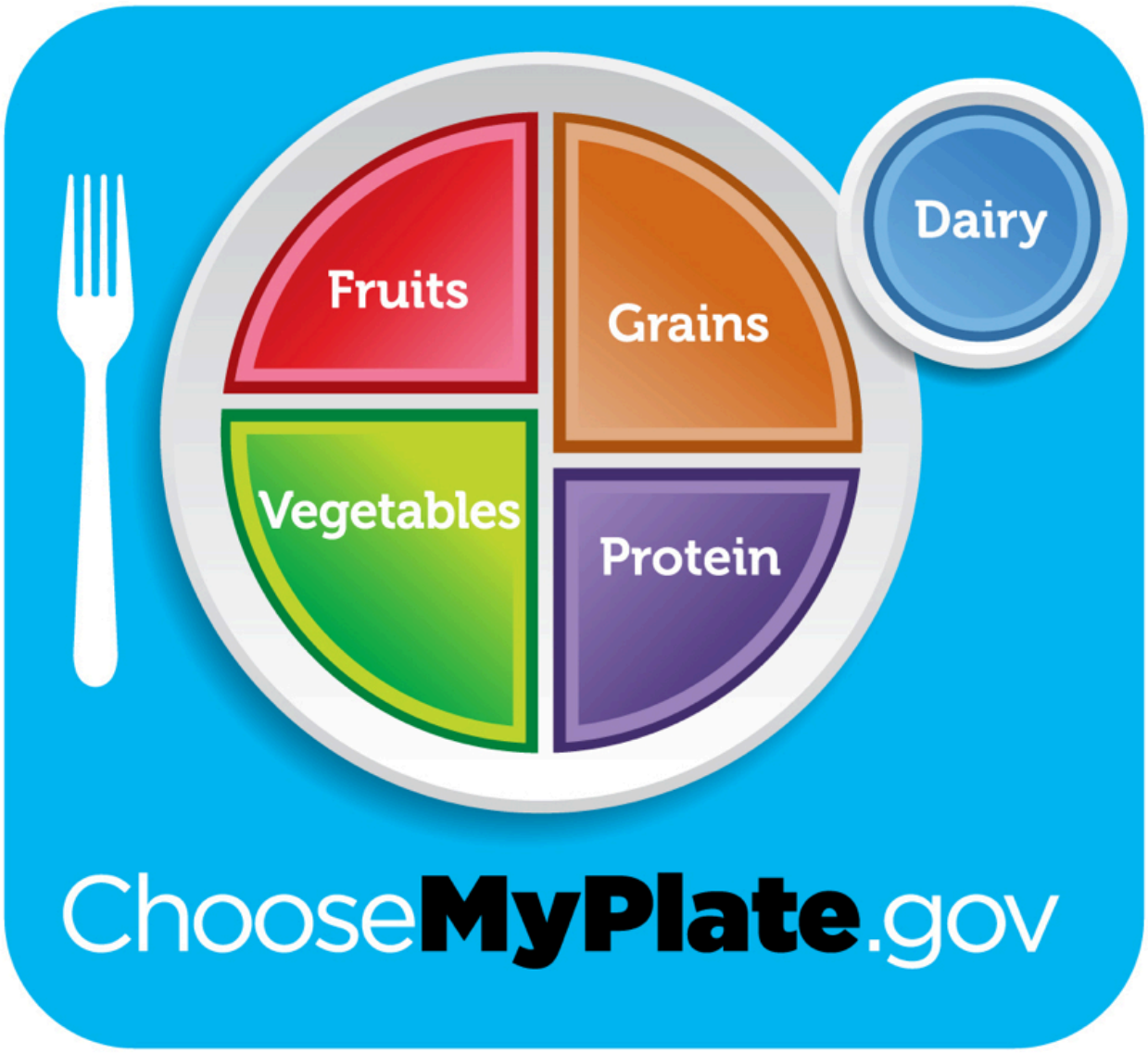
Centers for Disease Control – Healthy Eating
https://www.cdc.gov/healthyweight/healthy_eating/

Centers for Disease Control – Nutrition
https://www.cdc.gov/nutrition/

Dietary Guidelines for Americans 2015-2020
https://health.gov/dietaryguidelines/2015/resources/2015-2020_Dietary_Guidelines.pdf

United States Department of Agriculture – Choose My Plate
https://www.choosemyplate.gov/

United States Department of Agriculture – My Plate Tip Sheets
https://www.choosemyplate.gov/ten-tips



Online resources (such as "Choose My Plate" pictured above) are available to help individuals better understand nutritional recommendations and guidelines.

3.8 Conclusion

Health, wellness, and physical activity performance can either be improved or negatively impacted by an individual's nutritional choices. Chapter 3 provided a variety of tools and resources which may help students to make sound nutritional decisions in line with their unique dietary needs. The chapter also provided a foundational overview of the following: basic nutrition principles and terminology, current dietary recommendations, energy intake needs, and nutritional strategies for physical activity performance. Many of the recommendations provided within this text were created for the general population, and do not take into account an individual's unique characteristics and needs. The interested student is encouraged to explore the provided links and references to overreaching organizations which specialize in nutrition to deepen their understanding of the subject matter.

Notably, Chapter 3 did not contain information regarding eating disorders. Although this topic is both relevant and important, a thorough review of this complex issue is not possible with the confines of this introductory chapter.