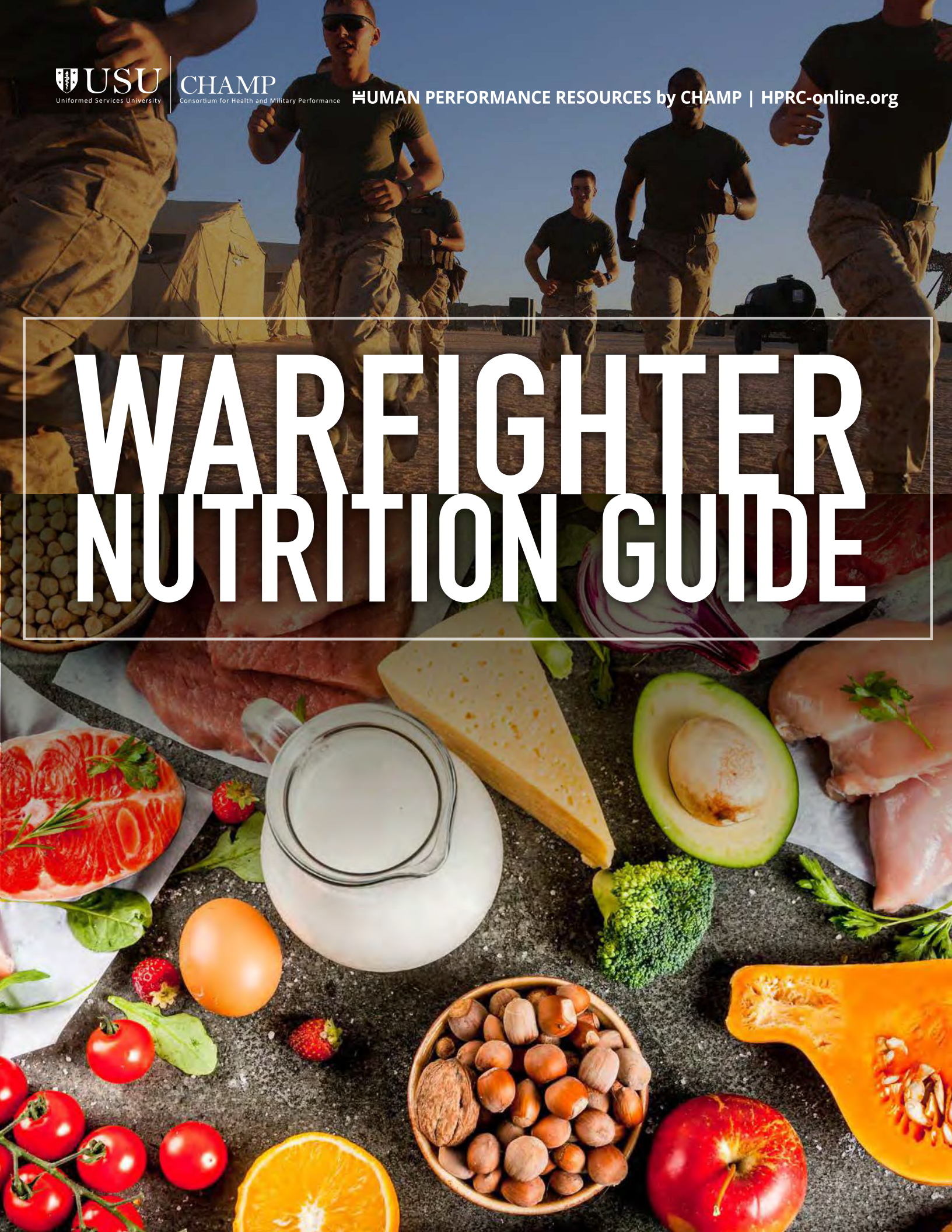
USU Uniformed Services University | CHAMP Consortium for Health and Military Performance

HUMAN PERFORMANCE RESOURCES by CHAMP | HPRC-online.org

WARFIGHTER NUTRITION GUIDE

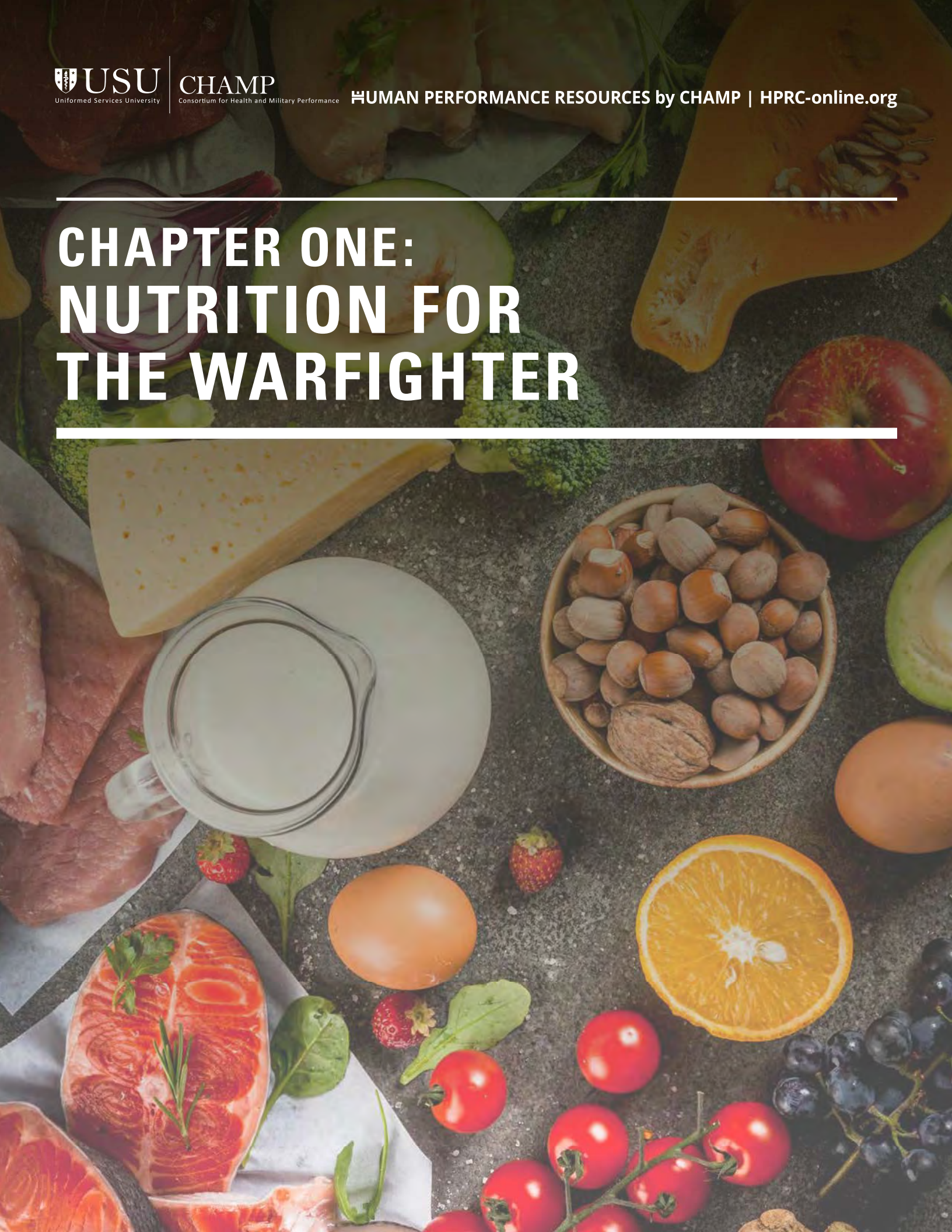


WARFIGHTER NUTRITION GUIDE

The *Warfighter Nutrition Guide* contains strategies and recommendations for all aspects of performance nutrition for Military Service Members. It covers the spectrum of nutritional needs to optimize the performance of Warfighters under the most rigorous conditions. Despite differences across military commands, this Guide is designed to provide Military Service Members with science-based, effective nutritional strategies to optimize performance during operations and to preserve health.

CONTENTS

CHAPTER ONE: NUTRITION FOR THE WARFIGHTER



IN THIS CHAPTER

Nutrition as a key to success

What to expect in WNG

NUTRITION AS A KEY TO SUCCESS

The demands of military service, training, and missions are unique, requiring strength and endurance—physical and mental—to succeed. One factor that can enhance your mental and physical performance and contribute to mission success is good nutrition. In addition, feeding your body nutrient-rich foods can contribute to optimal lifelong health.

This Guide includes a variety of materials—from short summaries to detailed information—with additional resources and important tips for nutrition at home, in garrison, and during deployment. Each command has specialized missions, with the duration of deployments ranging from 30 days to 12 months. Long missions far from central support pose nutritional concerns, and good solutions are not always possible. The Guide covers strategies for optimizing nutrition for all phases of military life.

WHAT TO EXPECT IN WNG

The *Warfighter Nutrition Guide* (WNG) evolved into its first edition after many conversations, discussions, and interactions with military, fitness, and nutrition experts. Human Performance Resources by CHAMP (HPRC) updates it periodically to keep pace with new developments in nutrition and wellness.

Chapters 2–5 provide general background information about energy expenditure, sources of energy, essential nutrients, and hydration. These are the backbone of WNG.

Chapters 6–8 explain how to select high-performance meals and snacks for everyday life—whether you eat in military dining facilities, at home, or at restaurants.

Chapters 9–12 review important information on using nutrition to excel. They cover strategies to achieve your training and mission goals, nutritional strategies for various missions, and dietary supplement safety and resources.

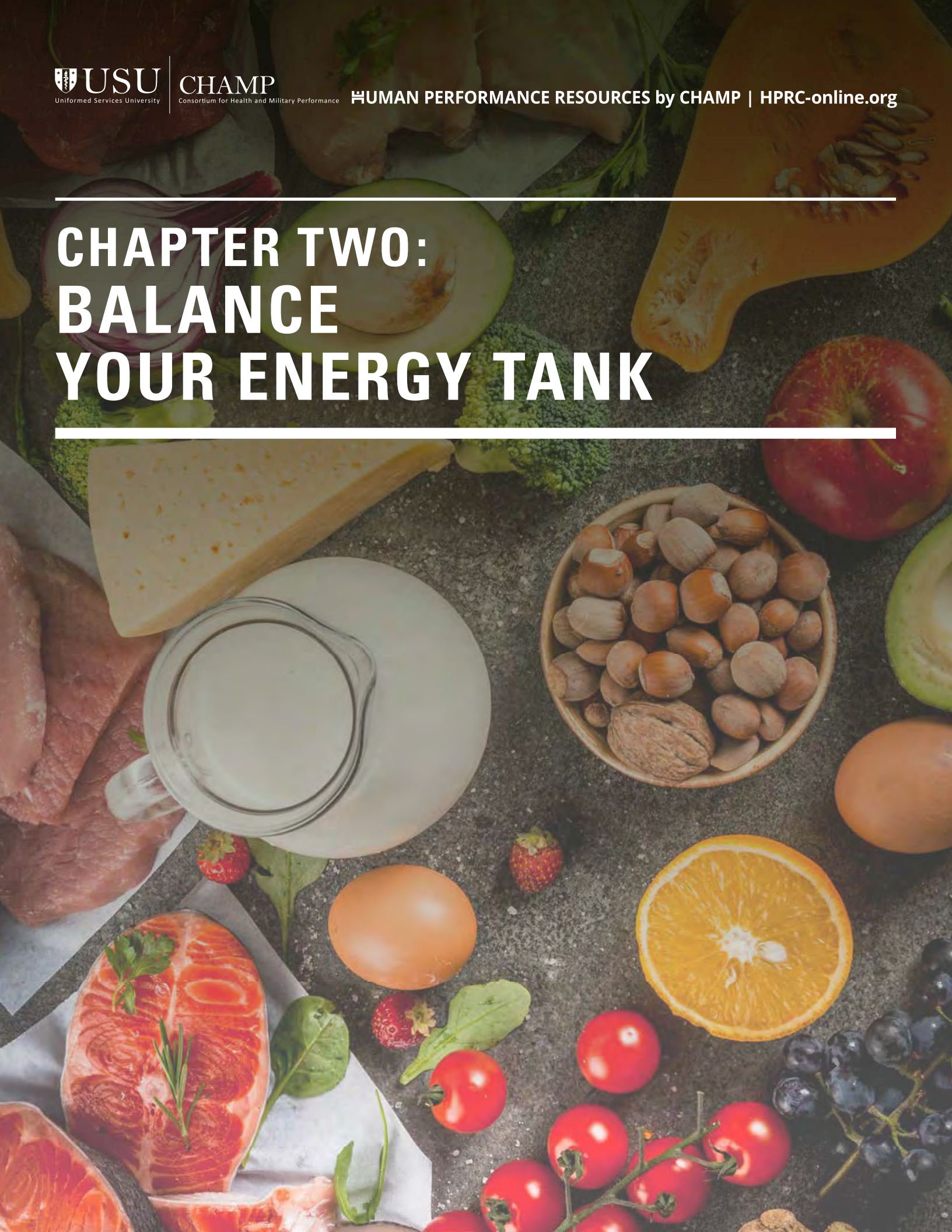
Chapters 13 and 14 explore nutrition strategies while deployed, including combat rations and ways to stay safe when eating abroad.

Chapter 15 discusses the importance of sleep, physical activity, and how you can eat to regain pre-deployment health and fitness after returning home from extended deployments.

Chapter 16 provides information on how to be a long-term warrior and what the seasoned warrior can do to maintain operational readiness and good health after years of intense physical training and activity.

Warfighters need effective nutritional strategies to optimize performance every day—whether you're at home or on a mission—and preserve health into retirement.

CHAPTER TWO: BALANCE YOUR ENERGY TANK



IN THIS CHAPTER

KEY POINTS

It can be hard to balance energy intake and expenditure when activity levels are very high (such as operating in extreme weather conditions) or very low (such as working long hours at a desk).

Body weight typically remains constant when energy intake equals energy used.

Calculate your Estimated Energy Requirements (EER) to determine how much energy you might use in one day.

Body mass index (BMI) is a clinical tool based on height and weight used to classify individuals as underweight, normal, overweight, or obese.

Based on your activity, you can calculate how much fuel—or energy—your "tank" requires for you to function optimally. Energy use must be balanced by energy intake to maintain body weight or "energy balance." To determine how much fuel you need, learn more about your metabolic rate and activity level.

CALORIES: UNITS OF ENERGY

The calorie is the unit most commonly used to describe energy intake and energy use. Think of a calorie as a measure of energy.

ENERGY BALANCE: ENERGY INTAKE VERSUS ENERGY EXPENDITURE

Energy intake refers to the calories you eat and drink from foods and beverages. Energy use, or "expenditure," refers to the number of calories you use or "burn" in a single day. The 3 major contributors to your EER are:

Basal metabolic rate

Physical activity

Energy used in digesting foods ("thermic effect of food" or TEF)

Energy intake and energy expenditure together make up energy balance. When energy intake is greater than expenditure, there is a positive energy balance, which leads to weight gain. However, when energy intake is less than expenditure, there is a negative energy balance, or "energy deficit," which leads to weight loss. **When energy intake equals energy expenditure, body weight doesn't change**. Each body's energy needs are unique, and the amount of energy needed to lose or gain weight varies among individuals and can be complicated. Overall, you can intentionally create an energy deficit by exercising more, eating less, or both. You also can unintentionally create an energy deficit by "under-fueling"—that is, by not eating enough to balance the energy you expend through activity and exercise.

Continue reading to learn more about basal metabolic rate and physical activity, the two factors that contribute the most to energy expenditure.

Basal Metabolic Rate

Basal metabolic rate (BMR) is the amount of energy—used for body functions such as breathing, heartbeat, maintaining body temperature, and other life processes—you need every day just to maintain life. You can use the appropriate equation below to estimate your BMR. While it isn't 100% accurate, it can give you an idea of your energy (calorie) needs.

Physical Activity

BMR is the minimum number of calories your body needs to function. It doesn't include the calories you burn while you're moving or exercising, which vary from day to day. For example, some days you might be very active, involved with strenuous running, swimming, calisthenics, cold-water exposure, sleep deprivation, or carrying of heavy loads. Some days you might be in a classroom or office, sitting a good portion of the day. Other days you might be only moderately active, with some recreational activities. To estimate your calorie needs for a day, multiply your BMR by the activity factor appropriate for your lifestyle (Table 2–1 on the following page).

Calculate EER

Use the equation below to estimate your EER. While it isn't 100% accurate, it can give you an idea of your daily energy (calorie) needs based on your age, physical activity (PA), weight, and height.

Institute of Medicine equation[1]**:**

EER for Men: 662 – (9.53 × age [y]) + PA × (15.91 × weight [kg] + 539.6 × height [m])

EER for Women: 354 – (6.91 × age [y]) + PA × (9.36 × weight [kg] + 726 × height [m])

Example:
For a 25-year-old male Warfighter who weighs 187 pounds, is 69 inches tall, and is active, use the formula (from above) to estimate daily calorie needs:

10 × W (in kg) + 6.25 × H (in cm) – 5 × A (in years) + 5 = calories

EER for Men: 662 – (9.53 × age [y]) + PA × (15.91 × weight [kg] + 539.6 × height [m])

Step 1: Convert pounds to kilograms and inches to meters.

187 pounds ÷ 2.2 = 85 kg

69 inches × 0.0254 = 1.75 m

Step 2: Multiply age in years times 9.53.

9.53 × 25 = 238

Step 3: Subtract result in Step 2 from 662.

662 – 238 = 424

Step 4: Multiply weight in kg times 15.91.

85 kg × 15.91 = 1352

Step 5: Multiply height in m times 539.6.

1.75 m × 539.6 = 944

Step 6: Add results from Steps 4 and 5, multiply result by PA.

1.25 (1352 + 944) = 2870

Step 7: Add results from Steps 3 and 6.

424 + 2870 = 3294 calories needed per day

Note: To convert pounds to kilograms (kg), divide pounds by 2.2. To convert inches to meters (m), multiply inches by 0.0254. You can use an online calculator to convert the units.

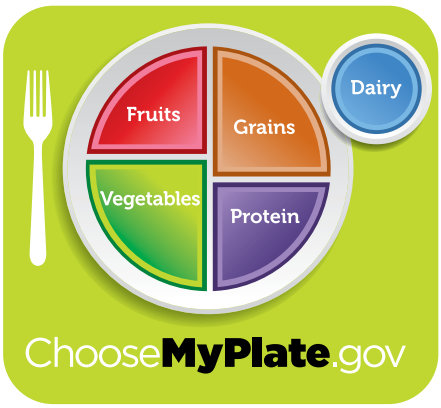
Next, select the appropriate PA category for your lifestyle (Table 2–1).

TABLE 2–1. INSTITUTE OF MEDICINE PHYSICAL ACTIVITY CATEGORIES (PA)[1]

PA Category	Mean PA Value	Example
Sedentary	Men: 1.00 Women: 1.00	A person with a sedentary occupation who spends his or her entire day sitting
Low level of physical activity	Men: 1.11 Women: 1.12	An office worker who sits most of the day, other than the walking necessary to perform tasks of daily living
Active	Men: 1.25 Women: 1.27	An athlete who exercises approximately one hour a day, or a person with an active vocation equivalent to walking 6–8 miles in a day
Very active	Men: 1.48 Women: 1.45	A competitive athlete engaging in several hours of vigorous exercise per day

FUEL YOUR TANK

Warfighters should aim for a meal pattern that follows the MyPlate eating guide. MyPlate tools can help you build healthy meals with all the essential food groups. Table 2–2 includes recommended daily amounts for each food group. MyPlate generally recommends filling ½ of your plate with fruit and vegetables, ¼ of your plate with grains, ¼ of your plate with protein (plant- and/or animal-based), and one serving of dairy.



You also should include a serving of healthy fats with your meal or snack. For example, add oil-based dressings to salads or an avocado-based topping to fish. Foods in the MyPlate

dairy or nuts (protein) categories also contain fats. And it's important to drink plenty of fluids with each meal or snack, so you're properly hydrated.

Following a meal plan such as MyPlate will ensure that you get enough essential vitamins and minerals, fiber, protein, carbohydrates, and fats (discussed individually in Chapters 3 and 4).

TABLE 2–2. FOOD GROUPS AND RECOMMENDED DAILY AMOUNTS[2]

Food Group	Recommended Daily Amount*	What counts as one serving?	Examples of one serving
Vegetables	2½ cups	1 cup	1 cup cooked leafy greens (for example, spinach or lettuce) 2 cups raw leafy greens 12 baby carrots
Fruits	2 cups	1 cup	1 large banana (8" to 9" long) 1 small apple (2¼" diameter) 1 large peach (2¾" diameter) ½ cup dried fruit (for example, raisins or cranberries)
Grains	6 **ounce-equivalents**	1 ounce-equivalent	1 slice whole-wheat bread ½ cup cooked brown rice ½ cup cooked oatmeal 3 cups popcorn (popped)
Dairy	3 cups	1 cup	1 cup dairy or soy milk 8 oz container of yogurt ⅓ cup shredded cheese 2 cups cottage cheese
Proteins	5½ **ounce-equivalents**	1 ounce-equivalent	1 oz meat, fish, or poultry 1 egg 1 tablespoon nut butter 2 tablespoons hummus ¼ cup cooked beans or peas

* The amounts in this table are based on a 2,000-calorie/day eating plan. Active Warfighters might have higher energy needs and require more servings of each food group.

Remember that **good nutrition is a lifestyle** and all about consistency. Warfighters should strive for the MyPlate pattern at all meals, not just before a mission or training session. Keep in mind that your energy intake needs might vary weekly or even daily, depending on your energy expenditure, job duties, and tasks.

Warfighters also should be mindful of **portion size**—the amount of food you actually eat—compared to serving size—a standard amount used primarily for labeling and measuring foods. Overlooking the difference between portion and serving sizes contributes to excess weight and obesity. Adjust your portion sizes to match what your body actually needs for optimal performance. On days when you're more active, you likely need larger portions to fuel your "tank" appropriately. In general, if your body weight is stable, you feel energized, and you're performing well, your "tank" is probably balanced.

ASSESS YOUR FOOD INTAKE

Understanding your energy expenditure and intake, as they relate to types and amounts of food, can help you determine your nutritional "fitness." Two easy ways to assess your nutritional intake are (1) a 24-hour food recall and (2) a food diary. Most people underestimate how much they eat, so tracking your intake can help you see where your calories are coming from. A "**24-hour food recall**" is a snapshot of your diet that involves writing down everything you ate in the last 24 hours—even that piece of candy or handful of pretzels on your way out the door. A **food diary** is more detailed: It involves writing down what you eat and drink for at least 3 days (including one weekend day). Many smartphone apps and online programs are available to help you track your intake. To get the most out of your recall or diary, keep these goals in mind:

Write down all foods and drinks you consumed.

Approximate how much you actually ate or drank. This can be challenging, since most people have difficulty determining their portion sizes, but try your best. If possible, measure or weigh out your portions for more exact amounts.

Identify where and when you ate—whether it was in your car, at home, at a restaurant, or even at your desk. This will give some insight into your eating habits and patterns.

After you complete your recall or diary, review your intake and ask yourself some questions:

Where do you eat most of your meals? What impact might this location have on your nutrition?

Are you getting the recommended amounts of fruits, vegetables, and whole grains?

Do you ever eat when you aren't hungry?

How many meals and snacks do you eat in a day?

How do you usually feel after you eat? Bloated, tired, satisfied, full, or "stuffed"?

Being aware of what, when, where, and how much you eat is the first step toward positive lifestyle changes that will improve your health, maintain your energy balance, and optimize your mental and physical performance.

Try a **food-tracker app** to start recording what you eat and drink.

BODY MASS INDEX

Body mass index (BMI) is a ratio of your weight to your height. It's commonly used as a screening tool to classify individuals as underweight, normal weight, overweight, or obese. BMI doesn't measure the amount of fat or muscle in your body. In fact, Warfighters who are very muscular might be deemed "overweight" or "obese" according to their BMI. However, if your body fat exceeds **military standards**, you probably need to lose weight. To learn more and calculate your own BMI, visit the Centers for Disease Control and Prevention web page "**About Adult BMI**."

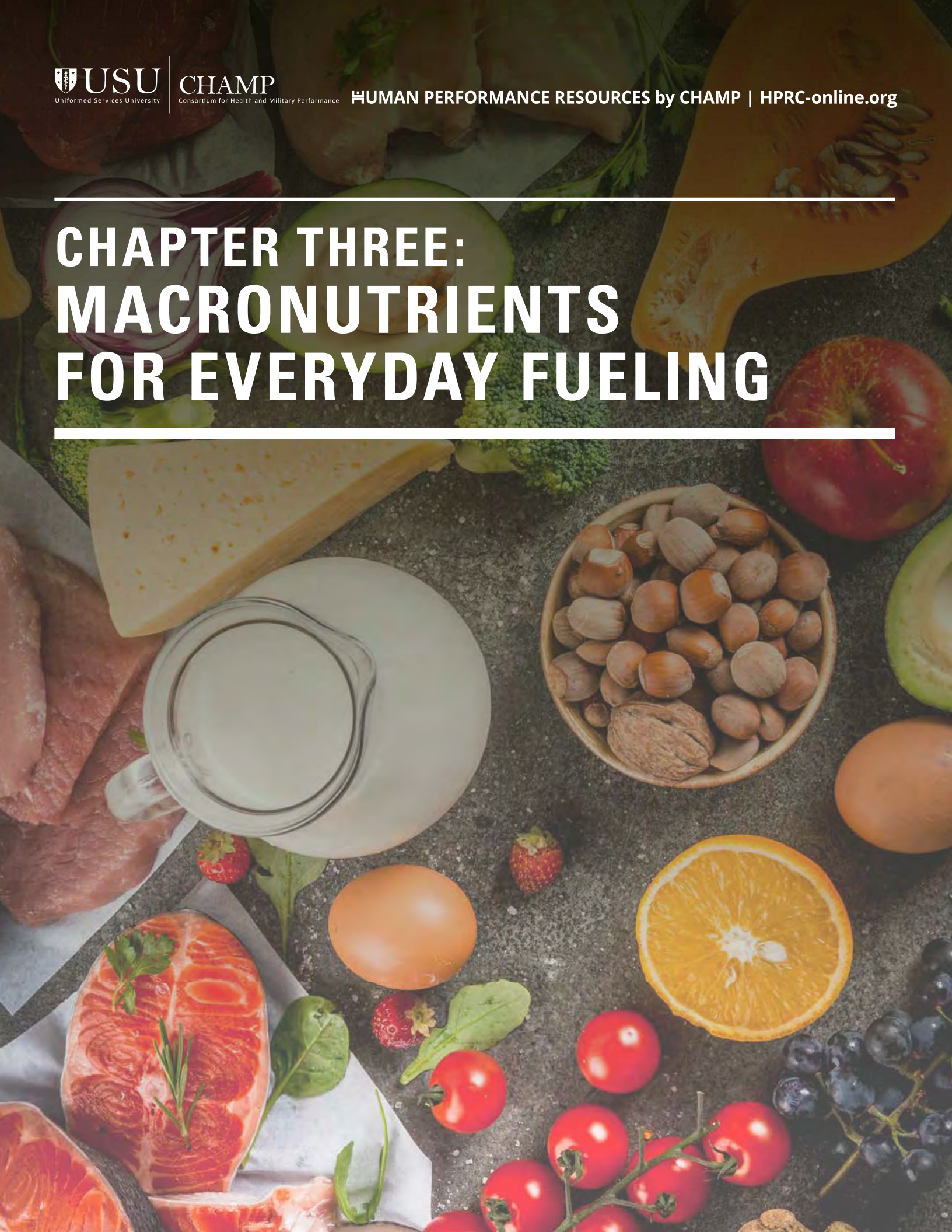
PERSONALIZED NUTRITION NEEDS

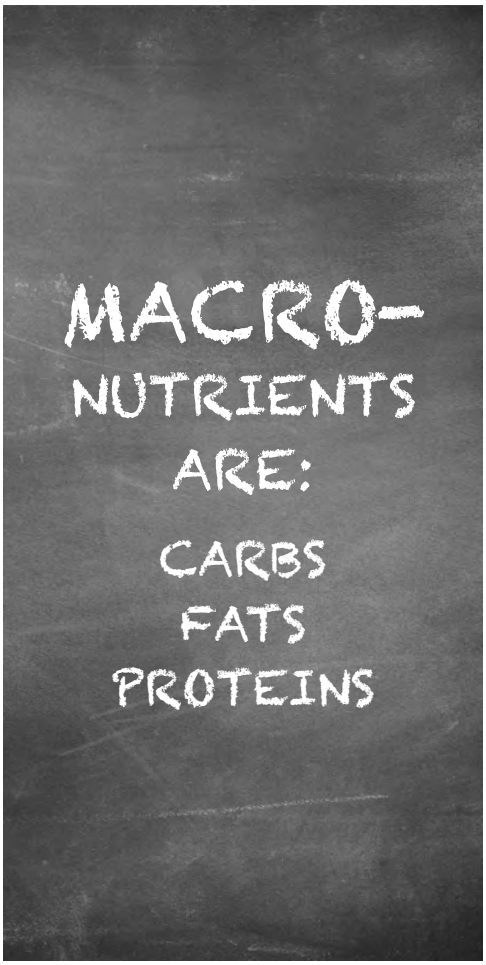
The nutrition each Warfighter needs to achieve or maintain optimal weight for performance depends on his or her age, gender, job duties, activity level, and environment. Under-fueling or over-fueling can be detrimental to your mission readiness and success. Registered Dietitians (RD) and Registered Dietitian Nutritionists (RDN) are food-and-nutrition experts who can help take your performance to the next level. RDs and RDNs who are board-certified specialists in sports dietetics (CSSD) are especially useful for performance-focused counseling and meal planning. Look for an RD or RDN at your installation's nutrition clinic, wellness or health-promotion department, or general-medicine clinic.

CHAPTER 2 REFERENCES

1. Institute of Medicine, Food and Nutrition Board, Panel on Macronutrients, Subcommittee on Upper Reference Levels of Nutrients, Subcommittee on Interpretation and Uses of Dietary Reference Intakes, & Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. (2005). *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids.* Washington, DC: The National Academies Press. doi:10.17226/10490
2. United States Department of Agriculture. What is MyPlate? Retrieved 30 July 2018 from https://www.choosemyplate.gov/MyPlate

CHAPTER THREE: MACRONUTRIENTS FOR EVERYDAY FUELING





IN THIS CHAPTER

KEY POINTS

Carbohydrates (carbs) are the body's preferred fuel source for endurance and resistance activities, competitive athletic events, and mental agility.

Fats, the primary form of stored energy, are essential. Most intake should be healthy fats.

Proteins are essential for building and repairing body tissues, but excess protein is not beneficial to performance.

The foods you eat make a difference in your performance, longevity, and quality of life. Your body needs and uses energy from carbohydrates, fats, and proteins, but it will use whatever is available. Without energy, your body would starve and begin to break down its own muscle and tissue for fuel, which greatly reduces physical and mental performance. This chapter provides basic information about macronutrients, water, and alcohol.

FUELS FOR ENERGY

The 3 main sources of energy are carbohydrates, fats, and proteins. These fuels are called "**macronutrients**" because you need to eat them in large quantities compared to micronutrients, which you need in much smaller quantities (as discussed in Chapter 4).

Carbohydrates

Carbohydrates, commonly referred to as carbs, are your body's preferred source of energy. Carbs are found in many foods, including fruits, vegetables, beans/legumes, dairy, and grains. They exist in many forms, but carbs are classified basically as either simple or complex based on their structure. Carbs also might be classified by how they react (digest)—fast or slow—in your body. In general, simple carbs digest quickly while complex carbs digest more slowly. Some foods, such as whole fruit, are simple in structure (fructose), but are considered slow carbs because their fiber content slows digestion.

Simple carbohydrates. "Fast" carbs—such as sucrose, fructose, lactose, and several others—are digested quickly. Examples include white or brown sugar (sucrose), fruit (fructose), milk sugar (lactose), honey, corn syrup, high-fructose corn syrup, maple syrup, and molasses.

Complex carbohydrates. "Slow" carbs—such as starch and fiber—are made up of chains of simple sugars and digest more slowly. Examples include grains, fruits, seeds, potatoes, pasta, peas, beans, and all other vegetables. Complex carbs come from plant materials and generally digest more slowly (or not at all). Your body digests starches for energy. However, it doesn't digest fiber, as discussed in Chapter 16.

Function of carbohydrates in your body

Your body uses carbs mainly as fuel in the form of glucose for your muscles, brain, heart, and other organs. It needs approximately 130 g of carbs daily to supply your brain with glucose for proper brain function.[1] Carbs also spare the use of protein—needed for other functions—for energy.

Excess carbs not needed for immediate energy are stored in your skeletal muscle and liver as glycogen. Your body uses glycogen as a fuel source during exercise. However, your body can store only about 500 g of glycogen, so it's important to **refuel with carbohydrate-rich foods after a training session to replenish your glycogen stores**. A 24-hour fast will use up the glycogen stored in your liver as well, so it's important to include carbs at each meal. If you don't eat enough carbs every day, you'll likely experience fatigue and an overall decrease in physical and mental performance—sometimes referred to as "hitting the wall."

Keep in mind that all carbs aren't created equal. Carbs that are highly processed and contain refined sugars (simple carbs) are less healthy than whole foods such as baked potatoes, brown rice, whole-wheat pasta, whole-wheat bread, and other **whole grains** (complex carbs).

How many carbs should you eat?

You can calculate how many grams of carbs you should eat based on your body weight and activity level (Table 3–1). Chapter 9 discusses carb amounts further with regard to nutrient timing and exercise.

TABLE 3–1. DAILY CARB NEEDS FOR FUEL AND RECOVERY[2-5]

Activity Level	Carb Needs (grams/ kg body weight)
Light (low-intensity or skilled-based activities)	3–5
Moderate (moderate exercise program; about one hour per day)	5–7
High (endurance program; 1–2 hours per day of moderate to high-intensity exercise)	6–8

Fats

Fats are vital to your eating plan because they add taste to foods, satisfy your hunger, and play an essential role in normal body functioning. Dietary fats are classified as either saturated or unsaturated (Table 3–2). Unsaturated fats are better choices because they are beneficial to your health.

TABLE 3–2. TYPES AND SOURCES OF DIETARY FAT[6-8]

Type	Description	Examples of Food Sources
Monounsaturated fats	Liquid at room temperature but solid when refrigerated	Olive, canola, and peanut oils; peanut butter, cashews, almonds, and avocados
Polyunsaturated fats	Liquid at room temperature	Safflower, sesame, soy, corn, and sunflower oils; nuts, seeds, and fish
Saturated fats	Generally solid at room temperature; mainly in animal products but also in some tropical oils	Whole milk, cream, ice cream, whole-milk cheeses, butter, lard, meat, palm-kernel and coconut oils, and cocoa butter
Trans fats or "partially-hydrogenated" fats	Solid at room temperature. Small amounts are naturally occurring (meat and dairy). Most of the trans fats you eat are created artificially from polyunsaturated fats.	Fatty parts of meat or milk (small amounts); packaged and processed foods such as cookies, crackers, and baked goods; French fries, donuts, and other commercial fried foods

Fats contain more than twice as many calories per gram as carbs and protein (Table 3–3), so be mindful of your portion sizes, especially if you're trying to maintain a healthy weight. (Visit Chapter 10 to learn more about weight management.)

Function of fat in your body

Fat—dietary and body—serves a number of critical functions:

- Provides energy during exercise, in cold environments, and during starvation because it's the major form of stored energy
- Insulates the body
- Helps transport other nutrients to various parts of the body
- Protects organs
- Serves a structural role in cells
- Is needed for production of key hormones

How much fat should you eat?

Adjust your total fat intake (saturated, monounsaturated, and polyunsaturated) to fit your total caloric needs. No more than 30% of total calories should come from fat.[9] Saturated fat intake should not exceed 10%, and the balance (20% or more) should come from mono- and polyunsaturated fats. Simple changes to your eating plan can enable you to meet these recommendations. Try the following strategies:

- Use oils instead of butter when preparing and cooking food.
- Avoid deep-fried foods. Try different methods of cooking such as baking, broiling, stir-frying, grilling, roasting, and steaming.
- Incorporate more whole grains, beans, legumes, fruits, and vegetables into your meals.
- Consume lean sources of protein such as fish and shellfish, skinless chicken and turkey, and tofu.
- Eat or drink reduced-fat or non-fat milk, yogurt, and other dairy, or eat smaller portions of full-fat dairy products such as cheese.
- Cut visible fat off meat and drain excess fat after cooking.

Proteins

Protein is made up of amino acids—small building blocks hooked together in various ways. Although your body contains more than 20 different amino acids, only the 9 "essential amino acids" (EAA) are of major dietary concern:

TABLE 3–3. SUMMARY OF CALORIE YIELDS FROM MACRONUTRIENTS, ALCOHOL, AND WATER[8]

1 gram of…	=	Calories
Carbohydrate	=	4
Fat	=	9
Protein	=	4
Alcohol	=	7
Water	=	0

histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. EAA are called "essential" because your body can't make them, so you must obtain them from protein sources in your diet. An unbalanced eating plan can result in not enough or the wrong balance of the 9 EAA and can cause the breakdown of bodily proteins such as those found in muscles.

Function of proteins in your body

There are numerous types of proteins. They vary in size depending on how many amino acids are linked together. Each one also performs different functions in your body, including:

Contraction of muscles
Formation of muscle, hair, nails, skin, and other tissues
Production of energy (although not the primary source)
Repair of injuries
Protection from infections
Transportation of fats, vitamins, and minerals throughout the body
Structural roles for every part of the body

How much protein should you eat?

How much protein you need depends on your age, body weight, training intensity, and activity level. In general, protein needs range from 0.8–1.6 g/kg/day. Consume protein at the higher end of the range with intensified training, more frequent training, new training stimulus, if you're less trained, or when energy intake (calories) is low.[2]

When you don't take in enough calories to meet your body's demands (negative energy balance), you might need up to 2 grams of protein/kg body weight to maintain muscle mass, strength, and performance. When you're in severe negative energy balance, such as during intense training, missions, or extreme environmental conditions, even extra protein might not be enough to preserve muscle mass. In these settings, it's best to focus on getting enough high-quality foods and drinks to help meet your energy needs. Eating and drinking more calories helps your body avoid using protein for energy.

Protein needs can, and should, be met by whole foods instead of supplements (Table 3–4). For optimal fueling, include protein at meals and snacks throughout the day and after strenuous activities.[2]

Many Military Service Members believe if they eat more protein, their muscles will increase in size. However, this isn't necessarily true. There's no "storage system" for excess protein, so you must obtain protein from food

daily. Once you've met your daily protein and caloric needs, the rest is stored as fat. See HPRC's article on **protein requirements** to learn how to calculate your individual protein needs based on your body weight and activity level, along with a sample one-day meal plan.

TABLE 3–4. FOOD SOURCES OF PROTEIN[10]

Food	Protein (g)
Sirloin steak, 5 oz	42
Chicken breast, 5 oz	40
Pork chop, 5 oz	38
Atlantic cod, 5 oz	32
Non-fat Greek yogurt, strawberry, 5.3 oz	12
Low-fat milk, 8 fl oz	8
Black beans, ½ cup	7
One hardboiled egg	6
Almonds, 1 oz	6

Water

Water is the most abundant component of the body. It's needed for digestion and absorption of nutrients, excretion of waste products, blood circulation, and regulation of body temperature. Approximately 50–70% of your total body weight is water. Your body constantly loses water and other fluids through urine, feces, sweat, and breathing, so you must consume fluids regularly to ensure your body functions normally. When you don't consume enough fluids, dehydration occurs, impairing your health and your mental and physical performance. Read Chapter 5 for in-depth information on hydration before, during, and after physical activity and Chapter 11 for information on hydration during missions.

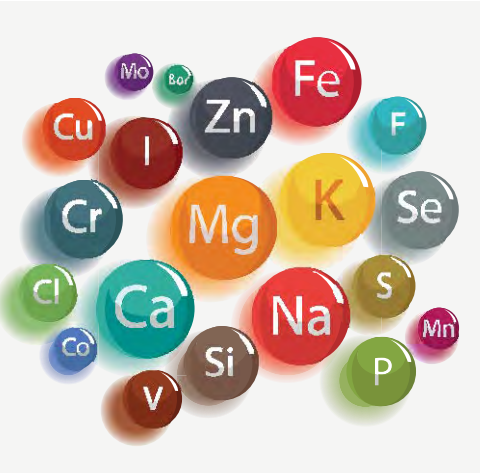
Alcohol

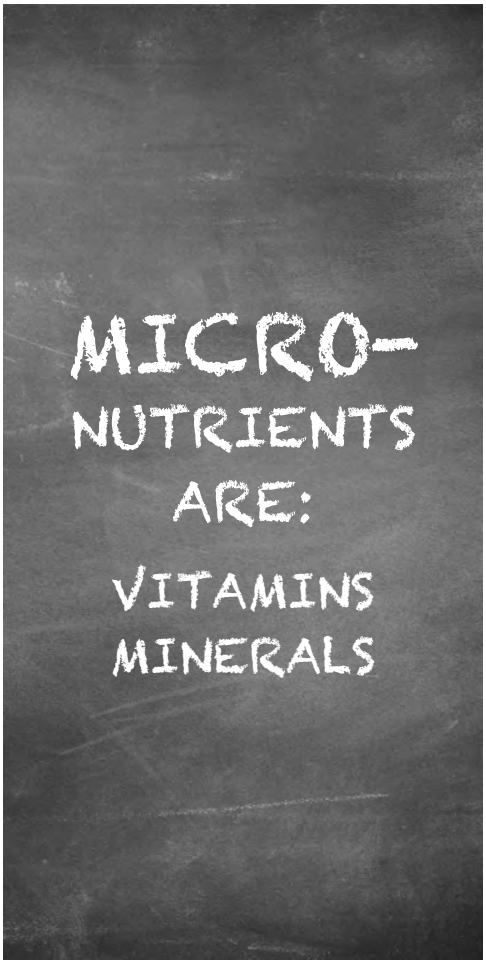
Alcohol itself is not a nutrient, but alcoholic beverages (beer, wine, or liquor) contribute energy (calories) to your intake (see Table 15–1, Chapter 15). In addition, it isn't a good source of energy for physical activity or exercise because alcohol can prevent your body from fully utilizing other nutrients. For optimal performance, it's a good idea to minimize the amount of alcohol you consume. Refer to Chapter 15 for more information on alcohol.

CHAPTER 3 REFERENCES

1. Institute of Medicine, Food and Nutrition Board, Panel on Macronutrients, Subcommittee on Upper Reference Levels of Nutrients, Subcommittee on Interpretation and Uses of Dietary Reference Intakes, & Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. (2005). *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids.* Washington, DC: The National Academies Press.
2. Academy of Nutrition and Dietetics, Dietitians of Canada, & American College of Sports Medicine. (2016). Nutrition and athletic performance. *Medicine & Science in Sports & Exercise*, *48*(3), 543–568. doi:10.1249/MSS.0000000000000852
3. Burke, L. (2012). *New guidelines for carbohydrate Intake in sport from the International Olympic Committee*. SCAN's *Pulse*, *31*(3), 7–11.
4. Maughan, R. J. (Ed.) (2014). *The Encyclopaedia of Sports Medicine: Sports Nutrition* (Vol. 19). Chichester, UK: John Wiley & Sons Ltd.
5. Karpinski, C., & Rosenbloom, C. A. (2017). *Sports Nutrition: A Handbook for Professionals* (6th ed.). Chicago: Academy of Nutrition and Dietetics.
6. MedlinePlus. (2016a). Facts about monounsaturated fats. Retrieved 2 May 2017 from https://medlineplus.gov/ency/patientinstructions/000785.htm
7. MedlinePlus. (2016b). Facts about polyunsaturated fats. Retrieved 2 May 2017 from https://medlineplus.gov/ency/patientinstructions/000747.htm
8. 2015 Dietary Guidelines Advisory Committee. (2015). *Dietary Guidelines for Americans*, 2015–2020 (8th ed.). Washington, DC: Department of Health and Human Services & U.S. Department of Agriculture.
9. Headquarters, Departments of the Army, the Navy, & the Air Force. (2017). *Nutrition and menu standards for human performance optimization* (AR 40–25/OPNAVINST 10110.1/MCO 10110.49/AFI 44–141). Departments of the Army, the Navy, and the Air Force, Washington, DC. Retrieved from: https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/AR40-25_WEB_Final.pdf
10. United States Department of Agriculture Agricultural Research Service. (2016). USDA Food Composition Databases. Retrieved 26 April 2017 from National Agricultural Library https://ndb.nal.usda.gov/ndb/

CHAPTER FOUR: MICRONUTIENTS FOR HIGH PERFORMANCE





IN THIS CHAPTER

KEY POINTS

- Vitamin and mineral needs can be met by eating a variety of nutrient-dense foods.
- Vitamins and minerals don't provide energy, but they're needed for energy production, among other functions.

Micronutrients support performance at a high level. They include vitamins and minerals required by the body in very small amounts to perform vital metabolic and physiologic functions. Taking in too little or too much of these nutrients can interfere with normal body functions. Depending on gender, age, activity, and environment, Warfighters need different amounts of vitamins and minerals to perform well. The best way to obtain them is to include nutrient-dense foods in your daily eating plan.

ROLE OF MICRONUTRIENTS IN PERFORMANCE

In general, your body needs micronutrients in order to:

- Help make energy
- Make red blood cells
- Optimize immune function
- Maintain the health of muscles and joints
- Recover from exercise

DIETARY REFERENCE INTAKES AND DEFINITIONS

The term Dietary Reference Intakes (DRI) refers to a set of well-established values used to plan and assess a healthy person's dietary nutrient intake. The military has established **Military Dietary Reference Intakes** (MDRIs), based on DRIs, to distinguish Military Service Members' specific nutrient needs.[1] MDRIs are used to plan and assess diets and develop menus for military personnel during garrison activities. They're also used to set a minimum standard for developing rations. While many MDRIs are similar to DRIs, one exception is sodium. The DRI for sodium for the general population is considered too low for the military, given the risk of sodium depletion during intense or prolonged physical activity, especially in hot environments. **Sodium's DRI for men and women is 1500 mg, but its MDRI is <2300 mg**. Upper intake levels (the maximum daily intake unlikely to cause adverse health effects) for the military are the same as those for civilians.

Visit the Office of Dietary Supplements (ODS) **DRI web page** for more information on Dietary Reference Intakes.

NUTRIENT DENSITY

The term "nutrient density" refers to the amount of nutrients per calorie in a given food—an index of nutritional quality. Essentially, a nutrient-dense food provides a high amount of nutrients (such as vitamins and minerals) while being relatively low in calories. Nutrient-dense foods include fruits and vegetables. Following a well-balanced eating plan with a variety of fruits, vegetables, grains, and protein-rich foods (plant- or animal-based) should help you meet your micronutrient needs.

Table 4–1 compares the nutrient density of two different foods: an apple and a serving of potato chips. As you can see, the potato chips provide more calories but fewer nutrients (vitamins, fiber, etc.). In general, try to choose foods with more fiber, vitamins, and minerals and less saturated fats and added sugars.

TABLE 4–1. NUTRIENT DENSITY COMPARISON[2]

Nutrient	Large apple (3¼" diameter)	Potato chips (1 oz; about 15 chips)
Calories	116	149
Fiber (grams)	5.4	0.9
Calcium (mg)	13	6
Vitamin C (mg)	10.3	6
Vitamin A (IU)	120	0

VITAMINS

Vitamins are nutrients that don't actually provide calories, but you need them for growth, development, and other body functions. They're broadly classified as water- and fat-soluble.

Water-soluble vitamins. These dissolve in water, and your body can't store them. Any excess is eliminated through your urine once your body has used the amount it needs. The water-soluble vitamins are vitamin C and the B vitamins: thiamine (B_1), riboflavin (B_2), niacin (B_3), pantothenic acid (B_5), pyridoxine (B_6), biotin (B_7), folic acid (B_9), and cyanocobalamin (B_{12}).

Fat-soluble vitamins. These are stored in your body fat and your liver, so you don't necessarily need to eat them every day, even though your body uses them daily. Since they're eliminated from your body much more slowly than water-soluble vitamins, they pose a greater risk for toxicity if you consume too much, such as in dietary supplements. The fat-soluble vitamins are vitamins A, D, E, and K.

Functions of vitamins

Each vitamin has its own function, but your body generally needs them to:

- Produce energy from macronutrients (carbs, fats, and proteins)
- Repair and grow tissue
- Maintain and support reproductive function
- Develop immune response

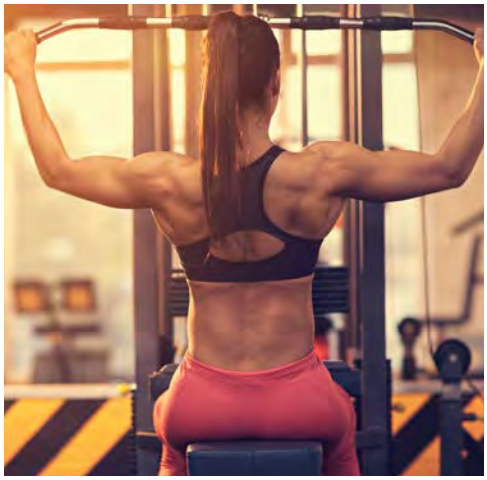
Some functions are specific to only one vitamin, whereas other functions require more than one vitamin. For example, several B vitamins and some minerals are needed to produce energy from foods.

MINERALS

Similar to vitamins, minerals don't provide energy or calories, but they're essential for health and optimal performance. Minerals typically are classified as either major minerals (macrominerals) or trace minerals.

Major minerals. Your body requires these in relatively large amounts (> 200 mg/day). Macrominerals include calcium, phosphorous, magnesium, sodium, potassium, chloride, and sulfur.

Trace minerals. Your body needs these in smaller amounts (< 200 mg/day). Trace minerals include iron, manganese, copper, iodine, zinc, fluoride, and selenium.



FUNCTIONS OF MINERALS

Your body requires appropriate dietary intakes of minerals to maintain physical health. For example, you need minerals for:

- Brain and neural function
- Bone structure and maintenance
- Muscle function and growth
- Production of energy
- Reproductive functions
- Immune function

For in-depth information about specific vitamins and minerals, visit the website of the **Office of Dietary Supplements.**

Good food sources of vitamins and minerals

No single food is a good source of all vitamins and minerals, which is why it's important to eat a variety of foods. Some processed foods provide many vitamins and minerals because they've been fortified (added to) with nutrients, whereas other processed foods might contain few, if any, micronutrients. When eating at home or dining out, the key to eating a balanced meal is to choose a variety of foods whenever possible. In general, foods rich in vitamins and minerals include fruits, vegetables, beans, legumes, whole grains, dairy products, eggs, nuts, seeds, fish, poultry, and meat. See Table 2–2 (Chapter 2) for a list of food groups and recommended daily amounts.

If you're eating field rations during training or deployment, eat all the entrées and other foods and beverages provided in the pack, because different foods and drinks are fortified with different micronutrients. Visit Chapter 13 for in-depth information about combat rations.

SPECIAL PERFORMANCE PROMOTERS: ANTIOXIDANTS

Antioxidants are substances that neutralize certain highly reactive, destructive compounds known as **free radicals**. Antioxidants can include vitamins and minerals, as well as other compounds naturally found in food, so nutrient-rich foods are the best sources of antioxidants (see Table 4–2). Chapter 16 includes more information about antioxidants and their importance for long-term health and performance.

TABLE 4–2: WELL-KNOWN ANTIOXIDANTS

Name	Classification	Food Sources
Beta-carotene[3]	A pigment found in plants that gives them their yellow and orange colors	Carrots, squash, sweet potatoes, tomatoes, cantaloupe, peaches, and apricots
Cysteine[4]	Nonessential amino acid	High-protein foods, including ricotta and cottage cheeses, yogurt, pork, chicken, turkey, wheat germ, and granola
Flavonoids[5]	Natural compounds found in plants	Kale, beets, cranberries, berries, red and black grapes, oranges, lemons, grapefruits, and green tea
Selenium[6]	Mineral	Fish, shellfish, red meat, grains, eggs, chicken, and garlic
Vitamin A[7]	Fat-soluble vitamin	Salmon, eggs, milk, spinach, carrots, sweet red peppers, mangos, black-eyed peas, and broccoli
Vitamin C[8]	Water-soluble vitamin, also called ascorbic acid	Citrus fruits, green pepper, broccoli, leafy greens, strawberries, raw cabbage, and potatoes
Vitamin E[9]	Fat-soluble vitamin	Wheat germ, nuts, seeds, whole grains, leafy greens, and vegetable oil

VITAMIN AND MINERAL DIETARY SUPPLEMENTS

In general, a balanced eating plan with a variety of nutrient-dense foods that matches your performance needs also should meet your daily vitamin and mineral needs. However, vitamin and mineral supplements might be useful if...

- You have a vitamin or mineral deficiency.
- You have poor nutrient intakes and dietary habits. However, **supplements are not a substitute** for a poor diet or under-fueling.

You can't meet your energy requirements from food.

You're exposed to extreme environments such as cold temperatures and high altitude for prolonged periods.[10]

Taking a general multivitamin/mineral supplement appears to have no measurable performance benefit when your vitamin and mineral needs are met through food.[11] If you want to take a vitamin and/or mineral supplement, it should provide nutrients in amounts that meet the DRIs. No supplement (or combination of supplements) should provide more than the upper intake levels (UL) set by the National Academy of Sciences (NAS). And keep in mind that supplements add to the amounts of nutrients you get from food.

If you're considering taking a vitamin or mineral supplement, first talk with your healthcare provider.

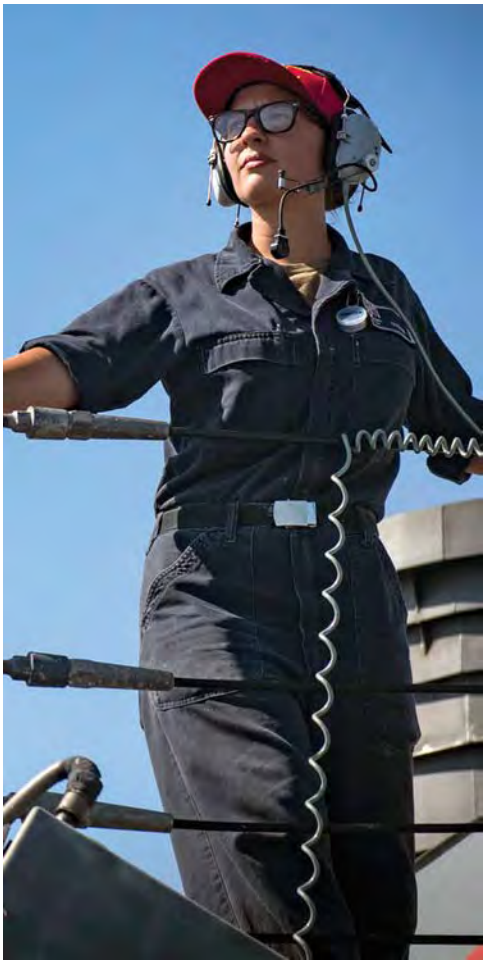
Risks of vitamin and mineral supplements

Excessive intake of some vitamin and mineral supplements can cause multiple side effects, and some vitamins and minerals can be toxic at intakes above the UL established by NAS. Toxicity usually is caused by supplements rather than foods. Excess amounts of single- or multiple-nutrient supplements also can upset your overall nutrient balance and cause a deficiency of other nutrients. Iron, zinc, and copper are good examples. Taking too much iron from supplements might decrease zinc absorption, and taking too much zinc can prevent proper absorption of copper.[12] Vitamin E also is an important antioxidant needed for healthy immune function. However, excess vitamin E (in the form of alpha-tocopherol) from supplements might increase your risk of bleeding after a cut or injury.[9]

As previously discussed, food is the best source of nutrients, including vitamins and minerals. Chapter 12 discusses dietary supplements in more detail.

CHAPTER 4 REFERENCES

1. Headquarters, Departments of the Army, the Navy, & the Air Force. (2017). *Nutrition and menu standards for human performance optimization* (AR 40–25/OPNAVINST 10110.1/MCO 10110.49/AFI 44–141). Departments of the Army, the Navy, and the Air Force, Washington, DC. Retrieved from: https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/AR40-25_WEB_Final.pdf
2. United States Department of Agriculture Agricultural Research Service. (2016). USDA Food Composition Databases. Retrieved 26 April 2017 from National Agricultural Library https://ndb.nal.usda.gov/ndb/
3. Higdon, J., Drake, V. J., & Delage, B. (2016). β-Carotene, β-Carotene, β-Cryptoxanthin, Lycopene, Lutein, and Zeaxanthin. Retrieved 12 July 2018 from https://lpi.oregonstate.edu/mic/dietary-factors/phytochemicals/carotenoids



4. Sarmadi, B. H., & Ismail, A. (2010). Antioxidative peptides from food proteins: A review. *Peptides*, *31*(10), 1949–1956. doi:10.1016/j.peptides.2010.06.020

5. University of Maryland Medical Center. (2013). In-Depth Patient Education Reports: Articles: Vitamins. Retrieved 26 April 2017 from http://www.umm.edu/health/medical/reports/articles/vitamins

6. National Institutes of Health, Office of Dietary Supplements (2018a). Selenium – Fact Sheet for Health Professionals. Retrieved 12 July 2018 from https://ods.od.nih.gov/factsheets/Selenium-HealthProfessional/

7. National Institutes of Health, Office of Dietary Supplements (2018b). Vitamin A – Fact Sheet for Health Professionals. Retrieved 12 July 2018 from https://ods.od.nih.gov/factsheets/VitaminA-HealthProfessional/

8. National Institutes of Health, Office of Dietary Supplements (2018c). Vitamin C – Fact Sheet for Health Professionals. Retrieved 12 July 2018 from https://ods.od.nih.gov/factsheets/VitaminC-HealthProfessional/

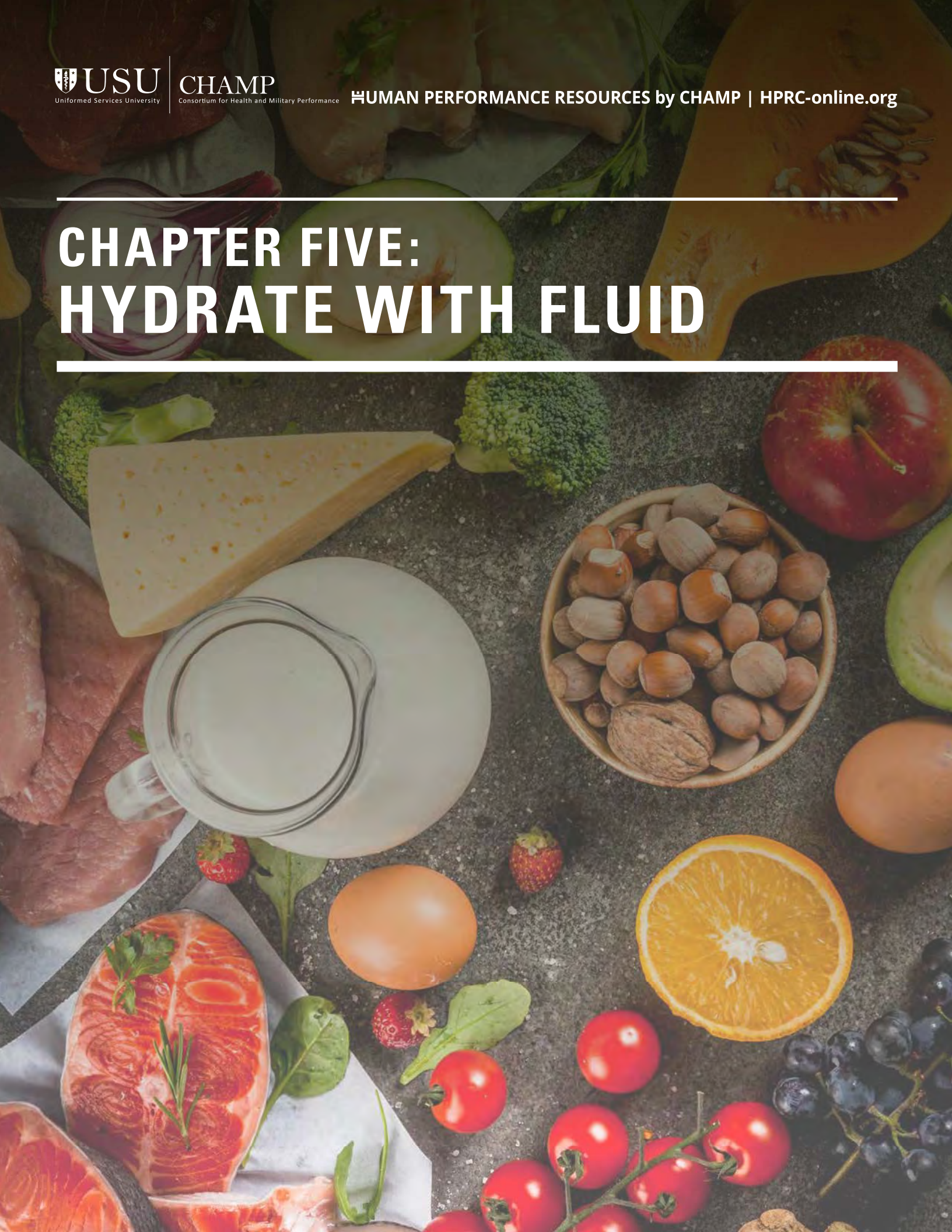
9. National Institutes of Health, Office of Dietary Supplements (2018d). Vitamin E – Fact Sheet for Health Professionals. Retrieved 12 July 2018 from https://ods.od.nih.gov/factsheets/VitaminE-HealthProfessional/

10. Institute of Medicine, Food and Nutrition Board, Committee on Military Nutrition Research, Marriott, B. M., & Carlson, S. J. (Eds.). (1996). *Nutritional Needs in Cold and in High-Altitude Environments: Applications for Military Personnel in Field Operations.* Washington, DC: National Academy Press.

11. Academy of Nutrition and Dietetics, Dieticians of Canada, & American College of Sports Medicine. (2016). *Nutrition and athletic performance. Medicine & Science in Sports & Exercise*, *48*(3), 543-568. doi:10. 1249/MSS.0000000000000852

12. National Institutes of Health, Office of Dietary Supplements (2018d). Zinc – Fact Sheet for Health Professionals. Retreived 5 November 2018 from https://ods.od.nih.gov/factsheets/Zinc-HealthProfessional/#h8

CHAPTER FIVE: HYDRATE WITH FLUID



IN THIS CHAPTER

KEY POINTS

- Don't rely on thirst as a good indicator of your fluid needs; consume fluids throughout the day with meals and snacks to ensure adequate hydration.
- Drink 14–22 fluid ounces of water at least 2–4 hours before and up to exercise or training sessions; urine should be pale yellow in color.
- Drink regularly or whenever possible during exercise, training, and operations. Drink 16–32 fl oz of fluid every 60 minutes during activity to stay hydrated.
- Performance will start to decline once you've lost as little as 2% of your body weight.
- To rehydrate (replace fluids) after exercise, drink liquids and eat foods that contain fluids. Consume about 20–24 fl oz for every pound of weight you lost.
- Drinking too much plain water or not consuming enough sodium can lead to hyponatremia (low sodium levels in your blood), a potentially serious condition.

Water is the most abundant component of the human body—around 50–70% of its weight—so your body requires fluids regularly to ensure its normal function. This chapter covers how to maintain your body's optimal amounts of water and electrolytes at all times.

FLUID BALANCE

Fluid balance is the amount of fluids you take in versus the fluids you lose, mostly through sweating, urinating, and breathing. It's important to consume fluids regularly throughout the day to maintain your fluid balance and ensure your body functions normally. When you don't drink enough water, your fluid output will exceed your fluid input. This can cause dehydration, impairing both mental and physical performance. Men and women have different hydration needs. However, fluid requirements also can vary depending on your workload, level of heat stress, and sweat rate. What and how much you drink before, during, and after exercise can greatly affect your performance.

When and how much to drink?

Military guidelines recommend 3–4.5 quarts (96–144 fl oz) of fluid per day for men and 2–3 quarts (64–96 fl oz) of fluid per day for women. Note: 1 quart is equal to 32 fl oz.[1] As a general rule of thumb, try to consume **half your body weight (in pounds) in fluid oz daily**. Remember that all fluids from food and beverages count towards this goal.

Fresh foods that contain high amounts of water include[2]:

Broccoli	Berries	Cauliflower	Celery
Citrus fruits	Cucumbers	Lettuce	Peaches
Peppers	Spinach	Tomatoes	Watermelon

You can maintain hydration by drinking beverages and eating foods high in water content throughout the day. However, each Warfighter's fluid needs are different, so it's important to learn to look for signs that indicate your own fluid needs. Be sure to adjust your intake when you're working or exercising outdoors, especially when it's hot and humid. If it's very hot, drink fluids with sodium and potassium to replace electrolytes lost from sweating. The more physically active you are, the more fluid you need!

DEHYDRATION

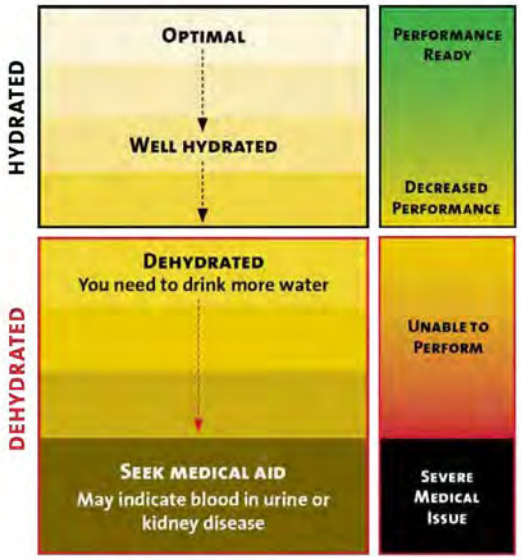
It's essential to stay well hydrated during operations. Dehydration can negatively affect your physical performance, decision-making abilities, concentration, and mood. In addition, it can put you at risk of **heat illness**, including heat exhaustion, heat injury, and heat stroke, and even can be life-threatening.[3,5] **Fluid losses are greater during exercise with a long duration and when it's hot or humid**. However, it's important to remember that you still lose fluids even when you don't seem to be sweating much, such as at higher altitudes, when it's cold, and during low-intensity physical activity.

Symptoms of **mild-to-moderate dehydration** include:

Thirst
Headache, dizziness, or light-headedness
Dark yellow urine
Dry or sticky mouth
Decreased urine output
Sleepiness or fatigue
Constipation
Dry skin

TABLE 5–1. BODYWEIGHT LOSSES AND DEHYDRATION

Starting Weight (lb)	Weight After 2% Fluid Loss (rounded to nearest lb)
150	147
170	167
190	186



This color chart is not for clinical use.

Some vitamins and supplements might cause a darkening of the urine unrelated to dehydration.

Symptoms of **severe dehydration** include:

Extreme thirst
Irritability or confusion
Unconsciousness or delirium
Very dark yellow or amber-colored urine
Rapid breathing
Rapid heartbeat
Lethargy

MONITORING FLUID LOSSES

You can monitor your hydration status by noting changes in your body weight. To determine a body weight that reflects a well-hydrated state, weigh yourself (nude for accuracy) first thing in the morning—over several days—and calculate your average weight. To estimate fluid balance, weigh yourself (nude for accuracy) before and after exercise and calculate the difference, as shown in the following equation:

Total body weight (before) – total body weight (after) = fluid lost during exercise

Losing more than 2% of your body's weight in water (Table 5–1) can result in poor performance, especially in hot weather.[3,4]

You can assess your hydration status by the color of your urine too. Pale yellow, almost-clear urine indicates adequate hydration. In general, the darker your urine, the more dehydrated you are. (Keep in mind that urine color can change for reasons other than your hydration status. For example, your urine can turn bright yellow if you're taking B-vitamin supplements, especially ones high in riboflavin.)

ELECTROLYTES

During activity, you mainly lose fluid through sweat. Sweat loss varies depending on age, type of training, physical fitness, clothing, and environmental conditions, as well as how you adapt to those conditions. Individual sweat rates for men and women can vary between 0.3 and 2.5 liters (about 0.3–2.6 quarts) per hour.[3,5] In addition to fluids, you lose electrolytes (sodium, potassium, chloride, calcium, and magnesium) and other minerals through sweat. Amounts vary, but they can be significant depending on your training status, dietary intake, genetics, sweat rate, and prior heat exposure. Electrolytes are important for

muscle function, and **loss of electrolytes can make dehydration worse** than just fluid loss alone.

It's important to consume foods and fluid-replacement beverages that contain electrolytes before, during, and after intense exercise or exercise of long duration to help maintain hydration. In particular, sodium can help your body retain fluids. Table 5–2 includes examples of foods that contain sodium. If you're eating at a dining facility that has the Go for Green® initiative, choose foods labeled "High Sodium." (Refer to Chapter 6 for more on Go for Green®.)

TABLE 5–2. APPROXIMATE SODIUM CONTENT OF FOODS[6]

Food	Serving Size	Sodium (mg)*
Beef jerky	1 oz	590
Canned chicken noodle soup	1 cup	700
Cheese, cheddar	1 oz	180
Cottage cheese	½ cup	400
Ham, honey-smoked	1 oz	250
Olives, black, canned	5 large	160
Peanut butter	2 Tbsp	150
Peanuts, dry-roasted, salted	1 oz	115
Pickle, dill	1 large (4" long)	1,090
Pretzels, hard	1 oz	350
Soy sauce	1 tsp	300
Table salt	1 tsp	2,325

* Actual sodium content can vary by brand.

You can eat dried fruit and other foods to replace potassium (Table 5–3).

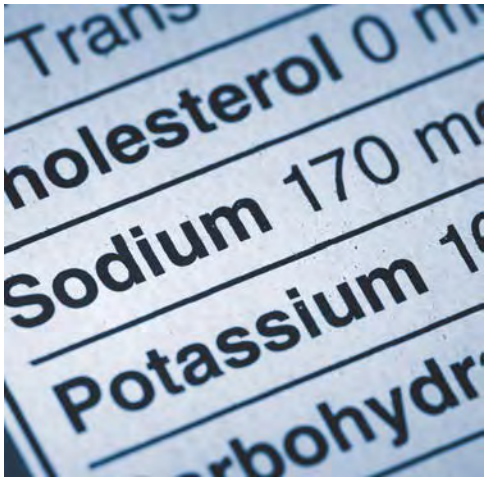


TABLE 5–3. APPROXIMATE POTASSIUM CONTENT OF FOODS[6]

Food	Serving Size	Potassium (mg)*
Apricots, Mediterranean, dried	¼ cup	430
Avocado	¼ of an avocado	250
Banana	1 medium (7–8" long)	420
Cantaloupe	1 cup	430
Figs, dried	2	115
Kiwi	1 kiwi (2" diameter)	215
Lima beans, cooked	½ cup	480
Milk, reduced fat	1 cup	350
Orange juice	1 cup	500
Orange	1 small (2½" diameter)	180
Peanuts, dry-roasted, salted	1 oz	180
Potato, baked, with skin	1 small (1¾"–2½" in diameter)	750
Raisins	1 small box (1.5 oz)	320
Spinach, cooked	½ cup	420
Tomatoes, cherry	½ cup	180
Yogurt, plain, nonfat	1 single-serve container (5–6 oz)	400

* Actual potassium content can vary by brand.

HYDRATION AND REHYDRATION: FLUID INGESTION AND TIMING

Before exercise

It's important to be well-hydrated before exercise to reduce your risk of dehydration during or after exercise. In general, consume approximately 14–22 fl oz (about 414–650 ml) of fluid about 2–4 hours before and up to when you begin exercise. You also can use your body weight to estimate your fluid needs.[3]

During exercise

Drink 16–32 fl oz of fluid every 60 minutes during exercise for good hydration.[7] Adjust your fluid intake based on your environment and how much you sweat because your fluid needs might be much higher in extreme environments such as heat and humidity, when it's cold, or at altitude (as discussed in Chapter 11). During exercise, limit fluid intake to 1.5 quarts (48 fl oz) per hour.[7] A "gulp" of fluid is about 1–2 oz.

When exercising **less than 60 minutes**, focus on drinking water. If it's hot or humid, a sports drink might be better for hydration. For activity **longer than 60 minutes**, you can drink water, sports drinks, or a mixture of both. Sports drinks help maintain hydration, replace electrolytes lost in sweat, and provide fuel (in the form of carbohydrates) for your muscles during exercise. Look for a **sports drink** that contains 12–24 grams of carbohydrates, 82–163 mg of sodium, and 18–46 mg of potassium per 8 oz serving.[1] You also can make your own sports drink with a few simple ingredients, as described in the article linked above.

While there are general recommendations, you still need to monitor your own fluid loss to ensure you replace the amount you lost.

After exercise

After exercise, consume foods and beverages to replace the fluids and electrolytes (such as sodium and potassium) you lost. Over a period of several hours, you actually should ingest more water and sodium than you lost. If you know the change in your body weight after exercise, drink 20–24 oz of liquid per pound of weight lost to fully restore your fluid balance (Table 5–4).[3]

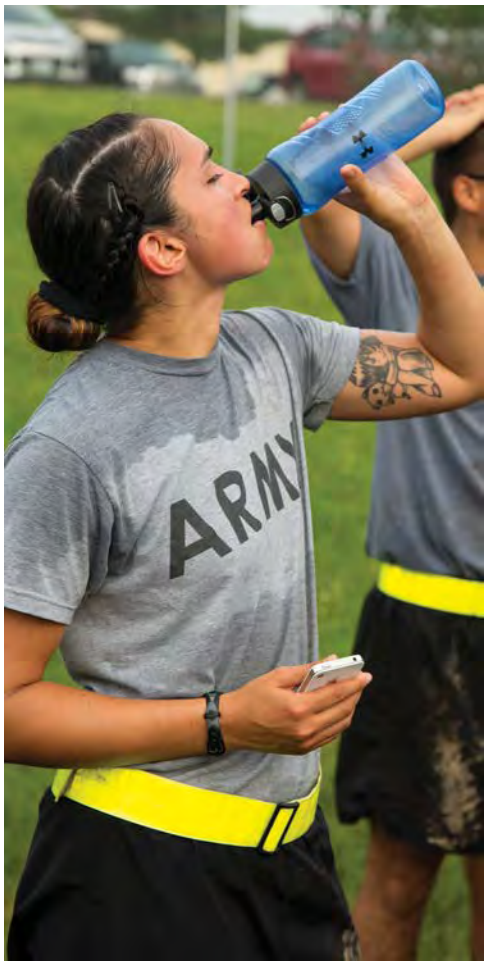
It's important to choose foods and beverages that contain sodium to promote faster and more complete recovery. Drinking too much plain water or not consuming enough sodium can result in hyponatremia (**low sodium** levels in your blood), which requires immediate medical attention to reduce risk of serious illness or death. Hyponatremia typically occurs during physical activities of longer duration. Symptoms, which can be severe, include headache, vomiting, swollen hands and feet, fatigue, confusion, disorientation, and breathing problems. Keep in mind that some symptoms of hyponatremia are similar to the symptoms of dehydration, so be mindful of how much and how often you drink fluids.

On the flip side, if you consume too much sodium and not enough fluids, you're at risk of hypernatremia (**high sodium** levels in your blood), but this is rare. Symptoms include thirst, headache, body cramps, and fatigue.

The guidelines discussed in this chapter will help ensure adequate fluid and electrolyte replacement and balance and reduce the risk of developing hypo- or hypernatremia.

TABLE 5–4. ESTIMATED FLUID REPLACEMENT NEEDS BASED ON WEIGHT LOSS[3]

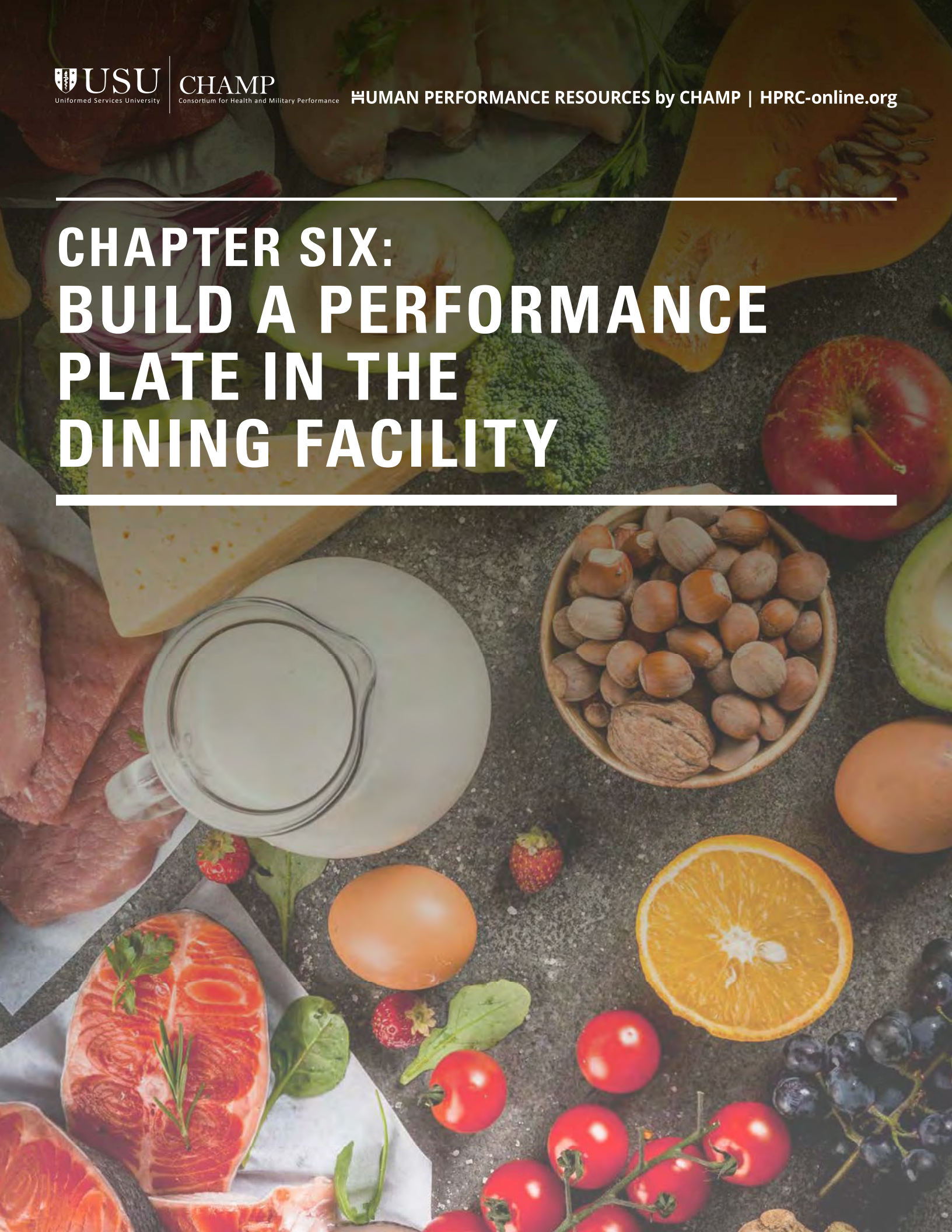
Weight Lost (lb)	Fluid to Replace Loss
1	16–24 oz (2–3 cups)
2	32–48 oz (4–6 cups)
4	64–96 oz (8–12 cups)



CHAPTER 5 REFERENCES

1. Headquarters, Departments of the Army, the Navy, & Air Force. (2017). *Nutrition and menu standards for human performance optimization* (AR 40–25/OPNAVINST 10110.1/ MCO 10110.49/AFI 44–141). Departments of the Army, the Navy, and the Air Force, Washington, DC. Retreived 10 January 2020 from: https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/AR40-25_WEB_Final.pdf
2. Produce for Better Health Foundation. Insider's Viewpoint: Stay Hydrated with Fruits & Veggies. *Insider's Viewpoint*. Retrieved 24 October 2019 from https://fruitsandveggies.org/stories/insiders-viewpoint-stay-hydrated-fruits-veggies/
3. Academy of Nutrition and Dietetics, Dietitians of Canada, & American College of Sports Medicine. (2016). Nutrition and athletic performance. *Medicine & Science in Sports & Exercise*, *48*(3), 543–568. doi:10.1249/MSS.0000000000000852
4. Karpinski, C., & Rosenbloom, C. A. (2017). *Sports Nutrition: A Handbook for Professionals* (6th ed.). Chicago: Academy of Nutrition and Dietetics
5. Sawka, M. N., Burke, L. M., Eichner, E. R., Maughan, R. J., Montain, S. J., & Stachenfeld, N. S. (2007). Exercise and fluid replacement (American College of Sports Medicine position stand). *Medicine & Science in Sports & Exercise*, 39(2), 377–390. doi:10.1249/mss.0b013e31802ca597
6. United States Department of Agriculture Agricultural Research Service. (2016). USDA Food Composition Databases. Retrieved 26 April 2017 from National Agricultural Library https://ndb.nal.usda.gov/ndb/
7. U.S. Army Public Health Command. (2011) *Work/Rest and Water Consumption Table*. U.S. Army Medical Department. Retrieved 10 January 2020 from: **https://www.hprc-online.org/sites/default/files/document/APHC_Work_Rest%20and%20Water%20Consumption%20Table508_0.pdf**

CHAPTER SIX: BUILD A PERFORMANCE PLATE IN THE DINING FACILITY



IN THIS CHAPTER

- "Balance" your plate
- Eat a variety of foods
- Choose optimal portions
- Recover with nutrient-dense foods
- Fuel up with Go for Green®

KEY POINTS

- A balanced plate creates the right mix of carbs, protein, and fat.
- Fill your plate with a variety of foods to optimize nutrient intake.
- Choose optimal portions for your activity and training needs.
- Go for Green® is a quick and easy way to choose high-performance fuel in your dining facility or galley.

Eating for performance requires choosing high-performance fuel for meals and snacks. Military dining facilities provide opportunities to build a plate to boost your performance morning, noon, and night. Consider the following strategies for meals that fuel your job duties, training needs, and lifestyle.

"BALANCE" YOUR PLATE

For optimal nutrition, choose nutrient-dense foods from the 5 food groups: grains, protein, dairy, fruits, and vegetables. At mealtimes, select items from at least 3 of the food groups—a mixed meal that contains **carbs, protein, and healthy fats**—to maintain energy for strong and effective training sessions. The Main/Hotline, Deli/Sandwich Bar, Grill, and Salad Bar serve components for delicious and nutritious meals.

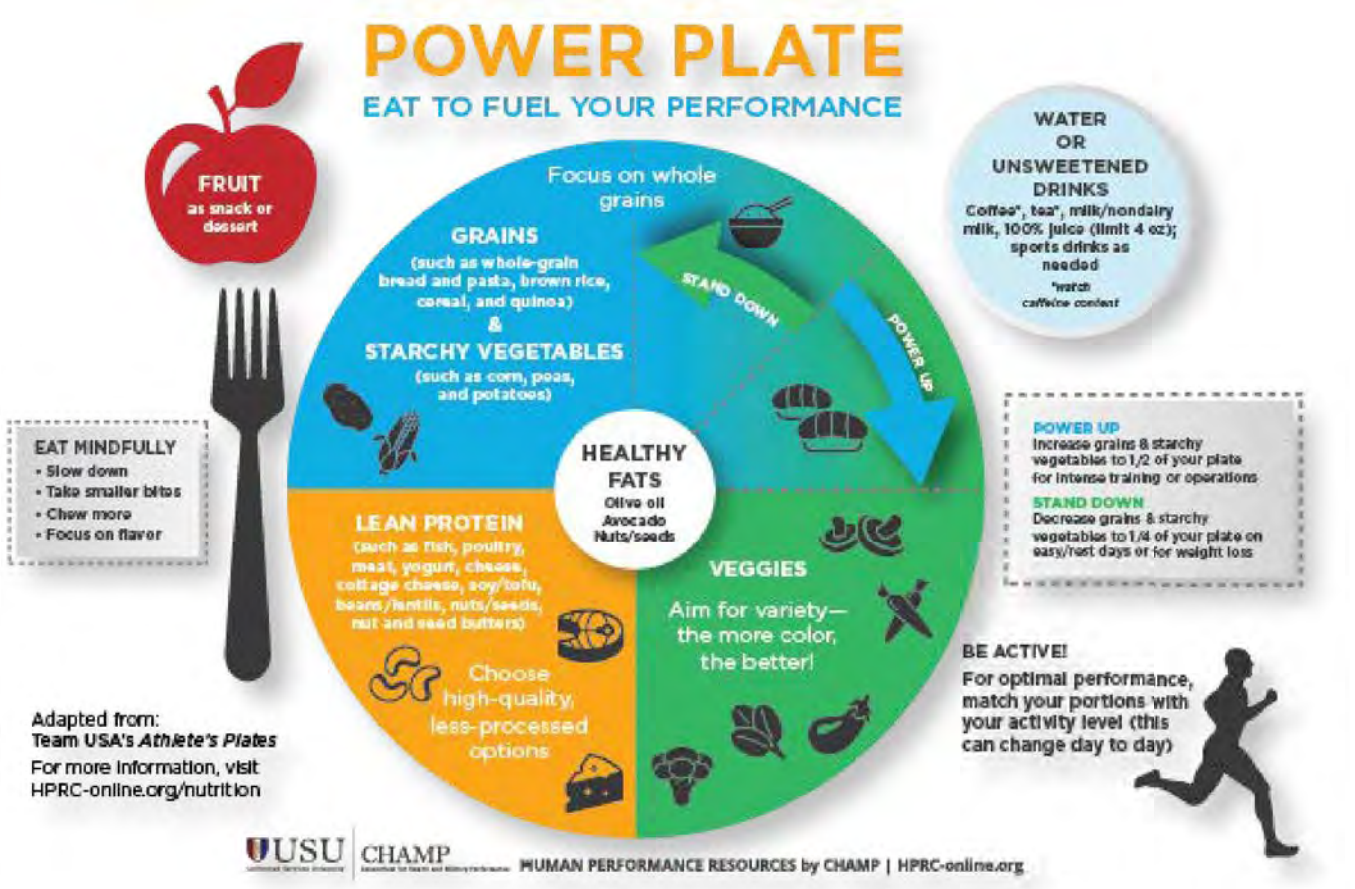
Some combinations include:

- Baked or grilled fish, brown rice, and vegetables
- Whole-grain cereal, low-fat milk, and fruit
- Turkey on whole-grain bread with tomato, lettuce, and onion
- Low-fat Greek yogurt, whole-grain cereal, and fruit
- Vegetable burrito (whole-grain tortilla, beans, vegetables, and cheese)
- Baked potato with chili and broccoli

EAT A VARIETY OF FOODS

An assortment of nutritious foods can help maximize your intake of micronutrients such as vitamins, minerals, and antioxidants, which help boost mental and physical performance. When eating in the dining facility, **vary your choices** to get the most out of your meals. For example, B vitamins found in a range of foods—including whole grains, lean proteins, dairy, nuts, beans, and leafy greens—support your body's processing of energy (see Chapter 2).[1] In addition, vitamins A, C, and E act as antioxidants that reduce muscle damage and enhance recovery from exercise (see Chapter 4).[1] These essential vitamins are found in many foods, including citrus (oranges and grapefruits), kiwi, cantaloupe, sweet potatoes, carrots, nuts, and seeds.

If you usually choose eggs in the morning, also consider alternate sources of protein: yogurt (Greek-style, if available), nuts, seeds, or peanut butter. If you usually create a salad with iceberg lettuce, carrots, and tomatoes, try to mix up your options—and **add more color** to your performance plate—by adding Main/Hotline vegetables or vegetable sides from any specialty bar.



CHOOSE OPTIMAL PORTIONS

Select the optimal portions for your body, training schedule, health conditions, and weight goals. Your portions might differ each day or even each meal, depending on your planned activities or job duties. On days that include intense training sessions, for example, eat extra portions of carbohydrate-rich foods to fuel your body properly. At breakfast, eat another scoop of oatmeal, a second serving of fruit, or another bowl of whole-grain cereal. At lunch or dinner, choose a second scoop of a starchy vegetable (potato, corn, or peas), a starchy side (brown rice, pasta, or roll), or a second serving of milk, yogurt, or 100% juice. Your plate should contain more starchy vegetables and grains on these days.

On days when you're less active or involved in lighter training sessions, choose smaller or fewer portions and fill your plate with more veggies and less starchy vegetables and grains. Eat what you need to fuel your day and feel satisfied, without being too full.

RECOVER WITH NUTRIENT-DENSE FOODS

After a tough workout or training session, the dining facility can provide essential fuel for your recovery. Leave the bars and shakes and instead make time for a well-balanced recovery meal or snack at your dining facility. Refueling after a strenuous workout with a carb-rich meal that contains 20–25 grams of protein helps replenish muscle glycogen stores and repair and build muscle.[2-4] Ideally, consume a mix of carbs and protein (along with fluid for hydration) within 2 hours of completing your workout or training. If your next meal is more than 2 hours away, have a snack. For example, eat peanut butter and jelly on whole-grain bread, or try granola with milk or yogurt. If you're really on the go, enjoy a glass of **chocolate milk**—which provides both carbs and protein—for a quick recovery drink. You can learn more about nutrient timing and recovery in Chapter 9.

FUEL UP WITH GO FOR GREEN®

As discussed in Chapter 2, the MyPlate method helps Warfighters create a balanced plate by dividing it proportionally by food group. Knowing the best choice within each food group can optimize your mental and physical performance. DoD's Go for Green® (G4G) or Fueled to Fight® (Marine Corps) initiative helps you make performance-boosting choices in dining facilities and galleys. G4G is an all-service performance-nutrition initiative that improves the food environment where Military Service Members live and work. It prompts you to make better food and beverage selections to optimize your performance, readiness, and health.

CHAPTER 6: BUILD A PERFORMANCE PLATE IN THE DINING FACILITY

G4G labels foods and beverages using a stoplight system—Green, Yellow, and Red—based on nutritional quality to help identify your best choices for peak performance. Nutritional quality also includes components such as saturated fat, fiber, sugar, degree of processing, and total fat. For example, Green-coded menu items are least processed, highest in nutrients, and lowest in added sugar, and the fats they contain are healthy fats. Warfighters should consume Green-coded foods and drinks most often.

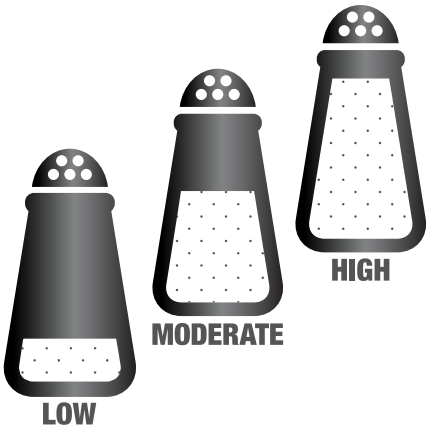
Green = High-performance fuel for the Warfighter's mind and body

Yellow = Moderate-performance fuel for the Warfighter's mind and body

Red = Low-performance fuel for the Warfighter's mind and body

G4G also labels foods with Low, Moderate, or High sodium symbols to point out sodium content. Sodium codes are independent of their color code; for example, not all Green-coded foods are low in sodium. Warfighters have different sodium needs based on their medical conditions, activities, and environments. If you're training or working intensely or for extended periods of time in a hot and humid environment, include some High-sodium items on your plate to ensure you're replenishing sodium lost through sweat.

The latest version of Go for Green®—G4G 2.0—is not yet available in all military dining facilities and galleys. However, you still can use G4G resources to find high-performance fuel. G4G provides a quick and simple Guide (see pages 42 and 43) to Green, Yellow, and Red foods and drinks, as well as Low-, Moderate-, and High-sodium foods. Visit HPRC's **G4G website section** for more resources and tips about Go for Green®.



CHAPTER 6 REFERENCES

1. Lukaski, H. C. (2004). Vitamin and mineral status: *Effects on physical performance. Nutrition*, *20*(7–8), 632–644. doi:10.1016/j.nut.2004.04.001
2. Academy of Nutrition and Dietetics, Dietitians of Canada, & American College of Sports Medicine. (2016). Nutrition and athletic performance. *Medicine & Science in Sports & Exercise*, *48*(3), 543–568. doi:10.1249/MSS.0000000000000852
3. Burke, L. (2010). Fasting and recovery from exercise. *British Journal of Sports Medicine*, *44*(7), 502–508. doi:10.1136/bjsm.2007.071472
4. Kerksick, C., Harvey, T., Stout, J., Campbell, B., Wilborn, C., Kreider, R., . . . Antonio, J. (2008). International Society of Sports Nutrition position stand: Nutrient timing. *Journal of the International Society of Sports Nutrition*, *5*(17), 1_12. doi:10.1186/1550-2783-5-17

THE G4G GUIDE: FOODS AND BEVERAGES

Tips to build a healthy plate	Eat Often Whole foods, least processed Naturally packed with nutrients		Eat Occasionally More-processed foods Choose portions carefully		Eat Rarely Most processed, least nutrients Choose small portions	
Vegetables Eat 3–4 cups non-starchy vegetables a day. See also Grains/ Starches.	Fresh or frozen vegetables—grilled, steamed, or raw Leafy green salads with dark greens (spinach, spring mix)	Vegetables with small amounts of added Fats/Oils from the Yellow or Red column	—		Deep-fried, tempura, or breaded vegetables Vegetables in cheese or creamed vegetables	Salads/vegetables with large amounts of Fats/Oils or Protein from the Red column
Fruits Eat 2–2.5 cups of fruit a day. Eat your fruit, don't drink it.	Fresh fruit Frozen fruit with minimal added sugar, fat, and/or sauce	Fruit canned in water or own juice Dried fruit (unsulfured, without added sugar)	Fresh or frozen fruit with added sugar/ syrups Canned fruit in light syrup	Dried fruit (sulfured) Dried fruit with added sugar 100% fruit juice	Fresh fruit with cream Frozen fruit with added sugars, fats, and/ or sauce Sweetened applesauce	Dried fruit with coatings (yogurt, chocolate, etc.) Canned fruit in heavy syrup
Grains/ Starches Choose 100% whole grain for at least half of all grain servings. Starchy vegetables such as potatoes and corn are included in this group.	Brown rice, wild rice, bulgur Oats, quinoa, barley Baked potato/sweet potato with skin with toppings from Green column Baked sweet-potato "fries" Whole-grain pasta and couscous	Whole-grain, low-sugar cereal/granola with less than 10g sugar and at least 3g fiber Whole-grain breads, bagels, rolls, waffles, pancakes, muffins English muffins with at least 3g fiber Popcorn with small amounts of butter or oil	White rice, couscous, pasta Grits, plain Baked French fries White potatoes made or topped with ingredients from the Yellow column Whole-grain cereals/ granola with 11–18 grams sugar per serving	Sweetened oatmeal/ oatmeal packets White-flour breads, bagels, English muffins, rolls, waffles, pancakes Pretzels, baked chips Crackers, high-fiber, reduced-fat	Biscuits, croissants, full-fat muffins Doughnuts, Danishes, pastries, sweetened breads Grains or pasta with cheese or cream sauce French fries (fried in oil)	White/sweet potatoes made or topped with moderate to large amounts of Fats/Oils from the Red column Processed cereals with more than 18g sugar per serving Deep-fried chips, most snack crackers Movie-style popcorn
Protein Vary your protein choices. Include seafood/ fish twice a week. Include beans for protein and fiber.	Egg whites Omelets with vegetables Fish and shellfish; Tuna canned in water Chicken and turkey breast without skin	Ground beef (90/10), ground poultry Pork tenderloin Beans/lentils Tofu, tempeh, edamame Veggie burgers, vegetable- or bean-based	Whole eggs Chicken and turkey with skin Chicken and turkey thighs and legs without skin Ham, roast beef Processed chicken/ turkey deli meats	Hamburger Ground beef (85% lean) or ground poultry Chicken/turkey sausage or bacon Soy patties, links, burgers Tuna canned in oil	Fried meat, poultry, fish, seafood Ground beef (standard or unspecified fat), fatty (marbled) cuts of red meat, beef ribs, corned beef Cheeseburger Pork sausage and bacon	Hot dogs, kielbasa, bratwurst Salami, bologna Refried beans made with lard or topped with cheese Fried tofu
Fats/Oils Choose healthy fats and oils.	Oils—olive, canola, safflower, sunflower, sesame, grapeseed Salad dressings made with these oils	Nuts and seeds—raw, dry, roasted Natural nut butters—peanut, almond, hazelnut, soynut Avocado	Oils—corn, peanut, vegetable Salad dressings made with these oils Mayonnaise made with canola oil	Margarine/spreads (trans-fat free, limited additives) Peanut butter with added oils/fats Gravy (made with water or low-fat milk)	Oils—coconut, palm, palm kernel Shortening and lard Most mayonnaises Most margarines	Creamy salad dressings Nut butters with added sugar or chocolate Gravy (made with fat drippings)
Beverages Choose water instead of sugary beverages. For milk, see Dairy.	Water (plain or carbonated) Naturally flavored water (no artificial sweeteners)	Decaf tea and decaf coffee Herbal tea 100% vegetable juice	Sports drinks Tea** and coffee**, plain or with small amounts of added sugar, cream, or milk	100% fruit juice Artificially sweetened beverages (diet or light sodas, teas, juices, many flavored waters)	Energy drinks* Coffee and tea with whole milk or cream and sugars or syrup	Sweetened beverages of any kind (sodas, sweet teas, fruit punches, juice drinks)
Dairy Compare sugar contents of yogurts. Some low-fat dairy products contain added flavors, stabilizers, sugar, or sodium; choose less-processed Green items when possible.	Milk, unsweetened (skim, 1%) Milk alternatives (soy, almond, rice, coconut), unsweetened, with calcium and vitamin D added	Yogurt, plain (non-fat or low-fat) Cottage cheese (non-fat or low-fat)	Milk (2% fat) Flavored (vanilla, chocolate, etc.) and sweetened milk (skim, 1%, or 2%) and milk alternatives Hot chocolate made with milk (skim, 1%, 2%)	Frozen yogurt Yogurt, flavored, with added sugars or artificial sweeteners (non-fat or low-fat) Cheese and cottage cheese (reduced-fat, 2%) Cheeses naturally lower in fat (Feta, Swiss)	Milk (whole), plain or flavored Hot chocolate made with whole milk Cream, half-and-half Yogurt (full-fat)	Cottage cheese (full-fat) Cheese (full-fat) Cream cheese, sour cream (full-fat) Ice cream, milkshakes, gelato Pudding

* For more information on energy drinks, visit HPRC's Dietary Supplements Classification System and read about Energy Drinks. **Contain caffeine.

This guide is a starting point for understanding which foods are high in sodium. Sodium is a mineral found naturally in some foods and added to packaged items to preserve freshness and enhance flavor.

Too much sodium can be harmful to your health, especially if you are salt sensitive. However, too little sodium can be harmful to health and performance if you lose a lot of sodium through multiple hours of activity, extreme environments, or sweat.

Sodium is important to maintain fluid balance, control blood pressure, and for muscles and nerves to work properly.

For average Americans, 2,300 mg of sodium per day[1] is appropriate; this is about the amount found in one teaspoon of tablea salt. Sodium needs vary depending on medical condition, activity, and environment. The most active warriors who operate in extreme conditions may require as much as 3,500mg (women) or 5,000 mg (men) of sodium per day.[2] Restaurant food often contains more salt. At home and in military dining facilities, the amounts of sodium vary greatly. Increased portion sizes also increase sodium intake. Use the table below along with the Food and Beverages (Green, Yellow, Red) Guide to help choose appropriate foods and beverages for your sodium needs.

	Low Sodium 	**Moderate Sodium** 	**High Sodium** 
Foods and Beverages	Fruit—fresh or frozen Vegetables—fresh or frozen No-added-salt/salt-free canned vegetable and tomato products Grains—plain, unseasoned Grain products—plain, unseasoned pasta, rice, quinoa, couscous Unsalted nuts, seeds Unsalted nut butters (peanut, almond, soynut) Fresh chicken, turkey, beef, pork Milk Most yogurts Olive oil, canola oil Dry beans, peas, lentils	Some breads, rolls, biscuits, pancakes, waffles, English muffins Low-sodium canned vegetables Most snack foods (pretzels, crackers, chips, popcorn) Most sauces/glazes on chicken, turkey, beef, or pork Most homemade soups made with low-sodium broth Most frozen meal "starters" Packaged rice/grain dishes, if you use only half the seasoning packet	Canned vegetables and beans Canned tomato products Instant noodles with flavor packet Deli meats/cold cuts—turkey, ham, bologna, salami, etc. Processed meats—sausage, bacon, pepperoni, hot dogs Cheese Condiments and toppings—soy sauce, ketchup, marinades, cocktail sauce, gravy, nacho cheese dip, pickles Seasoned salts, table salt Canned soups Almost all "fast foods" Frozen entrees/"microwave dinners"
When to Eat	Eat low-sodium foods most often, especially if you have been told to follow a "low-sodium diet." Not all low-sodium foods are also labeled Green; limit Yellow- and Red-labeled foods and beverages for overall good health.	Eat moderate-sodium foods sometimes. Moderate-sodium foods areappropriate for most warriors who are moderately active	Eat high-sodium foods rarely or in small amounts. For warriors who are active multiple hours per day and/or in extreme environments, some high-sodium foods should be included daily.
General Tips	Choose mostly whole, fresh foods. Cooking at home can help reduce sodium content. Purchase unflavored foods, and add your own fresh seasonings: herbs, spices, vinegars, citrus. When cooking with whole, fresh foods that are naturally very low in sodium, it's okay to add a pinch of salt.	Although snack foods and breads have moderate sodium, large portions can increase your sodium intake to high. Drain and rinse canned foods (beans, tuna) to reduce their sodium content. Even low- and reduced-sodium versions of your favorite chips or crackers may fall into the moderate sodium category.	Table salt is mostly sodium; use sparingly. Processed, packaged, and convenience foods contribute about 80% of sodium to our diets; read food labels and pay attention to serving sizes. Many condiments and toppings are high in sodium. Restaurant foods are generally higher in sodium than homemade foods.

[1] Dietary Guidelines for Americans 2010

[2] Military Dietary Reference Intake

CHAPTER SEVEN: FUELING AT HOME

IN THIS CHAPTER

KEY POINTS

Nutritious homemade meals can boost mission performance.
Smart grocery shopping is the first step toward healthy meal preparation.
Use the Nutrition Facts labels on packaged-food labels to help guide your choices.
Every meal is important for overall health and performance.
Use snacks as opportunities to pack more high-performance fuel into your day.

Homemade meals can have a positive impact on your performance, your health, and **your family**. When you cook, you can choose your ingredients and how your food is prepared. This chapter provides basic information on how to prepare and eat balanced meals and snacks at home.

BOOST NUTRITION WITH HOMEMADE MEALS

Making your own meals is a better choice than dining out because you can control the ingredients and preparation, which means they are generally higher in nutrients (such as fiber, calcium, iron, and vitamins such as folate, B_6, B_{12}, C, and E) and lower in saturated and trans fats. Homemade meals don't need to be fancy, and they often can be **planned in minutes**. They're usually cheaper than restaurant meals too.[1, 2] When cooking at home, use the **MyPlate food guide** (see Chapter 2) to plan your balanced meals with a variety of nutrient-rich foods, including fruits, vegetables, whole grains, and lean proteins. The Go for Green® (G4G) Guide (see pages 42 and 43 of Chapter 6) also can help you choose the best fuel for your plate.

GROCERY SHOPPING

High-performance meals start with high-quality, nutrient-dense ingredients. Commissaries and grocery stores offer a wide variety of foods that can be the building blocks for any performance-boosting meal. The key is to know which foods are more wholesome and can best fuel your body. Build your meals and snacks around **high-performance fuels** such as fruits, vegetables, whole grains, and lean protein.

The tips below can help guide your selections and **stretch your food dollars** while shopping at the grocery store.

Tips for grocery shopping

Use a **shopping list** or **smartphone app** to help with your meal planning and shopping.
Shop the **perimeter of the store** for fresh offerings from all food groups.
Select a **colorful** array of tasty fruits and vegetables.
Buy **whole grains** and whole-grain products.
Choose **low-fat dairy** products or plan smaller portions of full-fat dairy products.
Purchase **lean protein** sources.
Consider **meat alternatives** such as **beans**, nuts, seeds, and soy products
Buy **heart-healthy fats** such as olive and canola oils, nuts, seeds, olives, and avocados.
Limit drinks and foods that contain **added sugars**.
Read Nutrition Facts labels on packaged foods and carefully choose indulgent foods.

For more ideas, visit the MedlinePlus page about **healthy grocery shopping**.

DECODING NUTRITION FACTS

Packaged foods display Nutrition Facts labels that can help you get a sense of the nutritional content of what you're eating. When shopping for groceries, read Nutrition Facts labels to compare foods and determine which ones suit your nutritional goals. Recently revised after 20 years, the new **Nutrition Facts label** must appear on all packaged foods by 1 January 2021. In the meantime, you still might see the old version on products in your store.

LABEL COMPARISON

ORIGINAL LABEL

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

NEW LABEL

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

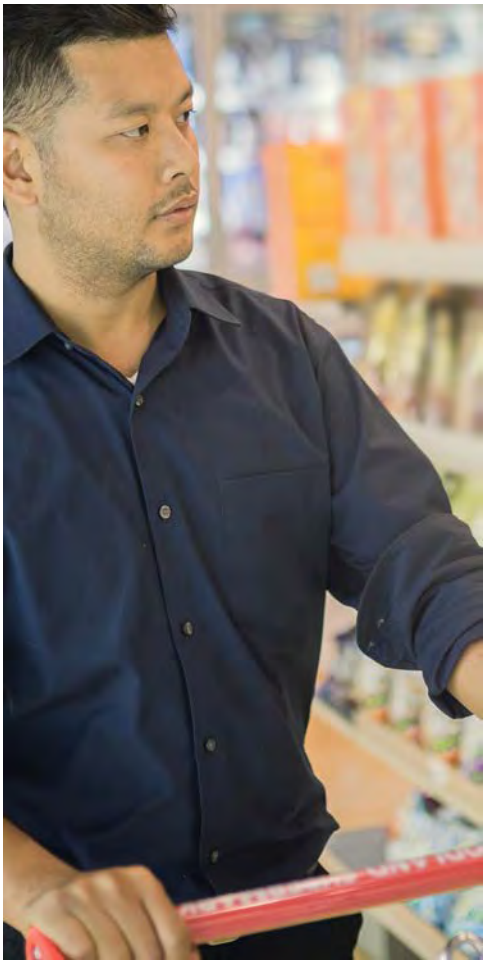
Amount per serving
Calories **230**

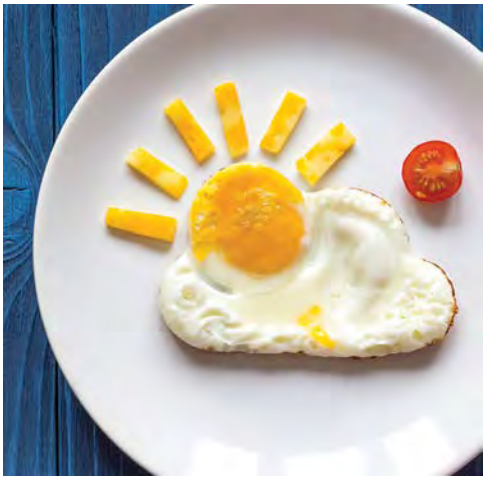
	% Daily Value*
Total Fat 8g	**10%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160mg	**7%**
Total Carbohydrate 37g	**13%**
Dietary Fiber 4g	**14%**
Total Sugars 12g	
Includes 10g Added Sugars	**20%**
Protein 3g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 8mg	45%
Potassium 235mg	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 images above are meant for illustrative purposes only to show how the new Nutrition Label might look compared to the old label. Both labels represent fictional products. When the original hypothetical label was developed in 2014 (the image at the top), added sugars was not yet proposed, so the "original" label shows 1g of sugar as an example. The image created for the "new" label (shown above) lists 12g total sugar and 10g added sugar to give an example of how added sugars would be broken out with a % Daily Value.

Source: https://www.fda.gov/downloads/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/UCM501646.pdf





Serving sizes and calories

Always look at serving sizes first, so you can see how the rest of the information on the label relates to how much you're actually going to eat. The new Nutrition Facts label shows serving size in larger print for visibility. Many serving sizes also have been revised to more closely match what people typically eat or drink.

Take a look at the number of servings per container too. You might be surprised to see how many servings are in that package of cookies or bottle of juice. It's often more than one. If you eat more than one serving, multiply each component (calories, fat, carbs, etc.) by the number of servings you eat to get the actual amount you consume.

The upper part of the Nutrition Facts panel lists calories, total fat (saturated fat and trans fat), cholesterol, sodium, total carbohydrates (including fiber, total sugar, and added sugar), and protein. The amount of each nutrient is displayed in grams and as % Daily Value.

Percent Daily Value

The % Daily Value (DV) tells you how much of a nutrient a food provides compared to how much you need every day. Keep in mind that DV is based on a 2,000-calorie diet, which might not be enough for a Military Service Member due to a Warfighter's training needs or job duties.

In general, more than 20% of any nutrient is high—whether the food is "high" in a nutrient you should eat more of (such as fiber) or "high" in something you should limit (such as cholesterol). In addition, anything less than 5% is low—whether the food is "low" in added sugar or "low" in fiber.

Micronutrients

The lower part of the Nutrition Facts label lists micronutrients. The new panel displays amounts of vitamin D, calcium, iron, and potassium. Vitamin D and potassium were added to the new format because many Americans don't get enough of these essential minerals. Vitamins A and C are no longer included since deficiencies of these are rare. Other nutrients might be included on the Nutrition Facts label as well.

Ingredients and allergens

According to federal regulations, any packaged food with more than one ingredient also must carry an ingredient list on the label. The ingredients are listed in descending order according to weight (not volume). For example, if your granola bar lists sugar as its first ingredient, this means that there is more sugar (by weight) than any other ingredient listed. If you have any food allergies or intolerances, double-check the ingredient list for any ingredients you need to avoid

or limit. The 8 most common allergens are milk, soy, wheat, tree nuts, seafood, shellfish, eggs, and peanuts. Allergen information is listed below the ingredients in bold, making it easy to find.

BREAKFAST: OFF TO A HEALTHY START

After a night of rest and 8–12 hours without food, your body needs fuel in the form of glucose (also known as sugar), especially if you exercise in the morning. Breakfast is your body's early-morning refueling stop to keep you energized until lunchtime. It's also an opportunity to eat important nutrients your body needs to power your day. Nutrient-dense choices such as a bowl of cereal with low-fat milk, toasted whole-grain bread with natural peanut or almond butter, and a piece of fresh fruit are easy, quick choices you can prepare and eat at home.

LUNCH: MIDDAY FUEL

Pack a nutritious lunch at home and take it to work. Weekday brown bagging saves money. More important, you can control what and how much you're eating and how it's prepared. Try to fill half your "plate" with fruits and vegetables. Think about where you'll eat, and plan ahead, because some foods are better suited for eating at a table while others are better for eating on the go. Some tasty ideas include:

Vegetables: Pack raw or lightly steamed (then chilled) choices with a small container of dip or olive oil-based salad dressing.

Hummus: Use as a dip or sandwich spread.

Stuffed tomatoes or bell peppers: Add tuna, chicken, egg, pasta, or rice.

Salads: Include a colorful, vegetable-based salad with your sandwich.

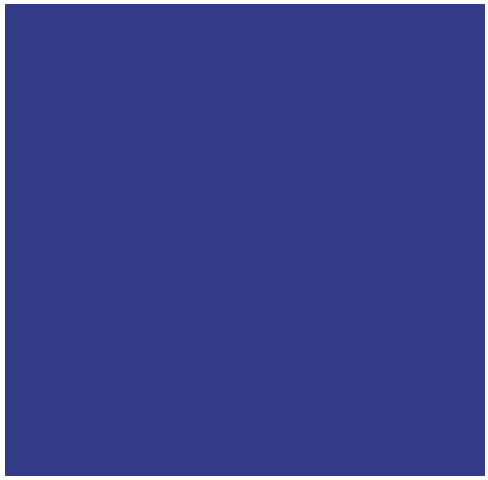
Sushi rolls: While these are terrific lunchbox fare, try to avoid deep-fried rolls or ones with cream cheese.

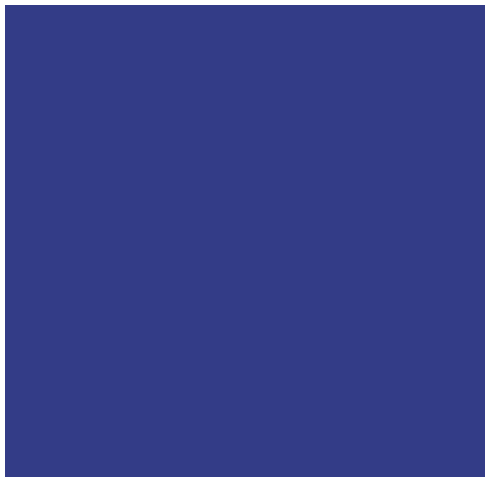
Trail mix: **Make your own** with raisins or other dried fruit, whole-grain cereal or air-popped popcorn, and nuts or seeds.

Fruit: Grab several pieces of fruit to go and try some with Greek yogurt.

DINNER: FINISH STRONG

Sometimes it can be hard to figure out what you should eat for dinner, especially after a long day at work. But with good planning and shopping skills, you can put together a balanced plate quickly. Although planning takes some time, and





shopping for foods is a must, you can prepare many nutritious meals ahead of time or within 30 minutes. Try these quick dinner strategies:

- Use canned, frozen, or pre-washed vegetables such as lettuce, baby carrots, and spinach. (Be sure to rinse canned varieties if you're trying to limit your sodium intake.)
- Use weekends to plan and prepare meals that can be popped in the oven or microwave when you're ready to eat.
- Invest in a crockpot: Toss ingredients into the crockpot in the morning, and you'll have a delicious, balanced meal waiting for you at dinnertime.

Other easy, nutritious dinner ideas include:

- Whole-grain pasta or rice with lean protein (tofu, meat, or fish) and vegetables.
- Brown rice and beans with salsa.
- Sirloin steak, baked potato, and leafy green salad.
- Grilled salmon, baked sweet potato, and vegetables.
- Colorful salad with beans or lentils, topped with an olive oil-based dressing or nuts/seeds, and whole-wheat toast.
- Sandwiches made with whole-grain bread, lean meats, and plenty of veggies (cucumber, lettuce, and tomato).

Cook **whole grains** such as brown or wild rice, barley, whole-wheat pasta, or quinoa in large quantities for use throughout the week. Just reheat and add grilled, baked, or roasted lean meats and vegetables to help round out meals that support performance and recovery.

HEALTHY SNACKING

Snacks help maintain physical and mental performance. Carefully chosen snacks can fill nutritional gaps and boost energy without causing weight gain. Think through a typical day. How often and where do you usually snack? Are your snacks high in nutrients or loaded with "empty" calories?

Snacking tips

- Plan and prepare snacks ahead of time.
- To stave off hunger longer, pick snacks with protein, fiber, and heart-healthy fats.
- Match snacks to your activity level. If you're more sedentary, choose ones that are lower in calories or smaller in size. However, if you're active and exercise

daily, you might need larger portions or more frequent snacks.

Be conscious of portion sizes (as discussed in Chapter 2).

If possible, avoid snacking in front of the TV or computer because it's too easy to overeat.

Avoid all-day nibbling or eating directly out of the bag or box, which makes it difficult to keep track of how much you're eating.

Read HPRC's article about **smart snacking** for more ideas.

Snacking environment

Satisfy your snacking urge with convenient and healthy choices—whether you're at home, at work, or on the go.

Stock your fridge and freezer at home (and at work) with:

Greek yogurt, cottage cheese, cheese sticks or slices, and milk

Lean deli meats

Whole fruits and cut-up raw veggies

100% fruit and vegetable juices

Frozen juice bars

Plain baked potato or sweet potato with a sprinkle of cheddar cheese

Whole-wheat pita bread or English muffins with tomato sauce, Italian herbs, a sprinkle of mozzarella cheese, and diced peppers for instant pizza

Whole-grain bagel with peanut butter and banana slices

Single-serve packs of vegetables or fruit with dip

Natural peanut, cashew, or almond butter with whole-grain crackers or bread

No-bake energy bites

Shelf-stable options:

Vegetable or bean soups in heat-and-serve cans or instant soup cups

Refried beans or salsa with whole-wheat tortillas or baked chips

Snack-size boxes or packets of cereal, instant oatmeal, raisins or other dried fruit, or whole-grain pretzels

Trail mix

Mini cans or single-serve pouches of water-packed tuna or chicken

Beef jerky

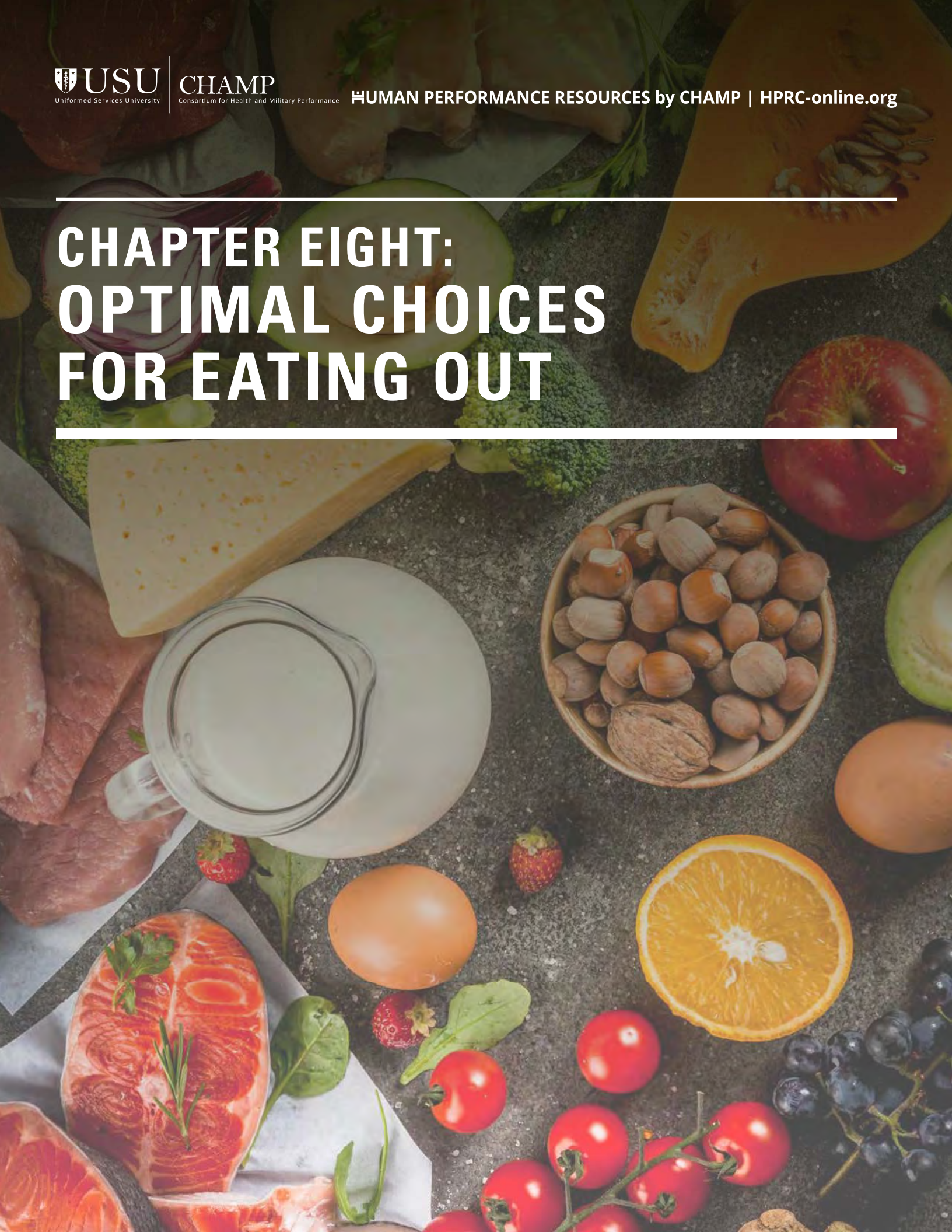
Single-serve fruit cups packed in 100% juice or water
Dry-roasted, unsalted nuts or seeds
Whole-grain granola bars low in sugar
Canned or boxed 100% fruit juice (no added sugar)
Single-serve packages of microwave popcorn

For more videos, tips, and hints on cooking equipment, grocery shopping, and cooking, visit HPRC's **Eating Environments** section.

CHAPTER 7 REFERENCES

1. French, S. A., Story, M., Neumark-Sztainer, D., Fulkerson, J. A., & Hannan, P. (2001). Fast food restaurant use among adolescents: Associations with nutrient intake, food choices and behavioral and psychosocial variables. *International Journal of Obesity*, *25*(12), 1823–1833. doi:10.1038/sj.ijo.0801820
2. Lin, B.-H., & Guthrie, J. (2012). *Nutritional quality of food prepared at home and away from home, 1977–2008*. United States Department of Agriculture Agricultural, Washington, DC. Retrieved from: https://www.ers.usda.gov/publications/pub-details/?pubid=43699

CHAPTER EIGHT: OPTIMAL CHOICES FOR EATING OUT



IN THIS CHAPTER

KEY POINTS

- Choose restaurants that offer lean proteins, vegetables, and meals cooked to order.
- Add more vegetables to your meal to boost your intake of vitamins, minerals, and fiber.
- Eat smaller portions of heavy, creamy, cheesy, or fried dishes and desserts.
- Make sensible food choices at fast-food restaurants.

Active schedules, training requirements, and deployments boost the appeal of dining out, especially because it can be simpler than cooking at home. When eating out at fast-food places, restaurants, social events, or when traveling, it's important to choose foods and drinks that improve your performance and maximize mental agility, stamina, and health. This chapter provides information on how to maintain a high-performance eating plan when eating away from home.

DINING OUT

As discussed in Chapter 7, with meals prepared at home you can control the ingredients and how they're prepared. Still, restaurant and fast-food meals don't have to be poor performance fuel. If you know what to look for, you can maintain a high-performance eating plan while enjoying the experience of dining out. Try these tips on how to choose a restaurant:

Select a restaurant where food is cooked to order rather than one where items are prepared in advance.

- Avoid places with all-you-can-eat or buffet-only specials.
- Skip the hot dogs, burgers, and pizza. Instead, search for restaurants and fast-food places that offer nutritious options such as fruit, sushi, salads, sandwiches, or wraps.
- Plan ahead: Look for a place that offers menus with nutrition information or check the restaurant's website for nutrition details before you head out.

Avoid eating out when you're very hungry. Eat a healthy snack to tide you over, if necessary.

CHOOSE HIGH-PERFORMANCE MEALS

Read restaurant menus carefully and try to order nutrient-dense meals. The following strategies can help you select meals that fit into your nutrition plan.

Appetizers

Appetizers are tasty, but they can lead to mindless nibbling and overeating, leaving little room for a nutritious meal. Ask your server to remove chips, peanuts, or your basket of bread after you've sampled a small portion. Try to limit appetizers that are fried or covered with cheese. Or choose healthier options. For example, many broth-based soups, such as vegetable soup, will help fill you up and satisfy your hunger. Cream-based soups tend to be high in saturated fat and calories.

Enjoy fresh vegetable salads as appetizers too. If you're at the salad bar, remember your salad should be mostly vegetables: Start with dark leafy greens such as romaine lettuce, kale, or spinach, plus colorful vegetables. Add tomatoes, shredded carrots, green peas, yellow and red bell peppers, broccoli, cauliflower, crispy cucumber, and other vegetables to turn your greens into a fiesta of colors. Don't forget the healthy fats—sliced avocado and a sprinkle of nuts, seeds, or olives—that add richness to salads and help you feel fuller longer. Top it off with an oil-based salad dressing (such as olive-oil vinaigrette) or spread (hummus). Avoid high-calorie, nutrient-poor additions such as bacon bits, croutons, and fried tortilla strips.

Main meal

To maximize nutrients, ensure your main course is full of vegetables, lean protein, and whole grains. Just like you do at home, try to "balance" your plate and choose high-performance fuel when dining out (Table 8–1).

TABLE 8–1. RESTAURANT "FUELING" OPTIONS

High-performance Fuel	Low- or Moderate-performance Fuel
Fresh fruit or fruit cup in 100% fruit juice	Fruit in syrup
Wraps and burritos with veggies and lean protein	Hoagie or sub roll with extra deli meat, cheese, and creamy sauces or dressings
Extra vegetables or any vegetable combination	French fries or fried vegetables

TABLE 8–1. RESTAURANT "FUELING" OPTIONS (CONTINUED)

High-performance Fuel	Low- or Moderate-performance Fuel
Vegetable pizza (with 4 or more veggie toppings)	"Meat lovers" pizza
Baked potato or sweet potato	French fries or potato salad
Salad bar	Pasta salads with mayonnaise
Fresh fruit with a dollop of whipped cream	Tarts, cheesecake, Danishes, and other pastries

Try the following tips to create a more balanced plate when eating away from home.

Meat and fish

A reasonable portion of steak, chicken, or fish is 3–6 oz. If you have higher-calorie needs (perhaps because you're more active), you'll want to eat a portion that's on the higher end. **Portion sizes** should be about the size of a deck of cards or the palm of your hand, not the size of your plate.

Pass on gravies or heavy sauces, which add significant amounts of calories, sodium, and less-healthy fats. Season your meat or fish with pepper, chunky salsa, or herbs.

Opt for skinless chicken that's not fried.

Choose pork cuts such as tenderloin and chops, which tend to be leaner than other cuts. Limit fatty choices such as sausage, bacon, and ribs.

Select healthy food preparations. Ask if your meat or fish can be steamed, poached, broiled, baked, grilled, or roasted rather than fried.

Add a protein powerhouse such as grilled chicken, salmon, or tuna to a salad for a satisfying meal.

Starches and other carbohydrates

Order a baked potato or plain rice (brown or wild, if available), not fried rice. Avoid au gratin. Top your baked potato with small portions of sour cream, butter, cheese, or bacon. Or skip those toppings altogether and add salsa or chives for a healthier alternative with a lot of flavor.

Choose dishes made with whole grains—such as brown rice, quinoa, whole-grain couscous, and barley—and whole-wheat bread.

Beans and lentils are great sources of carbohydrates, fiber, and lean protein.

Vegetables

Protein is often the "star" of your restaurant meal, so order an extra side (or two) of fresh, steamed veggies or a side salad to balance out your plate. Most restaurants will substitute an extra side of vegetables for potato options.

Make a meal out of vegetable soup and a side salad. Be sure your meal includes a serving of protein to keep you full and satisfied.

Instead of battered, deep-fried, or cheesy vegetables, choose steamed, grilled, sautéed, or roasted ones.

Pastas

When ordering pasta dishes, choose tomato-based sauces (marinara) over cream-based sauces. Tomato sauce can count as a vegetable, so it's a win-win situation.

Look for whole-wheat pasta, which provides an extra boost from fiber, vitamins, and minerals.

If you add meat to your pasta entrée, select grilled chicken or salmon instead of sausage or meatballs.

Sandwiches

Order sandwiches with whole-wheat or whole-grain pita or breads.

Choose lean deli meats and cheeses, and top with condiments such as mustard, relish, or ketchup. Spreads such as hummus and avocado are nutrient-rich alternatives to mayonnaise or "special sauce."

Add as many vegetables as available, including roasted sweet peppers, lettuce, tomato, cucumber, sprouts, shredded carrots, chopped olives, and jalapeños to add flavor and texture.

Beverages

Drink water (plain or sparkling), small (4 oz) portions of 100% fruit juice, skim or low-fat milk (or soy milk), or unsweetened tea or coffee with your meal. Alcohol and sugar-sweetened beverages such as sodas, sweet tea, and lemonade add unnecessary "empty" calories.

If you want wine or beer, drink one glass with your main dish. Take time to enjoy the taste by sipping it slowly rather than mindlessly consuming it.

Desserts

Desserts are often high in unhealthy fats and sugar and low in performance-enhancing nutrients. If you can't resist dessert, order sorbet, fresh or poached fruit, or frozen yogurt. Fresh berries with a dollop of whipped cream or angel-food cake with strawberries are refreshing desserts too.

If you want an "over-the-top," big, rich dessert, split it with your dining partners to enjoy a smaller portion.

Mindful eating

Be **mindful**, eat slowly, and take time to taste and savor your food.

It takes about 20 minutes for your brain to receive the signal that you're full, so eat just until you feel satisfied, not full or uncomfortable.

Remember not to deprive yourself of foods you love. All foods can fit into a well-balanced eating plan. How much and how often you eat various foods is the key.

Other helpful tips

Ask how a dish is prepared and request healthy substitutions (for example, baked instead of fried and olive oil instead of butter).

If portions at the restaurant are large, split one meal with your dinner partner. Or ask for a "doggie bag" up front and set aside half of your meal before you start eating. This will help ensure that you don't overeat, and you'll have another meal from your leftovers.

Try to avoid dishes described as au gratin, buttered, buttery, creamed, crispy, escalloped, fried, hash, hollandaise, in cheese sauce, in cream sauce, in gravy, rich, stewed, or with bacon or sausage.

FAST FOOD

Fast food is typically high in calories, saturated fat, and sodium, so it's best to eat it occasionally and choose carefully when you do (Table 8–2). However, if you plan ahead, it can fit into your healthy eating plan.

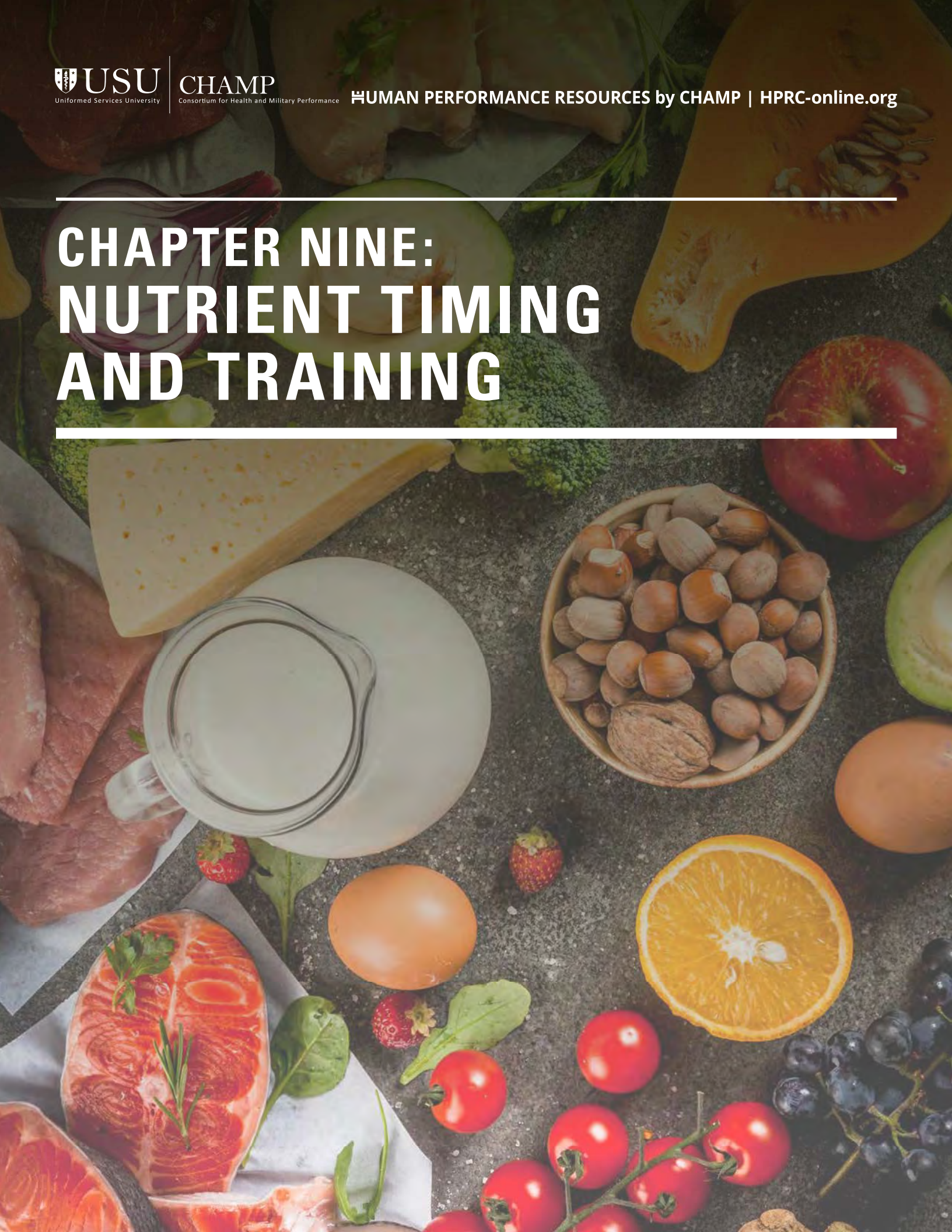
TABLE 8–2. FAST FOOD SWAPS

Skip This	Calories[1] (approx.)	Try This	Calories[1] (approx.)	Calories Saved
Double cheeseburger	460	Cheeseburger	280	180
Large fries	480	Small fries	220	260
Burrito with beans, cheese, and beef	435	Soft chicken taco	185	250
Breakfast croissant sandwich with egg, cheese, and sausage	530	Breakfast English muffin with egg, cheese, and Canadian bacon	290	240
Pepperoni pizza (regular crust), one slice	315	Cheese pizza (thin crust), one slice	230	85
Large cola (32 oz)	415	Plain or seltzer water with lemon wedge	0	415
Crispy chicken tortilla wrap	365	Grilled chicken tortilla wrap	275	90

CHAPTER 8 REFERENCES

1. United States Department of Agriculture Agricultural Research Service. (2016). USDA Food Composition Databases. Retrieved 26 April 2017 from National Agricultural Library https://ndb.nal.usda.gov/ndb/

CHAPTER NINE: NUTRIENT TIMING AND TRAINING



IN THIS CHAPTER

- Everyday nutrition and training
- Fatigue and glycogen depletion
- "Burnout" and overtraining
- Nutrient timing

KEY POINTS

- A balanced, nutrient-dense daily eating plan will ensure better performance and optimal recovery.
- The timing of nutrient and fluid delivery is critical to sustain your performance.
- Add protein to your recovery meal to help rebuild and repair muscle (anabolism).
- For prolonged, strenuous exercise that's longer than 60 minutes, consume foods or drinks that are rich in carbohydrate and contain protein within 2 hours after exercise.
- Sports bars, gels, and drinks are lightweight, portable, and easy to eat during military operations.

Training promotes changes in your body to optimize muscular strength, aerobic capacity, and endurance. You can meet your training goals with appropriate nutritional strategies. Before and after training or missions, it's important to ensure adequate energy stores and rapid recovery so you're ready for the next mission. This chapter will provide information about nutritional strategies to optimize your training in preparation for missions.

EVERYDAY NUTRITION AND TRAINING

Nutrition is a key enabler for successful military operations. Properly planned and executed, good eating practices in the field maintain and enhance operational performance and contribute significantly to mission accomplishment. In addition, well-balanced meals and snacks can support recovery by helping rebuild muscle and reduce your risk of injury. **You can meet your training goals through appropriate nutritional strategies** implemented before, during, and after training. But before you implement nutrient-timing practices, it's important to focus on your **everyday diet**. For example, if you eat lots of highly processed foods or regularly skip meals, eating a recovery snack won't

optimize your performance. Refer to Chapter 2 for information about "fueling your tank" daily.

FATIGUE AND GLYCOGEN DEPLETION

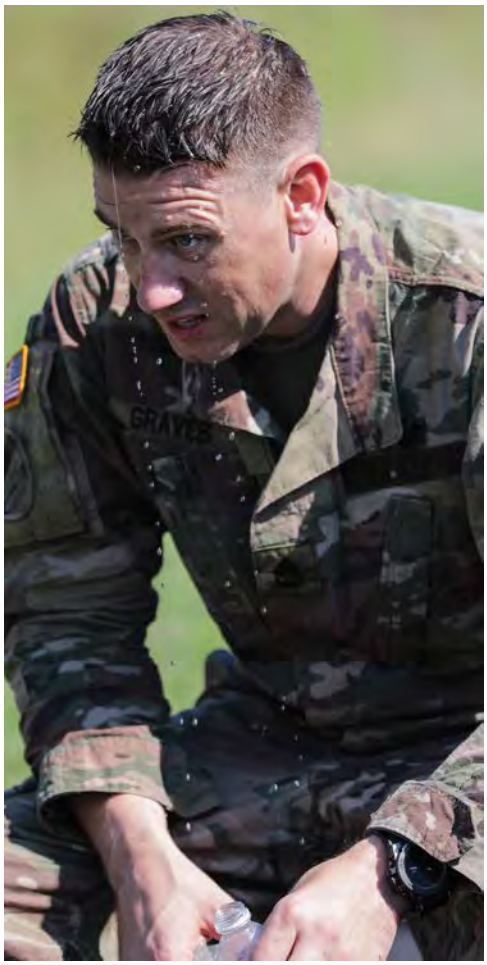
When you feel tired or lack energy, you're experiencing fatigue. Its causes can be central (brain and central nervous system) or local (muscle). One cause of fatigue is depletion of glycogen (the stored form of carbohydrate in the body). All strenuous exercise, including endurance and resistance training—whether you're at home or on a mission—will deplete glycogen, but fatigue is more likely to happen if you're under-fueling your body. Under-fueling by not getting enough carbohydrates can be intentional, especially when you're limiting calories, avoiding gluten, or losing weight. Or you might be limiting carbs unintentionally if you're unsure how much you need to eat or if you're skipping meals or snacks due to limited time or money. **Female Warfighters** are more susceptible to under-fueling than male Warfighters.

It's important to **eat enough carbs every day** because they feed your working muscles and help maintain blood sugar. Try to fill ⅔ to ¾ of your plate with carb-rich foods such as fruit, vegetables, whole grains, beans, and dairy to fuel your body properly. Choose a variety of fruits and vegetables to optimize your intake of vitamins, minerals, and fiber. Whole-grain breads, grains, and pastas provide more performance-boosting nutrients than white-flour and refined versions. Dairy products contribute carbs along with protein and calcium. If you don't fuel properly, your post-exercise recovery could suffer and result in "burnout."

"BURNOUT" AND OVERTRAINING

The terms "burnout" and "overtraining" are concerns for competitive athletes that can apply to Warfighters as well. Burnout and overtraining might result from too little recovery time in combination with too much training. A multitude of symptoms are associated with overtraining:

Unexplained, persistently poor performance
Moodiness, general fatigue, depression, and irritability
Painful muscles
Insomnia
Weight loss
Overuse injuries
Increased susceptibility to upper respiratory infections and gut problems



Example: A Warfighter weighs 187 pounds and prefers to eat 2 hours before his long-distance run.

Step 1: Convert pounds to kilograms.

187 lb ÷ 2.2 = 85 kg

Step 2: Multiply weight in kg times 2.

85 kg × 2 g/kg = 170 g of carbs

His meal might include stir-fry with 2 cups rice, 1 cup mixed vegetables, 3 oz chicken, a banana, and one cup of 100% fruit juice.

The symptoms of burnout or overtraining depend on your physical and physiological makeup, types of training regimens, dietary practices, sleep patterns, and various other factors. No single test can identify overtraining, but sports-medicine specialists and researchers have identified a number of key markers that change over time. These include stress hormones, immune markers, indicators of muscle damage, compromised muscle glycogen reserves, and decreases in aerobic and anaerobic capacity. For more information, read HPRC's article about **overtraining**.

NUTRIENT TIMING

To optimize your performance, get enough rest between workouts, and time your nutrition properly. You can view nutrient timing as 3 distinct phases:

Pre-exercise fueling
During exercise, when energy stores are being depleted
Post-exercise refueling (recovery)

Before exercise

A pre-exercise meal or snack can provide the fuel your body needs to optimize your workout. The amount and timing of your meal or snack depend on the type, intensity, and duration of your exercise, as well as your personal preferences for food choices and pre-exercise fueling.

In general, if you have 30–60 minutes before your workout, **eat a carbohydrate-rich snack**. Aim for around 200–300 calories. For example, eat half a peanut-butter-and-jelly sandwich.

For exercise you expect to last more than 60 minutes, use these pre-exercise fueling guidelines if you want to be more specific: Eat 1–4 grams of carbs per kilogram (about 0.5–1.8 grams of carbs per pound) of body weight 1–4 hours before exercise.[1] Adjust the timing and amount of carbs to match your schedule, activity, and preference. If you want to eat more, allow more time for digestion.

See Table 9–1 for examples of the carbs in various foods. Also, consuming up to 30 grams of protein before exercise might benefit those primarily involved in strength or power training to maximize their muscle building.[2]

During training is the time to find out if you need to **avoid foods high in fat or fiber** to reduce your risk of gastrointestinal issues.[3] Experiment ahead to see what works for you; don't wait until an event day or a mission to try new foods.

TABLE 9–1. APPROXIMATE CARBOHYDRATE CONTENT OF FOODS AND BEVERAGES[4]

Food	Serving Size	Carbohydrate (g)*
Pancakes with syrup	2 (6" diameter) with 2 Tbsp syrup	78
Cinnamon-raisin bagel	1 (4½" diameter)	72
Pretzels	10 twists	50
Rice	1 cup	45
Bean-and-meat burrito	1 medium	42
Pasta, no sauce	1 cup	40
Blueberry muffin	1 small (2–3" diameter)	35
Cereal, wheat flakes	1 cup	32
Seedless raisins	¼ cup	31
Sweet corn	1 cup	30
Potato, baked, with skin	1 small (1¾"–2½" diameter)	29
Banana	1 medium (7–8" long)	27
Apple	1 medium (3" diameter)	25
Blueberries	1 cup	20
Oatmeal cookie	1 medium	17
Wheat bread	1 slice	14
Milk, reduced fat	1 cup	12

* Actual carbohydrate content can vary depending on brand or preparation.

In general, consuming up to 200 mg of caffeine (amount in 16-oz coffee) approximately 30–60 minutes before an endurance event can improve performance. Caffeine intake should not exceed 600 mg in 24 hours (or 800 mg for sustained operations). For more information, read **"Caffeine and Performance"** from Operation Supplement Safety (OPSS).

During exercise

During exercise, energy stores help provide energy to your working muscles, as muscle protein is being broken down.[5] Consuming small amounts of carbs at regular intervals can enhance your athletic performance, especially when the exercise lasts longer than one hour. Water is generally sufficient for exercise

Trail mix is a great portable, quick, nutrient-dense snack for recovery. Enjoy it with 8 fl oz chocolate milk for the right balance of carbs and protein.

Try this homemade version:

2 cups dried fruit (raisins, cranberries, blueberries, pineapple chunks, or mango)

2 cups nuts and/or seeds (peanuts, almonds, cashews, pistachios, walnuts, sunflower seeds, or pumpkin seeds)

Mix well and store in an airtight container. The serving size is ¼ cup or about one handful (20 g carb, 4 g protein).

For more meal and snack ideas, read HPRC's **guide to nutrient timing**.

less than approximately one hour. During exercise lasting **longer than one hour**, a fluid such as a **sports drink** that contains carbs as well as electrolytes can help keep you hydrated. Small to moderate amounts of carbs (30–60 g per hour) from foods or fluids can extend your endurance performance. When your exercise duration is greater than 2.5–3 hours, you might need to consume up to 90 grams of carbs per hour, depending on the intensity of the exercise.[6] For exercise longer than 3 hours, Warfighters typically need to consume solid foods (such as sports gels or chews, fresh or dried fruits, and pretzels) as well as liquids to meet carb needs.

Try to eat various foods during your training to determine which ones are most suitable for you. Exercise intensity, duration, environmental conditions, and mode of exercise—whether you're running, marching, or performing manual labor—help determine the amounts of carbs and fluid your body needs. Military Service Members should simulate mission events to determine their optimal fuel sources. **Never test new foods during a mission or competition**; experiment during training to find what works best for you. Keep in mind that while protein is essential to build and repair muscle, consuming protein during events doesn't appear to improve performance.

After exercise (recovery)

After exercise, your body needs to transition from a catabolic (breakdown) state to an anabolic (build-up) one to promote recovery and restore what was depleted during exercise. **Within 2 hours** after strenuous exercise lasting over 60 minutes consume a balanced meal.[3] Aim for carb-rich foods and fluids along with 15–30 grams of protein to help restock your fuel stores and rebuild your muscles.[6-9] (If you know you can't eat a meal within that 2-hour time frame, try to eat a **snack**.) Foods with essential amino acids, especially leucine[6], will promote post-exercise muscle protein synthesis to rebuild and repair your muscle tissue. Foods with leucine include eggs, dairy, and chicken.

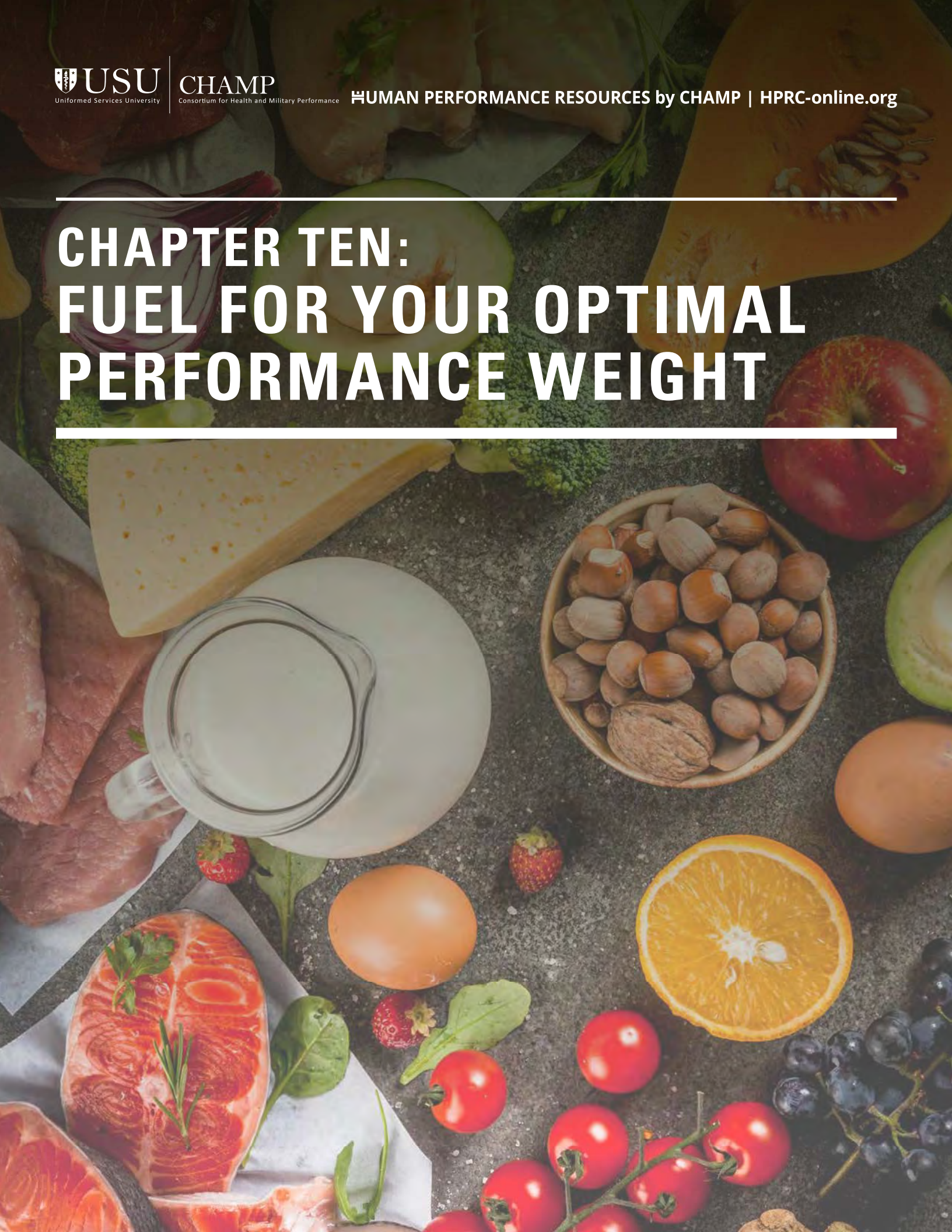
Without appropriate refueling after a hard training session or mission, your performance might be compromised, especially if a second workout or mission is going to occur within less than 24 hours.

Keep in mind that fueling and recovery occur throughout the day, not just before or after exercise. All meals, snacks, and beverages consumed during the day are part of the maintenance/recovery phase. Choose well-balanced meals and snacks with a good variety of food sources to optimize your performance. Refer to Chapter 3 for specifics on daily nutrition.

CHAPTER 9 REFERENCES

1. Karpinski, C., & Rosenbloom, C. A. (2017). *Sports Nutrition: A Handbook for Professionals* (6th ed.). Chicago: Academy of Nutrition and Dietetics.
2. Jäger, R., Kerksick, C. M., Campbell, B. I., Cribb, P. J., Wells, S. D., Skwiat, T. M.,... Antonio, J. (2017). International Society of Sports Nutrition Position Stand: Protein and exercise. *Journal of the International Society of Sports Nutrition*, *14*(20), 1-25. doi:10.1186/s12970-017-0177-8
3. Burke, L. (2012). New guidelines for carbohydrate intake in sport from the International Olympic Committee. *SCAN's Pulse*, *31*(3), 7–11.
4. United States Department of Agriculture Agricultural Research Service. (2016). USDA Food Composition Databases. Retrieved 26 April 2017 from National Agricultural Library https://ndb.nal.usda.gov/ndb/
5. Stellingwerff, T., & Cox, G. R. (2014). Systematic review: Carbohydrate supplementation on exercise performance or capacity of varying durations. *Applied Physiology, Nutrition, and Metabolism*, *39*(9), 998–1011. doi:10.1139/apnm-2014-0027
6. Academy of Nutrition and Dietetics, Dietitians of Canada, & American College of Sports Medicine. (2016). *Nutrition and athletic performance. Medicine & Science in Sports & Exercise*, 48(3), 543–568. doi:10.1249/MSS.0000000000000852
7. Dunford, M., & Doyle, J. A. (2008). *Nutrition for Sport and Exercise* (1st ed.). Belmont, CA: Thomson/Wadsworth.
8. Maughan, R. J. (Ed.) (2014). *The Encyclopaedia of Sports Medicine: Sports Nutrition* (Vol. 19). Chichester, UK: John Wiley & Sons Ltd.
9. Williams, M. (2009). *Nutrition for Health, Fitness & Sport* (9th ed.). New York: McGraw-Hill Science/Engineering/Math.
10. Director, Operations Directorate, Joint Culinary Center of Excellence. (2012). *Memorandum: Commercial Off-the-Shelf (COTS) Nutrition Supplements for Special Forces (SOF)*. U.S. Army Quartermaster Corps and Quartermaster School, Fort Lee, VA 28301.

CHAPTER TEN:
FUEL FOR YOUR OPTIMAL PERFORMANCE WEIGHT



IN THIS CHAPTER

- Getting lean
- Bulking up (muscular fitness)
- Anabolic steroids

KEY POINTS

- Look at your current eating habits to help maintain your optimal performance weight.
- Visit a Registered Dietitian for personalized help with your performance nutrition plan.
- Getting enough protein, calories, and strength training is essential for building muscle and strength.
- Anabolic steroids are illegal and not permitted for use by Warfighters.

Warfighters must be in excellent physical condition to endure arduous physical tasks for extended periods. Military missions and training also require strength. This chapter covers sound nutritional practices to enhance regular physical training and enable Warfighters to reach and maintain optimal performance weight and muscular fitness.

GETTING LEAN

For some Warfighters, injury, stress, lack of time, frequent travel, or other reasons might contribute to a higher-than-optimal weight. If you're one of them, it's important to find what's contributing to your weight gain or your inability to lose weight. It's most likely a matter of how you eat. However, it's also important to be realistic, because meaningful weight loss doesn't happen overnight. It takes dedication to adjust your eating habits, portion sizes, food choices, physical activity, and stress management. In addition, you're more likely to maintain lean muscle mass and performance if you lose no more than 1% of body weight per week.[1] **Overall, taking in fewer calories plus burning more calories adds up to weight loss**.

If you're working to achieve your optimal weight, assess your current habits and make sure portion sizes and food choices are right for your activities and weight goals. Track your food intake, as discussed in Chapter 2. This can help especially if you've **hit a plateau** in your weight loss. It's easy for old habits and poor food choices to creep back into your lifestyle, so just remember to go back

to the basics: Focus on an eating plan that consists of nutrient-rich, lean sources of protein—including fish, poultry, beans, nuts, and dairy products—and incorporate whole grains, fruits, and vegetables. Keep in mind that beverages can add calories too. Stick to water, low-fat milk (or soy milk), and unsweetened beverages with and between meals to stay hydrated. Sugar-sweetened beverages such as soda, sweet tea, and juice can add too many calories and interfere with your healthy eating goals. Finally, look at your **portion sizes**: Even small increases in portion sizes can add up and result in weight gain.

Since each body's nutrition needs are unique, consider making an appointment with a Registered Dietitian (RD) or Registered Dietitian Nutritionist (RDN) for personalized recommendations and assistance with meal plans. Visit HPRC's **Fighting Weight Strategies** section for more resources to help you achieve your optimal weight for performance.

BULKING UP (MUSCULAR FITNESS)

Military missions and training require muscular strength and endurance. In order to increase your strength and build your muscles, it's important to do well-rounded resistance training, which includes both endurance and **strength training**. Improving muscular fitness enhances physical condition, builds functional strength, and allows you to perform and complete strenuous missions. And if gaining weight is your goal, then it's best to do so with muscle, not fat. The appropriate strength-training program combined with a well-planned nutritional strategy can help optimize your performance and prevent musculoskeletal injuries too. Strength training also reduces your risk of injury from aerobic endurance training, and it can boost your speed with tasks requiring short bursts of activity.

Machines and bodyweight exercises are great for beginners because they're easier to learn and require less technique. For more experienced lifters, a combination of free weights and machines is ideal for building muscle mass. Another thing to consider is the number of muscles involved in the motion of each exercise. **The more joints and the larger the muscle group involved, the better**. For example, an exercise that involves the ankles, knees, and hips is better than one just involving the ankles.

In general, aim for 2 or 3 days each week of resistance training for each large muscle group. Make sure you're progressing your workouts at appropriate intervals as well. If you continue to do the same thing without pushing your body beyond what it's used to, you won't see any progress. Add more weight or intensity to your workout. Or create a **periodization program**. **Remember to include rest days** (48 hours) between bouts of resistance training for each major muscle group to allow for recovery and avoid putting yourself at risk of burnout or injury. Resistance training can be performed on a daily basis so long as you don't work the same major muscle group on consecutive days. Rest days

and sleep are also critical for muscle growth. Rest actively by choosing lighter-intensity exercise or a different modality, such as walking, biking, or yoga.

Nutrition requirements

The most effective method to increase your muscle mass is to accompany strength training with a positive nutritional energy balance.[2] If your nutrient intake is lacking as a result of poor meal planning and/or high operational tempo, skeletal muscle might be in a negative protein balance or a catabolic (breakdown) state. The timing and types of nutrients are critical for optimal muscle remodeling and growth. Appropriate nutritional interventions immediately after exercise and over the next 24 hours are essential to maintain and promote muscle mass. For more information about nutrient timing, read Chapter 9.

Protein requirements for building muscle

The protein needs of Military Service Members range from 0.8–1.6 g/kg (about 0.4–0.7 g/lb) body weight each day.[1] You might need higher intake for a short time during intensified training or when reducing your energy (calorie) intake.[1] (See Chapter 3 to learn more about protein.) Many Warfighters believe that more protein is better. However, **eating more protein than the established recommendation doesn't provide any additional benefit**.[3] In addition, if you consume excess protein, you are likely eating less of another essential macronutrient (carbohydrate or fat) to make room in your eating plan for the protein.[4] Because carbs are your body's preferred fuel source for performance, under-fueling with carbs can be detrimental to your performance.

You can meet your protein needs through intake of whole foods such as lean meats, poultry, fish, beans, nuts, eggs, and low-fat dairy. Whole foods provide other essential nutrients that protein powders and supplements lack. However, protein powders are sometimes acceptable when high-quality protein foods aren't available or practical. In general, a properly balanced eating plan can meet your protein needs effectively.

For some Warfighters, it can be challenging to eat enough to gain weight and build muscle. Use these tips to help add more calories and protein to your eating plan.

Eat more often. Plan to eat or drink something every few hours, **especially after your workout**. Be sure to keep **snacks** on hand—at work, in your bag, and at home—for convenient bites between meals. You can make your own **trail mix** to have on hand wherever you go.

Consume protein-rich foods. Protein is essential to build and repair your muscles. The best sources of protein are simply whole foods such as lean meats, poultry, fish, beans, nuts, eggs, and low-fat dairy. Try to add a source of protein to every meal and snack. You can use HPRC's article about **protein require-**

ments to calculate your individual protein needs based on body weight and activity level.

Try smoothies, shakes, or soups. Liquids can be an easy way to load up on calories in a small volume. Add Greek yogurt, milk or soy milk, powdered milk, flaxseeds, or chia seeds to your smoothies, shakes, and soups for calories and protein.

Add healthy fats. These are good for your heart and pack a lot of calories in a small amount of food. They're also versatile and can be added to almost any meal, snack, or drink. Use avocado or nut butter in sandwiches or smoothies, and add a little extra olive oil, canola oil, or oil-based spreads in your meal preparation.

ANABOLIC STEROIDS

Some Warfighters looking to build muscle and strength turn to anabolic steroids or dietary supplements. Anabolic steroids include testosterone and artificial compounds designed to behave like testosterone, the primary androgenic ("masculinizing") hormone that enhances male attributes, including muscle mass. They're used to enhance performance and improve physical appearance. However, anabolic steroids are classified as "**controlled substances**" and are regulated by the U.S. Drug Enforcement Administration (DEA). **They're illegal to purchase, use, or possess** without a prescription; they're banned by most athletic associations; and they're prohibited for use by Military Service Members. However, they sometimes are found in products marketed as dietary supplements, so it's important to read labels carefully and use only products that have been **tested by a reputable third-party organization** to ensure there are no "hidden" ingredients. Warfighters who use such substances (intentionally or unintentionally) might test positive for anabolic steroids on a DoD drug test.

Adverse effects of steroids

Anabolic steroids, whether taken alone or in combination with other performance-enhancing substances ("stacking"), can have short- and long-term effects.[5, 6] These include physical, psychological, and behavioral adverse side effects. Using anabolic steroids disturbs your regular production of testosterone, which might persist for months after discontinuing use. Some steroid users become addicted to them and experience withdrawal effects such as fatigue, mood swings, sleep problems, and decreased sex drive when they stop. For more information about anabolic steroids, visit the **National Institute on Drug Abuse** web page.

For information about dietary supplements and other "performance-enhancing" substances, including ones not permitted for use and ones that might be health risks, read Chapter 12.

CHAPTER 10 REFERENCES

1. Academy of Nutrition and Dietetics, Dietitians of Canada, & American College of Sports Medicine. (2016). *Nutrition and athletic performance. Medicine & Science in Sports & Exercise*, *48*(3), 543–568. doi:10.1249/MSS.0000000000000852

2. Garthe, I., Raastad, T., Refsnes, P. E., & Sundgot-Borgen, J. (2012). Effect of nutritional intervention on body composition and performance in elite athletes. *European Journal of Sport Science*, *13*(3), 295–303. doi:10.1080/17461391.2011.643923

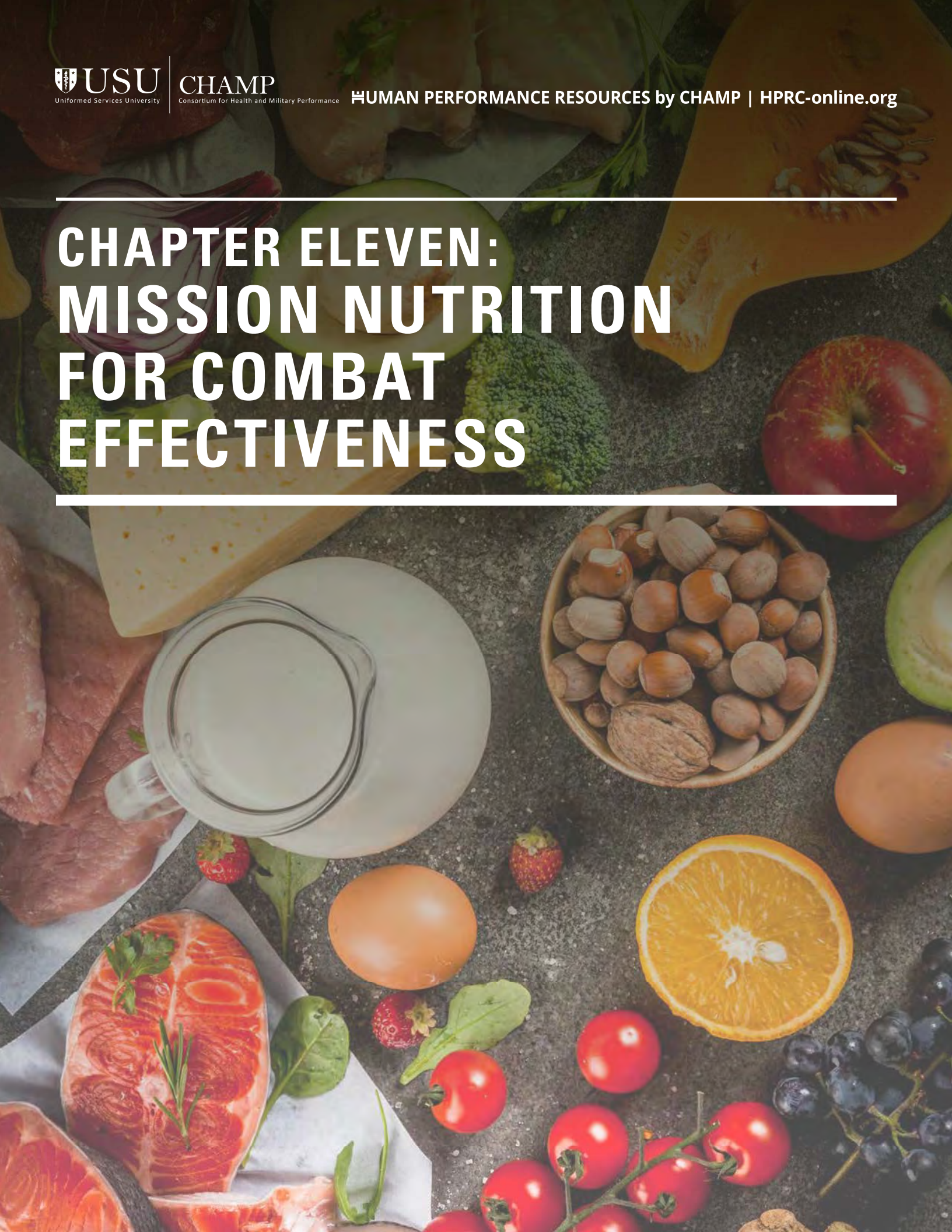
3. Karpinski, C., & Rosenbloom, C. A. (2017). *Sports Nutrition: A Handbook for Professionals* (6th ed.). Chicago: Academy of Nutrition and Dietetics.

4. Maughan, R. J. (Ed.) (2014). *The Encyclopaedia of Sports Medicine: Sports Nutrition* (Vol. 19). Chichester, UK: John Wiley & Sons Ltd.

5. Piacentino, D., Kotzalidis, G. D., Casale, A. d., Aromatario, M. R., Pomara, C., Paolo Girardi, & Sani, G. (2015). Anabolic-androgenic steroid use and psychopathology in athletes. a systematic review. *Current Neuropharmacology*, *13*(1), 101–121. doi:10.2174/1570159X13666141210222725

6. Trenton, A. J., & Currier, G. W. (2005). Behavioural manifestations of anabolic steroid use. *CNS Drugs*, *19*(7), 593–595. doi:10.2165/00023210-200519070-00002

CHAPTER ELEVEN: MISSION NUTRITION FOR COMBAT EFFECTIVENESS



IN THIS CHAPTER

KEY POINTS

- Inadequate energy intake and/or dehydration can result in fatigue and impair your performance during combat.
- Disruptions in eating and sleeping due to all-night and high op-tempo missions can affect your overall health.
- Plan to eat before night operations to prevent fatigue.
- Environmental exposures such as heat, cold, and altitude can reduce combat effectiveness if your nutritional and hydration needs aren't met appropriately.
- Energy and fluid requirements are typically higher than normal during combat and combat-simulated scenarios.

Adequate fueling is essential for operational performance and mission success. Operators of equipment such as Humvees, helicopters, and submarines especially need high-performance fuels to operate effectively. In some instances, fueling options are limited, but it's critical to meet your energy and fluid requirements whenever possible. This chapter describes fueling options when you're exposed to various environmental and logistical extremes.

NUTRITIONAL READINESS BEFORE MISSIONS

Warfighters must be prepared to deploy at any time. Immediately before, they might find themselves in the field or under lockdown on base. The two main nutritional considerations for readiness before missions are optimum glycogen stores and proper hydration.

Timing and composition of pre-mission meals

A pre-mission meal can help ensure adequate glycogen stores and maintain your blood sugar. A carb-rich eating plan (for several days before a mission, if possible) will increase glycogen stored in the liver and muscles and ensure adequate fuel stores.[1] **Every Warfighter should know his or her own tolerance** for timing of meals, types of snacks, and amounts of food needed to sustain performance. In general, intense physical activities demand a longer waiting period after you eat to allow for digestion and minimize gastrointestinal (GI) distress, as discussed in Chapter 9.

A pre-mission meal should be high in carbohydrates with some fat and protein. Avoid high-fat and high-protein meals because protein and fat digest more slowly than carbohydrates. Carbohydrate beverages and carb/protein drinks are excellent choices if consumed 1–4 hours before the start of a mission. The body digests and absorbs liquids more rapidly than solids, but personal taste and suitability are important in choosing what to consume. Be sure to **try any new foods and beverages before deploying** to ensure tolerance during missions.

MAINTAINING NUTRITION DURING MISSIONS

Rations

Boredom with rations and lack of time to eat contribute to decreased ration intake and weight loss. So, it's important to consume as much of your field ration as possible to maintain optimal performance and health. Combat rations often are fortified with vitamins and minerals to optimize nutrition, so try to **eat at least part of each ration item** whenever possible to obtain all the essential nutrients. See Chapter 13 for more information about combat rations.

Limit substitution of non-issue food items for rations or meals since they might lack important nutrients. Save them for snacks to supplement your daily rations. When authorized by your Command, pack high-carbohydrate items such as crackers, dried fruit, trail mixes, and sports bars too. Experiment with new foods and timing beforehand—during training—to see what eating patterns and foods suit you best.

Hydration status

Adequate daily fluid intake is critical to maintain optimal operational performance and health. **Warfighters' fluid needs usually are greater** than the recommended general guidelines (see Chapter 5) due to their intense training or work in extreme environments. Dehydration can affect your mental and physical performance, so stay hydrated with water, including beverages (such as juice, milk, coffee, and tea) and foods (mostly fruits and vegetables; see list in Chapter 5) that contain water.

You'll also need electrolyte replacement if you're (1) physically active longer than 3 hours; (2) not getting adequate nutrition; or (3) working in conditions where you sweat a lot, such as humid and hot weather conditions in the field and military exercises involving high mobility and strenuous physical work.[2] In such situations, consume fluid-replacement beverages with carbs and electrolytes (sodium and potassium) during extended missions, as discussed in Chapter 5. A carbohydrate–electrolyte beverage powder is available in rations, but if you use a commercial **sports drink** instead, choose one with no more than 24g of carbs per 8 oz during missions.

GI complaints

Changes in diet, dehydration, too much fiber, poor sanitary conditions, contaminated food, unfamiliar bacteria, and stress might result in diarrhea or constipation in the field. Try to ensure adequate hydration at all times and avoid new, non-issue foods whenever possible. See Chapter 14 to learn more about relieving GI distress.

Dietary fiber

Dietary fiber makes food pass through the GI system faster, improves stool bulk and weight, and promotes regularity. Consider a low-fiber diet during extended operations. Many high-fiber foods can cause bloating and gas, especially if you don't consume them regularly or if you don't drink enough water. It's important to gradually add fiber to your diet to prevent GI distress. Test high-fiber foods during training to find out how your system reacts. **Avoid all dietary modifications right before a mission or operational scenario**.

Caffeine

Caffeine is a stimulant found in energy drinks, coffee, tea, many sodas, some dietary supplements, and a few components of military rations. Research on caffeine shows it positively affects military-relevant tasks such as marksmanship, reaction time, vigilance, and logical reasoning.[3-7] In athletics, caffeine can help reduce perception of fatigue and allow you to sustain your targeted (or intended) intensity for a longer period of time.

Caffeine can increase your alertness and possibly even delay fatigue during extended operations. Caffeine (in moderate doses up to 200 mg) can improve cognitive performance in rested, sleep-deprived, and fatigued individuals.[8,10] However, the effective dose can vary, depending on your habitual caffeine intake and sensitivity to caffeine, and higher doses can cause unwanted side effects such as nausea, anxiousness, insomnia, and restlessness, which can have a negative effect on performance.[8,11]

Caffeine-rich drinks and foods are among the most popular forms of nutrition to help Warfighters maintain alertness at night. Sources of caffeine in First

Strike Rations and Modular Operational Ration Enhancement include caffeinated chocolate pudding (200 mg), Mocha First Strike Bar (mini; 110 mg) and caffeinated mints and gum (100 mg per piece, 5 pieces per package). In addition, coffee is available in the Meal, Ready-to-Eat (MRE), FSR, and Meal, Cold Weather (MCW) rations (80–100 mg per package).

For more about caffeine and performance, see the Operation Supplement Safety (OPSS) Caffeine & Performance infographic and Tables 11–1 and 11–2 below. Despite its effects on alertness and performance, caffeine shouldn't be used as a substitute for healthy habits (adequate sleep, regular meals, etc.).

TABLE 11–1. CAFFEINE CONTENT OF SELECTED BEVERAGES*

Item	Serving Size	Amount of Caffeine (mg/serving)
Coffee		
Coffee, brewed	8 oz	95
Coffee, brewed, decaffeinated	8 oz	2
Coffee, instant	1 tsp	31
Coffee, instant, decaffeinated	1 tsp	2
Starbucks Doubleshot Espresso (Espresso & Cream)**	1 can (6.5 oz)	110
Dunkin Donuts hot coffee	1 small (10 oz)	150
Starbucks Pike Place Roast**	1 "tall" (12 oz)	235
Teas		
Black tea, brewed, decaffeinated	8 oz	2
Green tea, brewed	8 oz	28
Black tea, brewed	8 oz	47
Brisk Iced Tea (Lemon)**	1 bottle (20 oz)	14
Fuze Iced Tea (Lemon)**	1 bottle (20 oz)	20
Honest Tea ("Just" Green Tea)**	1 bottle (16 oz)	55
Pure Leaf (Black Tea)**	1 bottle (18.5 oz)	70
Sodas*		
Coca-Cola	1 can (12 oz)	34
Pepsi	1 can (12 oz)	38

TABLE 11–1. CAFFEINE CONTENT OF SELECTED BEVERAGES*

Item	Serving Size	Amount of Caffeine (mg/serving)
Mello Yello	1 can (12 oz)	51
Mountain Dew	1 can (12 oz)	54
Energy Drinks*		
Red Bull	1 can (8.4 oz)	80
Mountain Dew Kickstart (Fruit Punch, Black Cherry, and Orange Citrus)	1 can (16 oz)	92
Arizona Natural Energy	1 can (15.5 oz)	120
Amp Energy (Cherry Blast and Tropical Punch)	1 can (16 oz)	160
Full Throttle	1 can (16 oz)	160
Monster Energy Extra Strength	1 can (12 oz)	160
NOS High Performance Energy Drink	1 can (16 oz)	160
Rip It Energy Fuel (G-Force)	1 can (16 oz)	160
Venom Energy	1 can (16 oz)	160
Xyience	1 can (16 oz)	176
Rockstar Punched	1 can (16 oz)	240
Energy Shots*		
5-Hour Energy Decaf	1 bottle (1.93 oz)	≤ 6
Guayaki Yerba Mate Shot (Wild Berry Reishi)	1 bottle (1.99 oz)	70
Clif Shot Energy Gel (Double Expresso)	1 pack (1.2 oz)	100
Rip It Energy Shot	1 bottle (2 oz)	100
Rip It Energy Shot Extra Strength	1 bottle (2 oz)	120-135
Guayaki Yerba Mate Shot (Lime Tangerine and Lemon)	1 bottle (1.99 oz)	140
5-Hour Energy	1 bottle (1.93 oz)	200
Eternal Energy	1 bottle (2 oz)	222
5-Hour Energy Extra Strength	1 bottle (1.93 oz)	230

* Except where noted otherwise, caffeine content was obtained from the USDA Food Composition Databases.[12] Actual caffeine content can vary depending on brand and preparation.

** Caffeine content obtained from product's marketing website or third-party retail website.

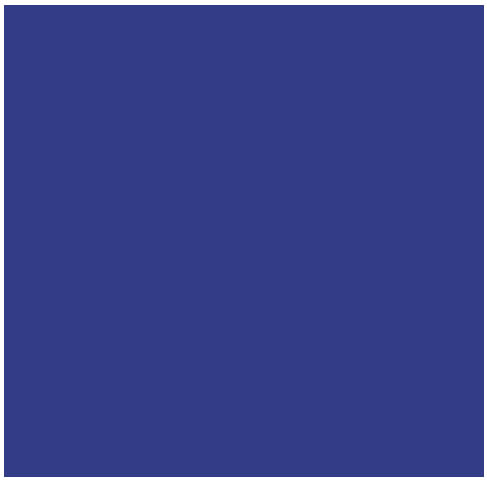


TABLE 11–2. CAFFEINE CONTENT OF SELECTED FOODS AND OVER-THE-COUNTER DRUGS*

Item	Serving Size	Amount of Caffeine (mg/serving)
Combat Rations		
Coffee (freeze-dried)	1 package	80–100
Caffeinated gum	1 piece	100
Caffeinated mints	1 piece	100
Mocha First Strike Bar (mini)	1 bar	110
Caffeinated chocolate pudding	1 container	200
Chocolates		
Milk chocolate	1 block (7 g)	1
Dark chocolate-coated coffee beans	10 pieces	121
Chewing Gum*		
Neuro Gum	1 piece	40
Run Gum	1 piece	50
Java Gum	1 piece	65
Blast Power Gum	1 piece	80
Over-the-counter Stimulants*		
Jet-Alert	1 tablet	100
NoDoz	1 caplet	200
Vivarin	1 tablet	200
Over-the-counter Pain Relievers*		
Anacin	1 tablet	32
Excedrin Extra Strength	1 caplet	65

* Except where noted otherwise, caffeine content was obtained from the USDA Food Composition Databases.[12] Actual caffeine content can vary depending on brand and preparation.

** Caffeine content obtained from product's marketing website or third-party retail website.

SUSTAINED NIGHT OPERATIONS

Night exercises require acute cognitive awareness and the ability to react quickly to sudden and potential compromised situations. Missions include both Sustained Operations (SUSOPS) and Continuous Operations (CONOPS), which frequently can result in fatigue and sleep deprivation. SUSOPS—work periods of 24 hours or more—usually result in physical and mental fatigue as well as sleep loss. In contrast, CONOPS involve periods of uninterrupted activity of "normal shift length" followed by "normal" sleep, but not always sufficient to recover or prepare for SUSOPS.[13, 14]

Under-fueling while exposed to these strenuous circumstances can lead to weight loss, fatigue, and mental impairments, including confusion, depression, and loss of vigilance.[13] **Nutritional interventions can partially offset the detrimental effects of fatigue and sleep deprivation** on physical and mental performance. You need **high-carb meals and snacks** to maintain muscle glycogen stores and blood glucose. If you fail to fuel properly during sustained missions, your blood glucose levels will fall, resulting in hypoglycemia (low blood sugar) and a decline in performance. Symptoms of hypoglycemia include headache, dizziness, blurred vision, weakness, fatigue, sweating, confusion, and unconsciousness.

MISSIONS IN THE HEAT

Repetitive movement along difficult terrain with heavy gear, such as during land-warfare operations, is strenuous under any environmental condition, but it's particularly grueling with extreme heat and humidity. Land-warfare scenarios in which Warfighters carry heavy loads or injured comrades increase overall effort, energy expenditure, and fluid and electrolyte needs. The major concerns during operations in a warm or hot environment are fluid and electrolyte balance. Working or exercising in the heat worsens water and electrolyte loss through sweating. The amounts of sweat and fluid lost depend on:

Environmental temperature and humidity
Work rate
Fitness level and acclimatization
Volume and rate of fluid replacement
Genetics

When the same task carried out in a more neutral-temperature environment is performed in a hot environment, energy requirements increase slightly due to the increased work of maintaining thermal balance.[1] If you're acclimated to heat, you likely won't need to increase your calories. However, working in the

heat might decrease your appetite or alter your food preferences, so it's important to monitor your food intake and any changes in body weight.[15]

Fluids—Drink early and often

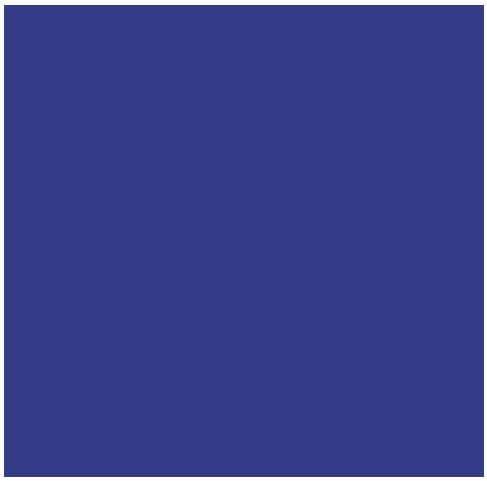
High work rates in hot, humid surroundings can significantly increase fluid and electrolyte losses. Losses of 1–2 quarts (32–64 fl oz) per hour or even more are likely when Warfighters wear special clothing such as chemical protective gear or body armor.[15] Your risk of performance mishaps is greater when you start any operation without being adequately hydrated. In addition, failure to replace fluids lost from sweating will result in dehydration and possible heat injury. When engaging in light to moderate activity in a temperate climate (under 86°F), you should aim to drink 2–5 quarts of fluids per day, but **when working in the heat, your daily fluid needs can double**.[2] Fluid-replacement beverages are most useful for rehydration. If it's available, fruit juice also provides some carbs, electrolytes, and fluid to help hydration.

Don't rely on thirst as a guideline to drink. By relying solely on thirst, your hydration can lag several hours behind fluid needs.[16] Try to set a pre-determined drinking schedule to ensure you're consuming enough fluids. Make sure to drink some type of beverage (water, juice, milk, iced tea, or sports drink) with all meals and snacks too.

Although such "forced drinking" is recommended during training and missions in a warm environment to ensure adequate fluid replacement for performance, **drinking too much water can result in hyponatremia** (as discussed in Chapter 5). Symptoms of hyponatremia include headache, vomiting, fatigue, confusion, and disorientation. Do not drink more than 1.5 quarts (48 fl oz) of water per hour or 12 quarts (384 fl oz) per day.[16]

Electrolyte balance

Excessive loss of electrolytes (sodium and potassium) from sweating can lead to severe medical problems. You can help minimize electrolyte losses if you stay in excellent physical condition. To maintain electrolyte balance, you might need to consume snacks that contain sodium and potassium, fluids with electrolytes, or electrolytes in the form of gels or chews during and after missions. Dried fruits are optimal food choices for potassium. For example, a small box of raisins (1.5 oz) provides 320 mg of potassium. Adding salt to foods (½ teaspoon provides 1,200 mg) or including sodium-rich foods in your diet will help retain water and avoid a sodium deficit. MREs provide sodium within the food components and in the salt packet.[16] **Sodium is the most critical electrolyte for maintaining fluid balance**. The Military Dietary Reference Intake for sodium is < 2,300 mg for men and women.[2] Adequate sodium intake should offset hyponatremia.



MISSIONS IN THE COLD

Exposure to a cold environment seriously challenges the human body. Blood vessels tighten to conserve heat, and shivering generates heat and guards against hypothermia (a dangerously low core body temperature). Side effects of these responses are increases in urine output and energy metabolism.

Energy intake

Energy requirements can increase 10–40% during cold-weather operations as compared to warm-weather operations.[17] Factors that can increase your calorie needs include:

Added exertion due to wearing heavy gear
Shivering to maintain body temperature
Greater exertion traveling over snow and icy terrain
Increased activity to keep warm

Energy expenditure for Warfighters during periods of physical exertion in the cold might range 4,200–4,600 calories per day, with some situations requiring as much as 6,000 calories per day.[17] A high-carb eating plan can provide the carbohydrates you need to replenish the glycogen your body uses to maintain core temperature. The high-calorie needs of cold weather operations can be difficult to meet. **Both fat and carbs are significant energy sources**, so you might need an eating plan that provides 35% of the energy as fat. Consume 3–4 standard MREs or 3 MCW/LRP rations per day to meet your energy needs.

Supplementing regular meals with frequent snacks between meals and before bed also can help you meet your calorie needs. **High-carb snacks**, many of which can be stored in your pockets for portable access, include:

Granola or power bars
Oatmeal cookies
Hot or cold protein or carb beverage
Bagel with jam
Pretzels
Trail mix
Dried or fresh fruit
Crackers with hard cheese
Popcorn, corn chips, or tortilla chips

Keep in mind that the increase in energy requirements doesn't apply to Warfighters located in cold-climate regions unless they are actually exposed to outdoor temperatures.[17]

Fluid status

Becoming dehydrated in cold environments is easy because of cold-induced increase in urine output, increased fluid losses through breathing, involuntary reduction in fluid intake, and sweating. Since dehydration decreases your performance and might lead to various medical problems, it's crucial to drink plenty of fluids and monitor your hydration, as discussed in Chapter 5. Fluid needs depend on physical activity level, but most **Warfighters require 3–6 quarts (96–192 fl oz) per day for adequate hydration**.[17] Try these tips to help maintain your fluid status.

Drink fluids (water, juice, tea, sports drinks, and coffee) with meals.
Force yourself to drink 16–32 fl oz of warm fluid at hourly intervals.
Avoid alcoholic beverages because alcohol tends to increase heat and urine losses.
Drink beverages with carbs to increase your energy intake.
Don't eat snow without first melting and purifying it.

Vitamin and mineral needs

Your requirements for some vitamins (for example, thiamin) and minerals (such as magnesium or zinc) are greater when you're working in the cold due to increases in energy metabolism or urinary losses.[18] People who are deficient in iron, copper, or zinc sometimes have difficulty regulating their body temperature. In most cases, you can meet your energy (calorie), vitamin, and mineral requirements by eating all ration components.

MISSIONS AT ALTITUDE

Ascent to altitude and flying can cause a variety of disturbances and increased oxidative stress, so adequate nutrition is crucial to maintain performance. The major nutritional concerns at altitude are:

Weight loss
Carb intake
Dehydration

Weight loss

At altitudes greater than 10,000 feet, energy needs greatly increase (by as much as 25%), especially for Warfighters performing extremely strenuous activities.[19] Virtually all people who go to high altitudes experience loss of weight and lean body mass due to greater energy needs, reduced food intake, loss of body fluids from increased breathing, decreased fluid intake, decreased absorption of nutrients, and GI symptoms (nausea, vomiting, and decreased appetite) related to Acute Mountain Sickness (AMS).[1] Over a period of several weeks or longer, bodyweight loss of approximately 5% or less is typical and usually won't affect the performance of most tasks.[20]

The only way to minimize weight loss is to be vigilant about your energy intake.

Carbohydrate intake

High-carb foods are the preferred energy source at altitude and in flight because they:

Replete glycogen stores
Provide the most efficient energy source
Can delay the progression or severity of AMS and reduce its symptoms (nausea, vomiting, and headache)
Maintain blood glucose

During strenuous activity, long flights, and recovery, eat high-carb snacks between meals and drink beverages that contain carbs to help meet your carbohydrate goals. Warfighters at altitude should aim to **consume a minimum of 400 grams of carbs per day**.[20]

Dehydration

Exposure to high altitude increases your loss of water, resulting in significant risk of dehydration, cold injury, and AMS. **Factors that cause dehydration at altitude include:**

Greater respiratory losses due to increased ventilation (breathing)
Increased urine output associated with altitude and cold temperatures
Failure to drink water
Limited access to water

Don't over-exercise before a flight because strenuous exercise can deplete body water, which might be difficult to replace quickly. Recent illness (including AMS), fever, diarrhea, or vomiting also will greatly affect your degree of dehydration.

Warfighters at altitude should follow the same guidance for fluid intake as for those in hot environments.[20] Maintain a drinking schedule and monitor your hydration status (see Chapter 5) daily to avoid AMS. Take regular sips of water before you feel thirsty to help prevent dehydration as well.

MISSIONS IN WATER AND AT DEPTH

As with exposure to altitude and cold environments, water operations (especially cold-water operations such as diving) are associated with greater energy expenditure and fluid losses.

Energy intake

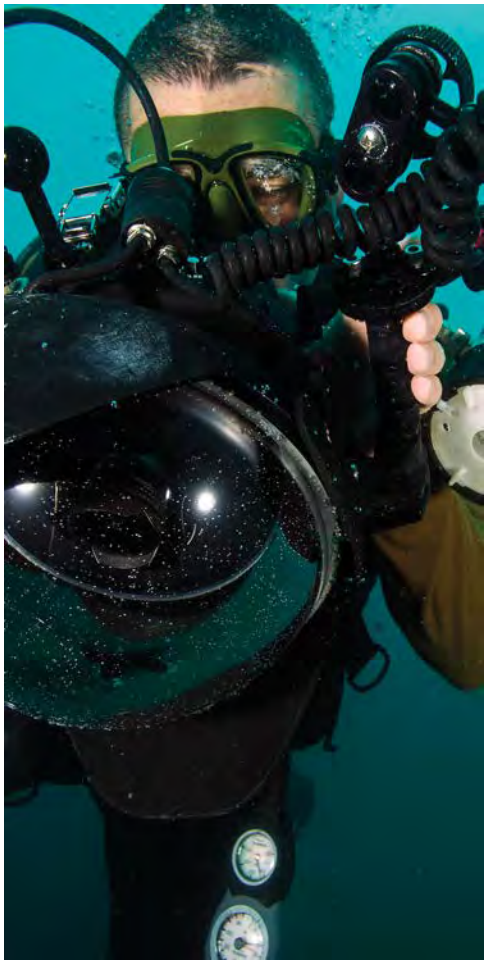
When working at the same rate in water as on land, the energy expenditure to accomplish the same task is greater. The reasons for this increased energy expenditure during water operations include:

Greater resistance offered by water
Decreased efficiency of movement when thermal protective clothing is worn

Your body uses glycogen stores rapidly when you're performing hard work in cold water. It's important to replace these stores between operations to prevent performance decrements. Increasing carb intake before an anticipated dive has been shown to improve and extend exercise performance during prolonged dives.

Fluid intake

Immersion in water alone doesn't significantly increase hydration needs. However, water depth and water temperature do affect hydration. Since immersion dulls the thirst response, voluntary water intake might decrease.[21] Without adequate hydration, a diver can quickly become dehydrated and suffer performance decrements, so it's important to consume fluids even when you aren't thirsty.



CHAPTER 11 REFERENCES

1. Deuster, P. A., & Singh, A. (2004). Nutritional considerations for military deployment. In P. Kelley (Ed.), *Textbooks of Military Medicine: Military Preventive Medicine, Mobilization and Deployment* (Vol. 1, pp. 317–340). Washington, DC: Office of the Surgeon General, Department of the Army, United States of America.

2. Headquarters, Departments of the Army, the Navy, & the Air Force. (2017). *Nutrition and menu standards for human performance optimization* (AR 40–25/OPNAVINST 10110.1/MCO 10110.49/AFI 44–141). Departments of the Army, the Navy, and the Air Force, Washington, DC. Retrieved from: https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/AR40-25_WEB_Final.pdf

3. Kamimori, G. H., McLellan, T. M., Tate, C. M., Voss, D. M., Niro, P., & Lieberman, H. R. (2014). Caffeine improves reaction time, vigilance and logical reasoning during extended periods with restricted opportunities for sleep. *Psychopharmacology*, *232*(12), 2031–2042. doi:10.1007/s00213-014-3834-5McLellan, T. M., Bell, D. G., & Kamimori, G. H. (2004). Caffeine improves physical performance during 24 h of active wakefulness. *Aviation, Space, and Environmental Medicine*, *75*(8), 666–672.

4. McLellan, T. M., Kamimori, G. H., Bell, D. G., & Belenky, G. (2005). Caffeine maintains vigilance and marksmanship in simulated urban operations with sleep deprivation. *Aviation, Space, and Environmental Medicine*, *76*(1), 39–45.

5. McLellan, T. M., Kamimori, G. H., Voss, D., & Johnson, D. (2005). Caffeine maintains vigilance and improves run times during night operations for Special Forces. *Aviation, Space, and Environmental Medicine*, *76*(7), 647–654.

6. McLellan, T. M., Kamimori, G. H., Voss, D., & Smith, S. J. R. (2007). Caffeine effects on physical and cognitive performance during sustained operations. *Aviation, Space, and Environmental Medicine*, *78*(9), 871–877.

7. Goldstein, E. R., Ziegenfuss, T., Kalman, D., Kreider, R., Campbell, B., Wilborn, C., . . . Antonio, J. (2010). International society of sports nutrition position stand: Caffeine and performance. *Journal of the International Society of Sports Nutrition*, *7*(5), 1–15. doi:10.1186/1550-2783-7-5

8. Lieberman, H., Tharion, W., Shukitt-Hale, B., Speckman, K., & Tulley, R. (2002). Effects of caffeine, sleep loss, and stress on cognitive performance and mood during U.S. Navy SEAL training. Psychopharmacology, 164(3), 250–261. doi:10.1007/s00213-002-1217-9

9. Institute of Medicine (US) Committee on Military Nutrition Research. (2001). Caffeine for the Sustainment of Mental Task Performance. Washington, DC: National Academies Press.

10. Peeling, P., Binnie, M.J., Goods, P.S.R., Sim, M., & Burke, L.M. (2018). Evidence-based supplements for the enhancement of athletic performance. International Journal of Sport Nutrition and Exercise Metabolism, 28(2), 178–187. doi:10.1123/ijsnem.2017-0343

11. United States Department of Agriculture Agricultural Research Service. (2016). USDA Food Composition Databases. Retrieved 26 April 2017 from National Agricultural Library https://ndb.nal.usda.gov/ndb/

12. Institute of Medicine, Food and Nutrition Board, Committee on Military Nutrition Research, & Committee on Optimization of Nutrient Composition of Military Rations for Short-Term High-Stress Situations (Eds.). (2006). *Nutrient Composition of Rations for Short-term, High-intensity Combat Operations*. Washington, DC: National Academies Press.

13. Institute of Medicine, Food and Nutrition Board, Committee on Military Nutrition Research, & Marriott, B. M. (Eds.). (1994). *Food Components to Enhance Performance: An Evaluation of Potential Performance-Enhancing Food Components for Operational Rations*. Washington, DC: National Academy Press.

14. Institute of Medicine, Food and Nutrition Board, Committee on Military Nutrition Research, & Marriott, B. M. (Eds.). (1993). *Nutritional Needs in Hot Environments: Applications for Military Personnel in Field Operations*. Washington, DC: National Academy Press.

15. Headquarters, Department of the Army and Air Force. (2003). *Heat stress control and heat casualty management*. Department of the Army and Air Force, Washington, DC. Retrieved from: http://www.usariem.army.mil/assets/docs/publications/articles/2003/tbmed507.pdf

16. Headquarters, Department of the Army. (2005). *Prevention and management of cold-weather injuries* (TB MED 508). Department of the Army, Washington, DC. Retrieved from: http://www.usariem.army.mil/assets/docs/publications/articles/2005/tbmed508.pdf

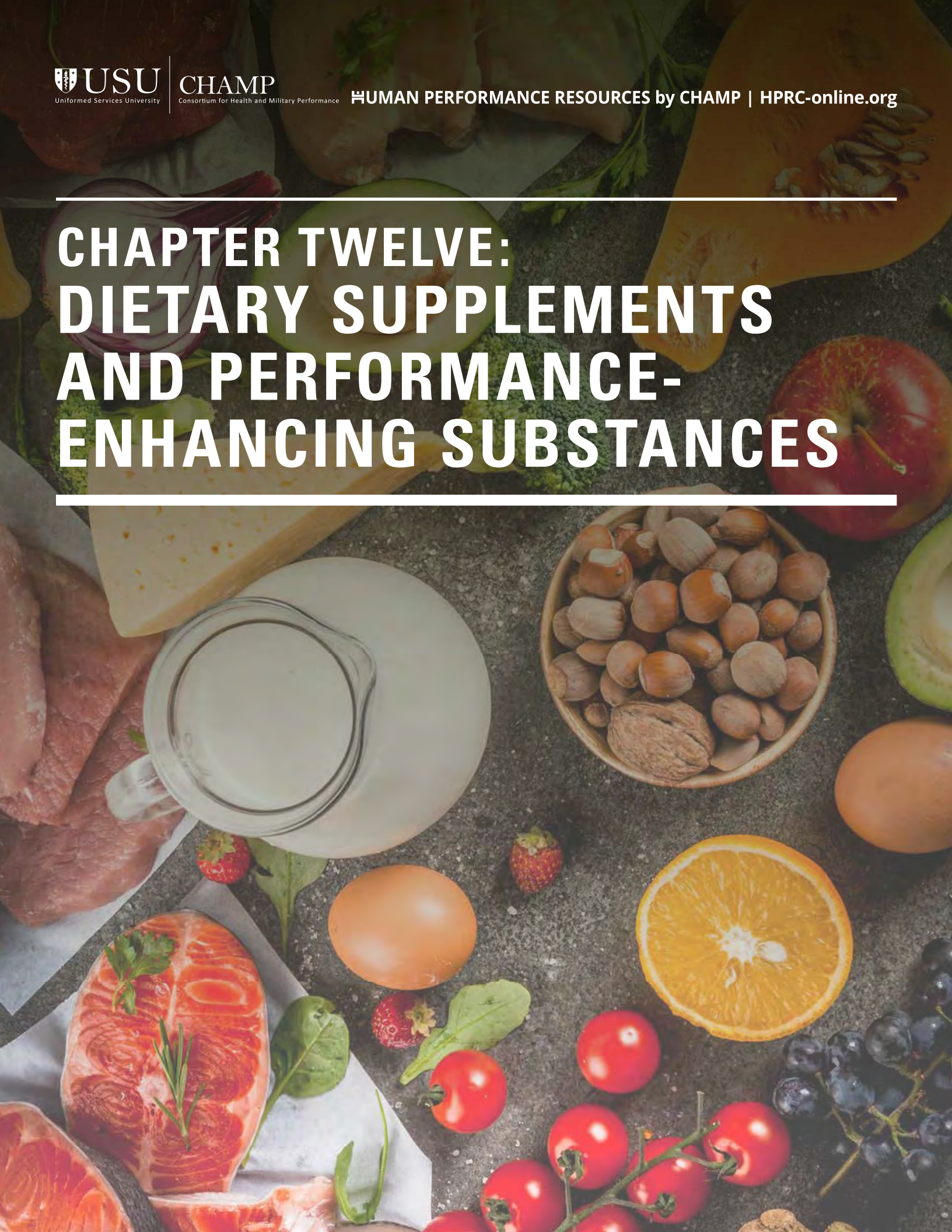
17. Institute of Medicine, Food and Nutrition Board, Committee on Military Nutrition Research, Marriott, B. M., & Carlson, S. J. (Eds.). (1996). *Nutritional Needs in Cold and in High-Altitude Environments: Applications for Military Personnel in Field Operations*. Washington, DC: National Academy Press.

18. Butterfield, G. E., Gates, J., Fleming, S., Brooks, G. A., Sutton, J. R., & Reeves, J. T. (1992). Increased energy intake minimizes weight loss in men at high altitude. *Journal of Applied Physiology*, *72*(5), 1741–1748.

19. Headquarters, Department of the Army. (2010). *Altitude acclimatization and illness management* (TB MED 505). Department of the Army, Washington, DC. Retrieved from: http://www.apd.army.mil/epubs/DR_pubs/DR_a/pdf/web/tbmed505.pdf

20. Montain, S. J., & Ely, M. (2012). Water requirements and soldier hydration. In K. E. Friedl & W. R. Santee (Eds.), *Military Quantitative Physiology: Problems and Concepts in Military Operational Medicine* (pp. 181–204). Fort Detrick, MD: Office of the Surgeon General, United States Army, U.S. Army Medical Department Center and School, Borden Institute.

CHAPTER TWELVE: DIETARY SUPPLEMENTS AND PERFORMANCE-ENHANCING SUBSTANCES



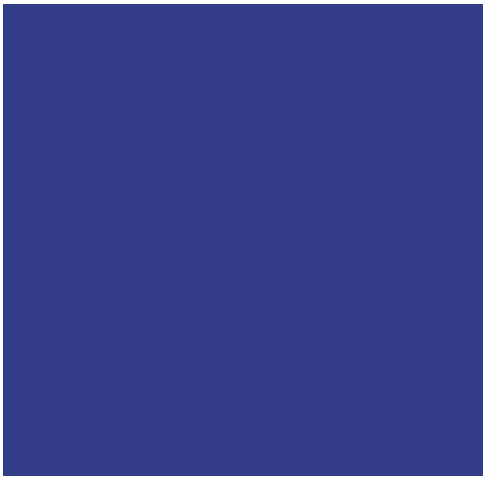
IN THIS CHAPTER

- Dietary supplements and the law
- Adverse events
- How to evaluate products
- Ingredients and products of concern
- DS and overall health
- Where to go for more information
- Energy drinks
- Nicotine

KEY POINTS

- Dietary supplements, including those sold on military installations, are not always safe, effective, or legal.
- Manufacturers of dietary supplements are responsible for ensuring products are properly labeled and safe.
- The Food and Drug Administration (FDA) must be able to prove a dietary supplement is unsafe before it can be taken off the market.
- If you use dietary supplements, select high-quality products with third-party certification seals.
- Energy drinks can contain caffeine that is not disclosed on the label; the combinations of ingredients commonly found in energy drinks have unknown effects.

The most common reasons active-duty Military Service Members use dietary supplements (DS) include promoting general health, losing weight, improving performance[1], increasing muscle mass, enhancing energy levels, and increasing strength. More than 65% of Americans take some type of DS. Sales of vitamins, minerals, herbs, meal supplements, sports-nutrition supplements, and specialty supplements exceeded $43 billion in 2017.[2] The purpose of this chapter is to provide an overview of dietary supplements, their regulatory framework, how to spot red flags, adverse events associated with some DS, and information about some ingredients and products of concern. This chapter is not all-inclusive; more information can be found at Operation Supplement Safety (**OPSS**), the DoD-wide effort that provides up-to-date, evidence-based information on dietary supplements.



DIETARY SUPPLEMENTS AND THE LAW

Regulation and oversight

In 1994 Congress passed the Dietary Supplement Health and Education Act (DSHEA) to amend the Food, Drug, and Cosmetic Act of 1938. DSHEA changed the regulation and labeling of dietary supplements. It gave the U.S. Food and Drug Administration (FDA) regulatory control over DS. The law also requires that the label of a DS provide the name and quantity of each ingredient or **proprietary blend**. The manufacturer must provide this information, and most consumers assume that the information on labels is truthful and not misleading. However, this is not always the case.

What is a dietary supplement?

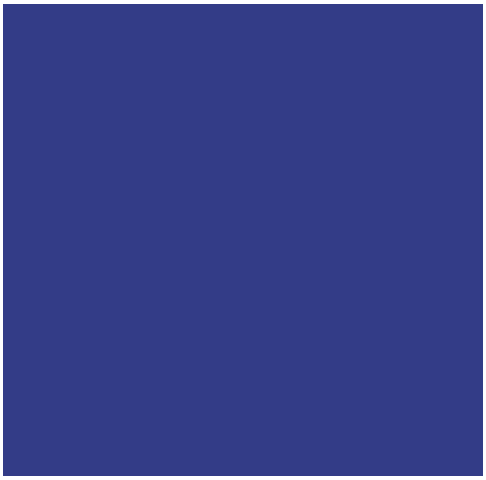
DSHEA defines a dietary supplement as a product taken by mouth (other than tobacco) intended to supplement the diet by increasing the total dietary intake[3] and containing one or more of the following dietary ingredients: vitamins, minerals, herbs or other botanicals, amino acids, and substances such as enzymes, organ tissues, glandulars, and metabolites. Under DSHEA, DS can be extracts or concentrates and may come as tablets, capsules, softgels, gelcaps, liquids, or powders.

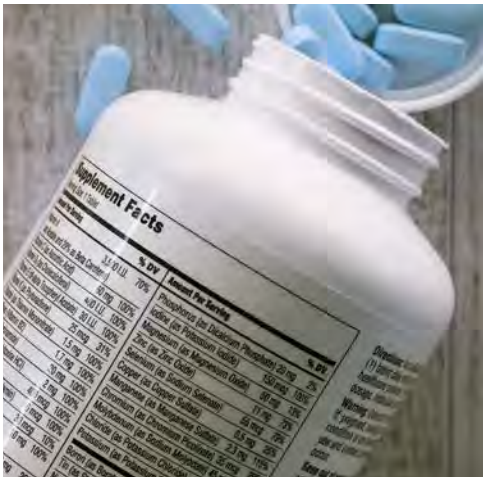
New dietary ingredients

FDA also regulates whether new ingredients are permitted. Technically, almost any ingredient that occurs "naturally" can be sold in the U.S. as a DS, but Federal rules don't require makers of DS to test all their ingredients. Instead, the law states that supplement ingredients in the food supply or sold as DS in the U.S. before 15 October 1994 are presumed to be safe and are not subject to FDA review for safety. However, any dietary ingredient not marketed in the U.S. before 15 October 1994 is considered a "new dietary ingredient" (NDI) and must undergo FDA review for safety. But no list of dietary ingredients in DS marketed before 15 October 1994 exists, so manufacturers and distributors are responsible to determine if an ingredient is NDI.[4]

Rules for manufacturing[5]

Facilities in which DS products are manufactured and packaged must comply with Current Good Manufacturing Practices (CGMPs). In June 2007, FDA announced new Federal regulations that require DS to be produced in a manner that ensures certain quality standards, such that they do not contain contaminants or impurities and are accurately labeled. Manufacturers are now required to test all of the ingredients in their products to make sure they are neither adulterated nor contaminated.[6]





To report an adverse event, or even if you suspect one, you can fill out a form through the Safety Reporting Portal.

The Food Safety Modernization Act (FSMA) of 2011 clarified and expanded this to include registration and inspection of facilities that manufacture, process, package, or hold dietary supplements for U.S. consumption.

Supplement Facts labeling requirements

FDA requires a "Supplement Facts" label on every DS product. Read the OPSS article on **labeling of dietary supplement products** to learn more.

FDA also regulates what claims may (or may not) be made, while the Federal Trade Commission (FTC) enforces unproven, misleading, or deceptive advertising claims. **Some DS products contain undisclosed ingredients** such as prescription and/or over-the-counter drugs, steroids, steroid-like ingredients, and stimulants. Products marketed for bodybuilding, weight loss, and sexual enhancement are more likely than others to contain undisclosed ingredients.

DSHEA regulations contain many gaps, including:

The manufacturer is responsible to ensure that products are properly labeled.
Supplement ingredients sold in the United States before 15 October 1994 are presumed to be safe and are not subject to FDA review for safety.
The manufacturer is responsible for providing evidence of safety.
Before a product can be removed from the market, FDA must prove it is **not safe**.
Government resources to monitor DS quality and safety are limited.

ADVERSE EVENTS

"Adverse events" are unfavorable or unusual reactions/effects/illnesses that can occur with the use of DS.

Examples of adverse events include anxiety, headaches, increased blood pressure, vision problems, stroke, heart arrhythmia, and death. Such adverse events might be due to one DS taken alone, combinations of DS, or interactions between drugs and DS.

Be sure to listen to your body, pay attention to how you feel, and keep a written list of all prescription drugs, DS products, and over-the-counter medications you are taking. Tell your healthcare provider about all DS you are taking and any changes in your health status, particularly if you start to feel symptoms you did not experience prior to taking the DS. It is always best to **talk to a healthcare provider before taking any dietary supplement**.

HOW TO EVALUATE PRODUCTS

Shop smart: Look for products that are third-party certified

Third-party certification seals confirm independent testing and evaluation of dietary supplements and their ingredients and ensure that manufacturing and storage facilities comply with GMP (or similar) requirements. The companies that conduct such reviews vary widely in terms of how they approach the certification process and how they test products. Certification programs confirm that a product contains the ingredients listed on the label. They do not ensure a product's effectiveness or safety.

The seals of 3 of the most common organizations (BSCG, LGC, and NSF) also ensure a product has been tested for and does not contain ingredients banned by the World Anti-Doping Agency (WADA). Another (USP) does not test for substances banned in sport, but it does verify the ingredients and their amounts in products. Note: All such testing is essentially a snapshot in time of a particular product and is no guarantee that future batches will have the same test results.

If you choose to use dietary supplements, look for products that are **third-party certified**.

Dietary supplement red flags

Despite growing popularity among military personnel, some DS on the market are tainted and unsafe. OPSS has an article about **how to spot red flags**. Ask yourself the red-flag questions to minimize your risk of consuming potentially harmful products. If you can answer "Yes" to any of the questions, you might want to reconsider taking that product.

DS companies often put a seal or stamp on their website or their product labels with words such as "Certified GMP," "FDA Approved Facility," or "CGMP Inspected Facility." There is no "official" seal or stamp, and misuse of FDA's logo is illegal. FDA does not approve or certify facilities or DS products. FDA does have the authority to inspect facilities and ensure they comply with CGMP regulations.

INGREDIENTS AND PRODUCTS OF CONCERN

Some DS products contain ingredients that are not legitimate dietary ingredients, including steroids, steroid-like substances, and other ingredients. FDA has found that bodybuilding, weight-loss, and sexual-enhancement products are the most common types of DS that contain undeclared drugs, which could cause issues with drug screening.

OPSS has a web page about **DoD-prohibited substances** that FDA, the Drug Enforcement Agency, and/or the U.S. Armed Forces have disallowed, including

Stimulants

Please read the OPSS articles about the following stimulants found in DS:

Acacia rigidula

BMPEA

Caffeine

DMAA

DMBA

Ephedra

Methylsynephrine

Synephrine

Yohimbe

The OPSS article about **stimulants in dietary supplements** has a more extensive list.

Other ingredients of concern

Aromatase inhibitors

Cannabidiol (CBD)

DHEA analogs

Kratom

Peptide hormones, including information about IGF-1 and HGH

a list prepared by OPSS of prohibited ingredients sometimes found in products labeled as DS.

Stimulants

In general, stimulants are substances that affect the chemicals that convey messages between your brain and the rest of your body in a way that makes you more alert. But they also can increase your heart rate and blood pressure. In some cases, stimulants also can make you feel euphoric. And some stimulants are more powerful than others.

The OPSS article about **stimulants in dietary supplements** has a more extensive list than the one at left.

Steroids, steroid-like ingredients, testosterone boosters, and SARMs

Anabolic steroids have been linked to liver toxicity, testicular shrinkage, breast enlargement in males, adverse effects on lipid levels, and increased risk of heart attack and stroke. Anabolic steroids are classified as "**controlled substances**" and are illegal to purchase, use, or possess without a prescription, as well as banned by most athletic associations. They are not DS, although they can be found in some products sold as DS, sometimes listed on the labels and other times not disclosed. For more information about anabolic steroids, visit the **National Institute on Drug Abuse**.

Some DS products contain synthetic anabolic androgenic steroids sometimes referred to as "designer steroids," "prohormones," or "testosterone boosters." For more information about these, read the OPSS article about **testosterone boosters** and **designer steroids**. There is no reliable scientific evidence that prohormones and testosterone boosters are effective to improve performance or increase testosterone levels, and there isn't enough research as to their safety.

Also of concern are SARMs—selective androgen receptor modulators. They are synthetic drugs and are not allowed for use as ingredients in DS or, currently, for any use other than research. For more information, please read the **OPSS web page about SARMs.**

DIETARY SUPPLEMENTS AND OVERALL HEALTH

In certain situations, some DS can benefit your health. Chapter 4 addresses vitamin and mineral supplements. You might need a fish-oil supplement, as discussed in Chapter 16, if foods high in omega-3s are not available. However, they should only be taken under the supervision of a healthcare provider. Chapter 16 also addresses joint supplements.

For women who are pregnant or of childbearing age, read the OPSS article about **dietary supplements while pregnant**.

WHERE TO GO FOR MORE INFORMATION

- OPSS
- FDA: Dietary Supplements
- Federal Trade Commission: Dietary Supplements
- National Center for Complementary and Integrative Health: Dietary and Herbal Supplements
- Office of Dietary Supplements (ODS)
- MedlinePlus: Drugs, Herbs and Supplements

ENERGY DRINKS

Energy drinks are beverages designed to give a burst of energy. Some are classified as DS (these have a Supplement Facts label) but nearly all are conventional foods (which carry a Nutrition Facts label). Typically, they contain a combination of sugars, caffeine, B vitamins, amino acids, and/or herbal ingredients. The long-term effects of the various energy-drink ingredient combinations are unknown. Potential side effects of energy drinks include an increase in heart rate and blood pressure, anxiety, and nervousness. Energy drinks should not be used while exercising, during training or missions, or with alcohol. FDA has issued warnings regarding the addition of caffeine to alcoholic beverages (including energy drinks with alcohol), because caffeine can mask the effects of alcohol.[7] Manufacturers of such products were required to remove them from the market.

Please see the OPSS article for more information about the ingredients found in **energy drinks**.

NICOTINE

Nicotine, like caffeine, exerts potent effects on the human body.[8] It is considered a psychoactive drug, which means it alters the normal functioning of the brain by stimulating the central nervous system. This results in a nicotine "buzz" or "high." Some people use smokeless tobacco for performance enhancement. Smokeless alternatives can contain higher nicotine concentrations than cigarettes.[8] When smokeless tobacco is placed in the mouth, the nicotine is readily taken up into the small blood vessels that line the mouth and gums, after which it travels through the bloodstream to the brain, where it exerts multiple effects.

Self-reported "benefits" of nicotine include:

Decreased appetite
Decreased pain
Control or reduction of body weight
Ability to focus attention
Increased energy

The reported ability of nicotine to focus attention or "enhance mental state" is why users claim their reaction time and performance are enhanced. However, studies consistently find no differences in reaction times between users and nonusers of smokeless tobacco.

Some studies have examined the effects of nicotine (using forms that did not require smoking) on exercise performance.[9] The results suggested that it might have some performance-enhancing benefits, but more studies are needed.

Nicotine has some very detrimental effects:[10]

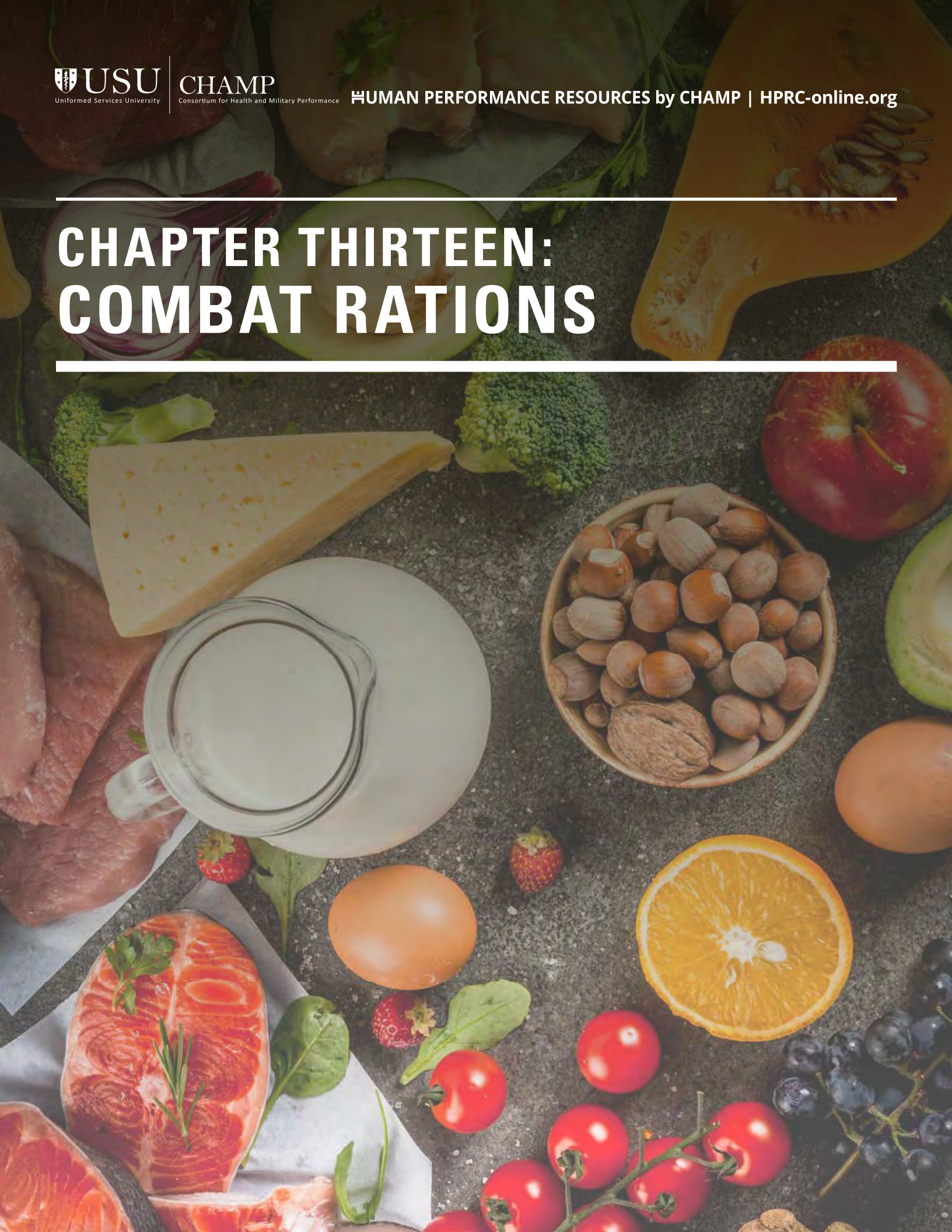
It increases blood pressure, heart rate, and rate of respiration.
It constricts/tightens blood vessels, which leads to increases in blood pressure and heart rate.
It stimulates the nervous system.

Although nicotine might have performance-enhancing benefits, they do not outweigh the negative effects of potential nicotine dependence and withdrawal. The Centers for Disease Control and Prevention has a **fact sheet** on the health effects of smokeless tobacco, including information about nicotine addiction. And read HPRC's article about **vaping** to learn why it is not a safe alternative, with or without nicotine.

CHAPTER 12 REFERENCES

1. Austin, K. G., McLellan, T. M., Farina, E. K., McGraw, S. M., & Lieberman, H. R. (2016). Soldier use of dietary supplements, including protein and body building supplements, in a combat zone is different than use in garrison. *Applied Physiology, Nutrition, and Metabolism*, *41*(1), 88–95. doi:10.1139/apnm-2015-0387
2. Nutrition Business Journal. (2018). *Supplement Business Report 2018*. New Hope Network, http://images.info.newhope.com/Web/NewHopeNaturalMedia/%7Bd6521f56-fca7-448f-84bb-2b3911741c88%7D_Supplement_Business_Report-PREVIEW_2018.pdf
3. U.S. Food & Drug Administration (FDA). (19 June 2018). *Questions and Answers on Dietary Supplements*. Retrieved 27 September 2017 from https://www.fda.gov/food/dietarysupplements/usingdietarysupplements/ucm480069.htm
4. U.S. Food & Drug Administration (FDA). (29 November 2017). New Dietary Ingredients in Dietary Supplements – Background for Industry. Retrieved 29 November 2017 from https://www.fda.gov/Food/DietarySupplements/NewDietaryIngredientsNotificationProcess/ucm109764.htm
5. U.S. Food & Drug Administration (FDA). (2010). Guidance for Industry: Current Good Manufacturing Practice in Manufacturing, Packaging, Labeling, or Holding Operations for Dietary Supplements; Small Entity Compliance Guide. Retrieved 27 September 2017 from https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/ucm238182.htm
6. U.S. Food & Drug Administration (FDA). (2008). Guidance for Industry: Final Rule Declaring Dietary Supplements Containing Ephedrine Alkaloids Adulterated Because They Present an Unreasonable Risk; Small Entity Compliance Guide. Retrieved 27 September 2017 from https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/ucm072997.htm
7. Centers for Disease Control and Prevention (CDC). Smokeless Tobacco: Health Effects. Retrieved 27 September 2017 from https://www.cdc.gov/tobacco/data_statistics/fact_sheets/smokeless/health_effects/index.htm
8. Pesta, D. H., Angadi, S. S., Burtscher, M., & Roberts, C. K. (2013). The effects of caffeine, nicotine, ethanol, and tetrahydrocannabinol on exercise performance. *Nutrition & Metabolism*, *10*(71), 1–15. doi:10.1186/1743-7075-10-71
9. Johnston, R., Doma, K., & Crowe, M. (2018). Nicotine effects on exercise performance and physiological responses in nicotine-naïve individuals: A systematic review. *Clinical Physiology and Functional Imaging*, *38*(4), 527–538. doi:10.1111/cpf.12443

CHAPTER THIRTEEN: COMBAT RATIONS



IN THIS CHAPTER

KEY POINTS

- Combat rations provide optimal amounts of energy and nutrients to meet the needs of Warfighters in various operational environments.
- Good nutrition is a key enabler for successful military operations.
- Enhancement packs also are available to supplement military rations with components tailored to specific operational environments.

Military rations are the cornerstone of combat and field feeding. The type of ration a Warfighter needs depends on his or her unit's mission, location, and availability of personnel and equipment to prepare meals. All military rations are designed to meet or exceed the nutritional standards in AR 40-25, OPNAVINST 10110.1/MCO 10110.49, and AFI 44-141: *Nutrition and Menu Standards for Human Performance Optimization*.[1] Warfighters should consume all or most of the rations provided because they're specially formulated to provide the fuel needed for optimal performance. This chapter provides an overview and descriptions of selected rations. **Combat Rations Database (ComRaD)** provides detailed nutrition information for Meal, Ready-to-Eat (MRE), First Strike Rations® (FSR), Meal, Cold Weather (MCW), and others. All of these are available in multiple menu options.[2]

INDIVIDUAL RATIONS

Meal, Ready-to-Eat (MRE)

MRE is the primary general-purpose ration for the individual Warfighter. Issued as a self-contained combat ration, it's designed for use as a single meal. Each MRE provides about 1,285 calories, including 40 grams protein, 176 grams carbohydrate, and 47 grams fat, meeting or exceeding the nutritional standards for operational rations.

Several ration components are fortified with specific vitamins and minerals to optimize nutritional content.[3] In a field environment, however, Warfighters often remove ration components to reduce weight. If you choose to "field strip," **don't remove your entrée or fortified items** such as beverage bases, chocolate protein drink, cheese spread, peanut butter, crackers, snack breads, pudding, fruits, and First Strike bars. Otherwise, you won't have the energy and nutrients you need to perform optimally.

Warfighters can consume MREs as their sole source of nutrition for up to 21 days. When MRE is the sole ration, units also should be provided with supplements (for example, milk) and enhancements (for example, bread and fresh fruit) whenever possible. After 21 days, other appropriate rations should be included in the daily field-feeding plan.

Meal, Cold Weather (MCW)

MCW is an individual ration designed for use during missions in extreme cold weather. The lightweight MCW contains dehydrated, precooked entrees and other low-moisture foods (granola, dried fruits, nuts, ramen noodle soup) that will not freeze. Each menu includes several beverages to encourage water consumption and prevent dehydration during cold-weather activities. Approximately 28–40 ounces of potable water are needed to rehydrate the ration components within each menu.

Each MCW menu provides an average of 1,600 calories, including 51 grams of protein, 227 grams of carbohydrates, and 58 grams of fat. Three MCWs (food for 24 hours) provide more than 4,500 calories, which is needed to meet the increased energy requirements when conducting operations in extreme cold-weather environments.

First Strike Ration® (FSR)

FSR is a compact, eat-on-the-move assault ration designed for use by an individual during short-duration, high-intensity missions.[3] FSR is substantially lighter and more compact than MRE, enhancing Warfighter consumption, nutritional intake, and mobility. FSR contains familiar, eat-out-of-hand foods that require little or no preparation.

Each FSR (food for 24 hours) provides around 2,900 calories, including 91 grams protein, 421 grams carbohydrates, and 98 grams fat.

GROUP RATIONS

The family of Unitized Group Rations (UGR) provides high-quality group meals to Warfighters during operations that allow organized food-service facilities. Each UGR contains all the items necessary for field-feeding 50 Warfighters, allowing culinary specialists to focus on food preparation instead of administration.

There are multiple ration types in the UGR family, including UGR-A, UGR-Heat & Serve (UGR-H&S), UGR-Marines (UGR-M), and UGR-Express (UGR-E).

UGR-A

UGR-A consists of both shelf-stable and perishable components. It delivers the highest-quality, most fresh-like field-feeding ration available anywhere. UGR-A is the only military operational ration that contains frozen food components. For this reason, it's based on a build-to-order assembly process that requires refrigerated or frozen storage and a field kitchen for preparation. The average UGR-A menu, including shelf-stable milk, provides approximately 1,270 calories, including 52 grams protein, 161 grams carbohydrates, and 45 grams fat.

UGR-A, Short-Order expands the variety of food choices, offering a choice between standard UGR-A "mainline" and "short-order" dinners.

UGR-H&S

UGR-H&S is the first group ration available for use in theater. Used in combination with MRE for daily feeding, its components are shelf stable and can be prepared in field kitchens without refrigeration. Each menu contains an entrée, starch, vegetable, and dessert.

The average UGR-H&S menu, including shelf-stable milk, provides approximately 1,370 calories, including 47 grams protein, 183 grams carbohydrates, and 50 grams fat.

UGR-M

UGR-M (formerly UGR-B) is the primary group ration for the Marine Corps. It meets the Marines' expeditionary requirements for high-quality group rations that are shelf stable (no refrigeration needed), quick, and easy to prepare. The average UGR-M menu, including shelf-stable milk, provides approximately 1,300 calories, including 46 grams protein, 176 grams carbohydrates, and 46 grams fat.

UGR-E

UGR-E provides complete group meals for Warfighters in remote locations where group field feeding wouldn't otherwise be possible. In addition, these meals don't require cooks or a field kitchen for preparation. With the simple pull of a tab, UGR–E is ready to serve in 30–45 minutes. One UGR-E module provides everything needed for a complete meal, including entrées, starches, vegetables, desserts, drink pouches, snacks or candies, dining trays, seasonings, disposable eating and serving utensils, condiments, beverages, napkins, wet-naps, and trash bags.

Each meal provides approximately 1,360 calories, including 39 grams protein, 179 grams carbohydrates, and 55 grams fat.

SURVIVAL RATIONS

Survival, General Purpose

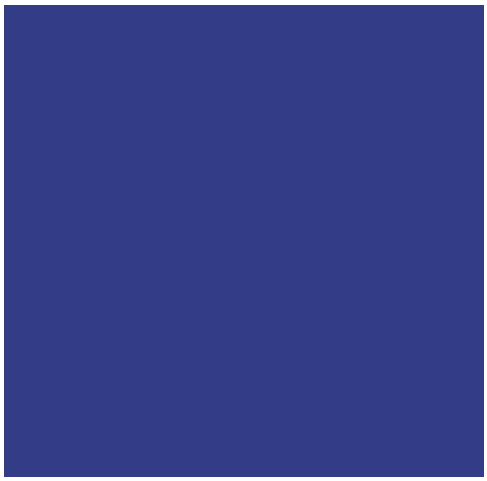
Survival, General Purpose can sustain anyone in survival situations (including escape and evasion, all environmental conditions, and when potable water is limited) for periods up to 5 consecutive days. The ration contains 5 compressed bars (2 cereal bars and 3 cookie bars), wintergreen tablets, lemon tea, and soup base. Each packet provides approximately 1,450 calories, including 18 grams protein, 200 grams carbohydrates, and 63 grams fat. This ration provides crucial nutrients and minimizes carry weight (one packet weighs 11.4 ounces). You'll need 14 oz water to reconstitute the lemon tea and soup.

Survival, Abandon Ship

The Navy uses this ration when it's necessary to abandon ship. Designed to fit in the storage areas of lifesaving craft, each packet contains a minimum of 6 individually wrapped bars (2 per day for 3 days) to sustain one person. The ration is strictly short-term survival food to minimize the effects of acute starvation. Each 20-ounce packet provides approximately 2,400 calories (54% carbohydrates) and is compatible with potable water restrictions.

Survival, Aircraft, Life Raft

The Navy uses this ration to sustain personnel who survive aircraft disasters at sea. The packet, along with other essential equipment, is supplied in emergency kits on naval aircraft. The ration weighs 3.5 ounces and contains hard candy and candy-coated chewing gum. It also includes an instruction sheet explaining that the food is good for a 24-hour period, even when water supply is limited. Each packet provides approximately 300 calories (100% carbohydrates). It's strictly short-term survival food to reduce the effects of acute starvation. The components also are compatible with potable water restrictions.



SPECIAL-PURPOSE RATIONS

Meal, Religious, Kosher/Halal

The Meal, Religious, Kosher/Halal is for those who maintain a strict religious diet. Each meal consists of one Kosher- or Halal-certified entrée and other religiously certified or acceptable complementary items. Like MRE, it's a complete, self-contained meal that provides approximately 1,330 calories, including 36 grams protein, 178 grams carbohydrates, and 53 grams fat. A Kosher for Passover version also is available.

ENHANCEMENT PACKS

Modular Operational Ration Enhancement (MORE)

Warfighters in extreme environments such as cold weather, high altitude, or elevated temperature require extra calories beyond the standard operational rations in order to combat weight loss and decreased physical and cognitive performance. MORE provides extra calories for these unique environmental scenarios. It isn't intended to replace a ration. Instead, these are nutritionally balanced **additions** that help ensure peak performance, even in harsh battlefield conditions.

MORE contains lightweight, compact, eat-on-the-move components that are easy to consume and digest. Each pack weighs about 0.75 pounds and provides approximately 1,000 calories per pack.

COMBAT RATIONS RESEARCH AND DEVELOPMENT

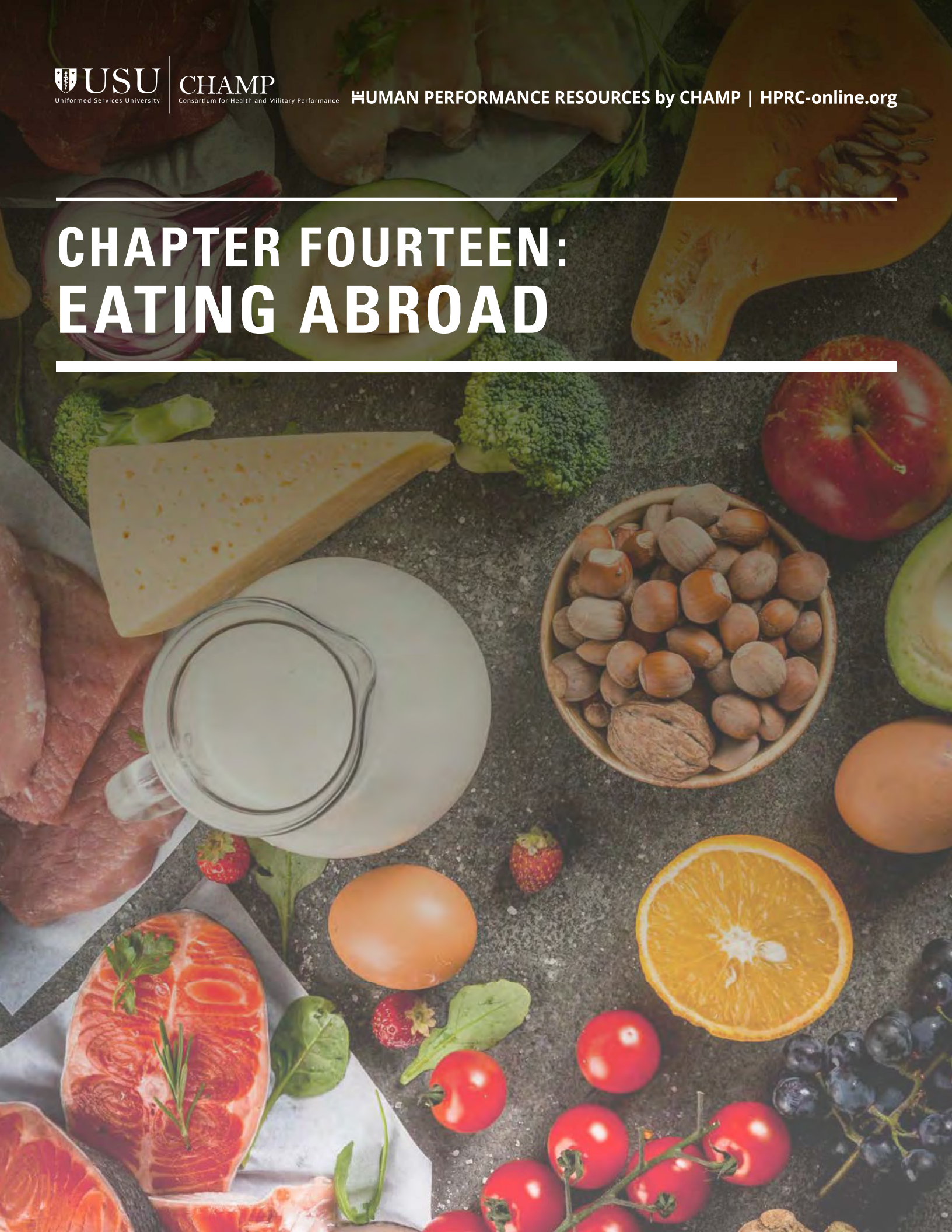
The mission of the DoD Combat Feeding Research and Engineering Program is to provide an operationally relevant research-and-development base to deliver solutions for evolving field-feeding challenges.

The Combat Feeding Directorate is responsible for the research, development, engineering, integration, and technical support for the entire family of operational rations.[2] The program is driven by Warfighter recommendations and feedback.

CHAPTER 13 REFERENCES

1. Headquarters, Departments of the Army, the Navy, & the Air Force. (2017). *Nutrition and menu standards for human performance optimization* (AR 40–25/OPNAVINST 10110.1/MCO 10110.49/AFI 44–141). Departments of the Army, the Navy, and the Air Force, Washington, DC. Retrieved from: https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/AR40-25_WEB_Final.pdf
2. Defense Logistics Agency. Rations Programs/Products. *DLA Troop Support Subsistence*. Retrieved 27 April 2017 from http://www.dla.mil/TroopSupport/Subsistence/Operationalrations/RationsPrograms.aspx
3. Institute of Medicine, Food and Nutrition Board, Committee on Military Nutrition Research, & Committee on Optimization of Nutrient Composition of Military Rations for Short-Term High-Stress Situations (Eds.). (2006). *Nutrient Composition of Rations for Short-term, High-intensity Combat Operations*. Washington, DC: National Academies Press.

CHAPTER FOURTEEN: EATING ABROAD



IN THIS CHAPTER

- Cultural awareness
- Foodborne illness
- Water purification
- Prevention and treatment of foodborne illness
- When to seek medical help

KEY POINTS

- When dining abroad, be aware of basic customs, dining habits, and other cultural differences associated with mealtimes.
- Take extra precautions with raw meat, poultry, shellfish, eggs, fresh produce, and other foods associated with foodborne illnesses.
- Carefully wash your hands before you eat and after you use the bathroom in order to prevent illness and the spread of infection to others.
- Make sure to purify your water; drinking contaminated water can put you at risk of serious illness.
- Carry an antibiotic (prescribed by your physician) and seek medical treatment for symptoms of foodborne illness from contaminated foods or beverages.

Most operations take place on the soil of other countries, and each country, region, and even town might have its own distinct customs. Food is a large part of any culture, so sharing meals can be a great way to interact and form relationships with local people. Enjoying the local cuisine is important, but some foods or approaches to preparing meals can lead to illness for those unaccustomed to such practices. This chapter covers cultural differences and how to avoid foodborne illnesses.

CULTURAL AWARENESS

Cultural awareness means recognizing, understanding, appreciating, and respecting the different perspectives and customs of other cultures. Become familiar with the local customs and cultures to avoid stereotyping, prejudice, and insulting your host, particularly when it comes to dining. Since each country has its own distinct culture and customs, there are things to consider and research before you deploy.

Basic customs

Know whether punctuality is or is not emphasized.

Use the appropriate customary greeting (handshake, bow, etc.).

Learn if it's customary to bring a gift, food, or beverages to your host's home or office. In some cultures, it's impolite to do so and implies that you're paying for your meal, or it might even be an insult to your host's cuisine.

Know whether it's customary to eat everything or leave some food on your plate. Don't waste food, because your host might have gone to great expense to prepare an extravagant meal. On the other hand, don't gorge yourself. In some cases what you consume might be at the expense of feeding your host's family.

Avoid rushing through a meal. Eating with others is often as much for social interaction as it is for nourishment.

Learn whether a certain prayer or phrase is spoken before or after meals and be respectful during this ritual.

Be respectful to the food and your host. Food has different meanings in other countries, and some items or practices might be considered sacred.

Find out who is supposed to eat first. Is it your host, other guests, or the person of highest status?

Soup and appetizers

Is slurping soup considered rude, or is it acceptable or even a complimentary sign of enjoyment?

Is it customary for appetizers or soup to be served before your meal? Avoid filling up on these items, so you can enjoy your main course.

Meat and fish

Some religions don't allow certain meats to be consumed. For example, laws in Islam and Judaism prohibit eating pork. Some Jews also don't eat shellfish or catfish. Similarly, Hindus don't eat beef.

In some parts of the world, dogs, cats, and horses are pets, while in others they might be food animals. Don't be surprised or put off if your host serves lamb, goat, horse, dog, camel, or monkey.

In many cultures, people eat or cook with all parts of an animal, including brains, organs, feet, intestines, and more.

Hospitality

Observe how your host treats you or others visiting his or her office, which might include serving food or beverages. Then behave similarly and, if you've learned it's appropriate, serve something when others visit your office.

In some cultures, refusing beverages and food when offered is considered rude. In others, it might be a gesture that should be refused altogether or accepted only after a certain number of offers.

Mealtimes

Some meals are eaten at hours you might find unusual. Don't expect or ask to eat at other times.

Meals might last longer than what you consider normal, so diners can digest, talk, and relax. Don't ask to leave too early.

Muslims fast from sunrise to sundown during the month of Ramadan.

Eating utensils

Some diners use forks as primary eating utensils while others use their hands, spoons, or chopsticks. Try to become familiar with the different utensils, including how and when they should be used during mealtimes.

Learn where to place your utensils when they're not being used. For example, in some Asian countries, it's disrespectful to stick your chopsticks upright in your rice. Place them on your plate or on a chopstick rest if one is available.

Follow your host's lead. For example, does he or she push rice from the bowl directly into his or her mouth or eat it with a utensil? And does your host use a spoon to consume soup or drink directly from the bowl?

Sometimes hand preference is important. For example, Bosnian Muslims eat with the left hand, while Arab Muslims eat with the right hand. Saudis consider the left hand unclean because it's typically used to maintain personal hygiene.

Proper attire

Dress appropriately and not too informally.

In some cultures, it's important to remove your shoes as you enter your host's home.

Paying the restaurant bill

In some countries, it's customary for the host to pay the restaurant bill. However, if you invite someone to eat out, expect to pay for his or her meal.

In addition to learning the food customs of other cultures, it's a good idea to find out what foods are commonly eaten in the country you'll be in, so you don't come across any surprises. Visit **foodbycountry.com** for more information.

FOODBORNE ILLNESS

Deploying to other countries can increase your risk of foodborne illness or infections if you consume foods or water that contain certain bacteria, viruses, or parasites. The risk of infection varies depending on where the food is eaten. Food prepared in a private home is generally considered moderate to high risk, depending on the hygiene. However, your risk is higher if you purchase ready-to-eat food from street vendors.

The 250+ different foodborne diseases have different symptoms, so there's no particular "syndrome" that describes foodborne illness.[1] The "culprit" is most often a bacterium that enters your body through the gastrointestinal (GI) tract, which causes the first symptoms: nausea, vomiting, abdominal cramps, and diarrhea. Roughly 50% of travelers in high-risk destinations develop "traveler's diarrhea." Bacterial infections can last 3–5 days, viral infections can last 2–3 days, and those caused by parasites can last 2 weeks or longer. In addition, persistent abdominal symptoms can develop after the infection has ended.

Foods associated with foodborne illness

Certain foods are typically associated with foodborne illnesses. Raw foods, particularly of animal origin, can be a major concern. Warfighters should avoid raw meat, poultry, fish, shellfish, eggs, unpasteurized milk, and fresh fruit or vegetable juice. Raw fruits and vegetables, such as salads and alfalfa and bean sprouts, can be just as risky as raw meat and fish. That's because **washing can reduce, but not eliminate, contamination**, in part because the water might be contaminated too. High-salt, high-sugar, and high-acid levels keep bacteria from growing, which is why salted meats, jams, and pickled vegetables are traditional preserved foods and usually safe to eat.

Make wise food choices

To maintain operational readiness and reduce your risk of foodborne illness, pay close attention to what you eat and drink and **always wash your hands** before eating. Try to follow these tips when eating abroad.

"Street food"

Avoid "street food" if possible.

However, if you choose to eat "street food," make sure it's cooked in front of you and steaming hot.

Don't choose anything that might have been cooked hours ago.

Cooked foods

Cooked food that's still hot is usually safe. Don't consume foods left at room temperature for longer than 2 hours.

Most bakery products are safe, but avoid those with cream or meat fillings.

Order hamburgers cooked "well done" and without lettuce or tomato. Meat, poultry, fish, and eggs also should be cooked thoroughly.

Staple items such as pasta, rice, potatoes, or other root vegetables that have been boiled or cooked over high heat are safe.

Fruits and vegetables

Avoid raw ingredients such as fresh vegetables. Fresh salads, even in many restaurants, can be contaminated due to the use of human waste for fertilizer.

Fresh fruits and vegetables with skins are usually fine if cleaned thoroughly. Scrub the skin with purified water or soap and water and then peel. If not cleaned first, surface contamination might be transferred to the fruit or vegetable during the peeling process.

Avoid fruits and vegetables that have been peeled already.

Beverages

Choose bottled or boiled water, hot beverages (such as coffee or tea) made with boiled water, and canned or bottled carbonated beverages, beer, and wine. Don't drink from containers that have been opened already.

Avoid ice in beverages because it might have been made from contaminated water.

Use purified or bottled water to brush your teeth. Don't even use small amounts of untreated water to rinse your mouth.

Avoid milk, other dairy products, and juice that have not been pasteurized.

You can get a handy pocket guide, "**Tips for Eating Local**," from the U.S. Army Public Health Command.

WATER PURIFICATION

Contaminated drinking water or food grown or prepared with contaminated water can increase your risk of traveler's diarrhea. Boiling is the most reliable method to make water safe to drink. Bring water to a rolling boil for one minute, and then allow it to cool. Boil drinking water for 3 minutes if you're at altitudes higher than 6,500 feet.[2]

You also can purify water with **chemical disinfecting agents**, specifically iodine or chlorine. These chemicals might not make water taste like bottled water from home, but they will decrease your risk of developing traveler's diarrhea. The disinfection capabilities of iodine have been recognized for many years, and iodine tablets are widely used as an emergency drinking-water disinfectant. Chlorine also is a reliable water disinfectant. Issued by the military, water purification tablets that contain chlorine kill *Giardia lamblia* cysts, bacteria, viruses, and other harmful microorganisms; they also remove sediment. Follow the manufacturer's instructions on the package for whichever method you choose.

You can use **filters to reduce microorganisms** in water too. However, this method depends on the pore size of the filter and the amounts and sizes of the contaminants in the water. It's important to carefully choose your filters because they might not effectively remove all viruses and bacteria. If a filter has a chemical disinfectant matrix, it's more likely to be effective against some viruses. Just as with chemical disinfectants, carefully read and follow the manufacturer's instructions on the package.

PREVENTION AND TREATMENT OF FOODBORNE ILLNESS

You might be able to prevent or treat many foodborne diseases. In addition to making wise food choices and drinking safe water, wash your hands before eating and after using the bathroom. If soap and water are unavailable, use an **alcohol-based sanitizer** (containing at least 60% alcohol) to clean your hands.[3]

Another preventive approach is to use Pepto-Bismol (brand name for the antacid bismuth subsalicylate). You can take it before and during international travel to help prevent diarrhea; doing so will reduce your risk of disease by half.[3] Take 2 ounces of the liquid medication 4 times daily, or 2 tablets 4 times daily, for no longer than 3 weeks. You also can use Pepto-Bismol to treat diarrhea and reduce the duration and severity of your illness.

Possible side effects of Pepto-Bismol include temporary blackening of your tongue and stools, occasional nausea and constipation, and rarely, ringing in your ears. Check with your healthcare provider before taking Pepto-Bismol, especially if you are using other medications or supplements.

You also can try probiotics (healthy bacteria or yeast), but they don't seem to work consistently. While antibiotics are effective, you shouldn't take them to prevent traveler's diarrhea unless even a short bout of diarrhea might affect your mission. Seek medical advice from your healthcare provider before going abroad.

The **treatment** of foodborne illnesses depends on your symptoms and the need to cure your infection in a timely manner. Illnesses that primarily cause diarrhea or vomiting can lead to dehydration. So, treating your traveler's diarrhea also requires you to replace lost fluids and electrolytes. Early and effective treatment also can lead to a quicker recovery.

Sometimes **food-borne illness can cause severe dehydration**, especially if you experience frequent vomiting. Symptoms include thirst, less-frequent urination that is unusually dark, dry mouth, fatigue, dizziness, and light-headedness (as discussed in Chapter 5). If you experience severe dehydration, use oral rehydration salts (ORS) solution to restore fluid losses. ORS packets—available at stores or pharmacies in almost all developing countries—are similar to Pedialyte®. Prepare ORS by adding one packet to boiled or treated water. Follow packet instructions to ensure the salts are added to the correct amount of water.

Since bacteria cause the majority of traveler's diarrhea, the **Centers for Disease Control and Prevention** recommend treatment with an antibiotic. Treatment with an antibiotic (often a single dose or one-day course) can reduce the duration and severity of traveler's diarrhea.[4] Before your deployment, your physician might provide you with an antibiotic to take with you, or you might have to seek medical care when affected to obtain this prescription treatment.

In addition to antibiotics, you can use **other medications**—such as loperamide (including over-the-counter Imodium®) or Lomotil (by prescription only in the U.S.)—to improve your symptoms. These are particularly effective when used with antibiotics. However, you should avoid such medications if you have a high fever or bloody stools because they could make your illness worse.

WHEN TO SEEK MEDICAL HELP

Foodborne illnesses can be dangerous, so it's important to seek treatment. Consult a healthcare provider when your GI illness is accompanied by:

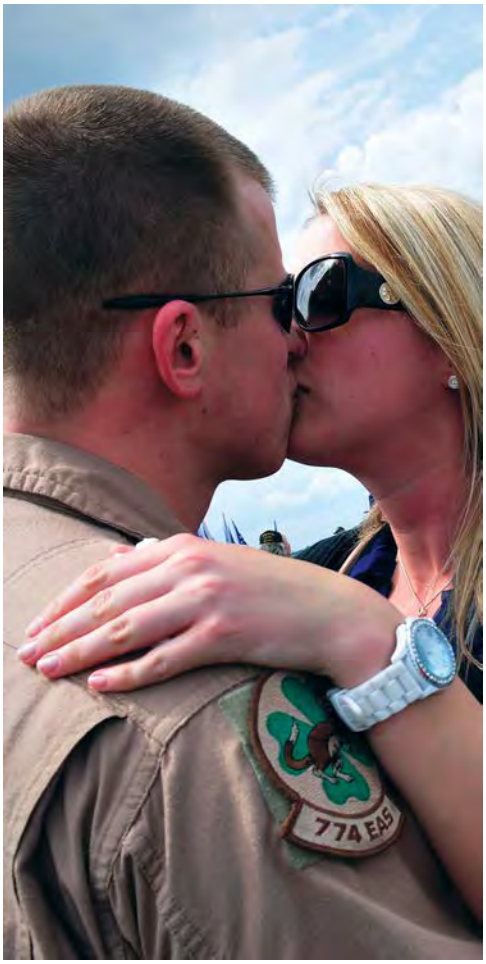
High fever (temperature over 101.5°F, measured orally)
Blood in your stools
Prolonged vomiting that prevents keeping liquids down
Signs of dehydration, including a decrease in urination, dry mouth and throat, and feeling dizzy upon standing
Diarrhea that lasts more than 3 days
Persistent GI symptoms lasting 2 weeks or longer after infection

For more information on avoiding foodborne illness abroad, visit the Centers for Disease Control and Prevention (CDC) article on **food and water safety**.

CHAPTER 14 REFERENCES

1. Centers for Disease Control and Prevention. (2016). Foodborne Germs and Illnesses. Retrieved 26 April 2017 from https://www.cdc.gov/foodsafety/foodborne-germs.html
2. Centers for Disease Control and Prevention. (2009). A Guide to Drinking Water Treatment and Sanitation for Backcountry & Travel Use. Retrieved 26 April 2017 from https://www.cdc.gov/healthywater/drinking/travel/backcountry_water_treatment.html
3. Connor, B. A. (2015). Travelers' diarrhea. CDC Yellow Book: CDC Health Information for International Travel (2014 online ed.). cdc.gov: Centers for Disease Control and Prevention. Retrieved from https://wwwnc.cdc.gov/travel/yellowbook/2016/the-pre-travel-consultation/travelers-diarrhea.
4. Yates, J. (2005). Traveler's diarrhea. *American Family Physician*, *71*(11), 2095–2100.

CHAPTER FIFTEEN: RETURNING TO HOME BASE



IN THIS CHAPTER

KEY POINTS

- Emphasize rest and rejuvenation upon return from deployment to re-optimize your mental and physical performance.
- Consistently getting quality sleep is essential to recover from deployments.
- Good nutrition and regular exercise are excellent antidotes to stress.
- Avoid binge eating and drinking upon returning from deployments. Excess food and alcohol intake can lead to unwanted weight gain and is detrimental to your overall health.

Warfighters who have been away from home for extended periods of time for deployments and training missions probably need to recalibrate basic health behaviors when they return home. During those times away, food and beverage options might not always be optimal. You might experience weight loss or weight gain during deployment depending on access to nutritious food, opportunities to exercise, and your body's response to stressful situations. Upon returning home, many Warfighters overindulge in food and alcohol, which can impact the ability to perform well. This chapter explores the web of connections between stress, sleep, exercise, and nutrition and how this can impact your health during reintegration.

THE RETURN HOME

While on deployment, Warfighters have to adjust their sleep and nutrition habits to meet mission constraints and limitations that come with being down-range. But habits that were helpful in theater might be harmful in a garrison environment.[1] Many military personnel have concerns about their eating and drinking behaviors upon returning home after a deployment. Stress from de-

ployment can sometimes lead to unhealthy nutrition decisions that add greater stress to an already hectic transition. For some Warfighters, weeks or months away from home also can result in feelings of having been deprived of comforts, which might promote binge eating and drinking. Significant problems—such as weight loss and/or gain, alcohol dependency, domestic problems, and even work-related conflicts—might occur that can affect overall military performance and general health and well-being.

Opt for nutritious food and other positive lifestyle choices to lay the foundation for a smooth transition. Healthy food choices and limited alcohol consumption also can help you maintain a healthy weight. It's important to understand that food choice is just one piece of the equation: Adequate rest and recovery, healthy sleep habits, stress-management strategies, and physical activity all contribute to Warfighter well-being. This chapter looks at each of these pieces in turn and discusses how they relate to nutrition.

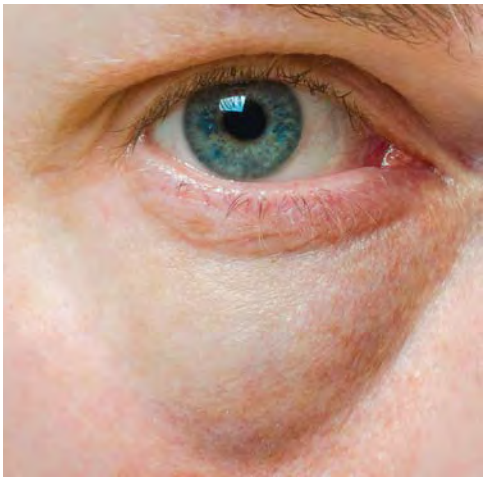
REINTEGRATION AND STRESS

Reintegration back home can feel hectic, and **dealing with your own stress** as well as the stress of your family can create even more stress. You might struggle to adapt to routines that developed in your absence, cope with the loss or injury of a teammate, or return to your role as a parent. Loved ones at home might feel stressed asking about your experiences or just bringing you back into the fold on the home front. Each of you perceives your own particular stressors as very important, and it can be difficult to understand one another.

Upon returning from combat, Warfighters often use alcohol and drugs to reduce stress, but these solutions provide only short-term relief from stress and actually contribute to stress over time. Stress also can make you more likely to smoke, have poor dietary habits, and be physically inactive. Extreme untreated stress lingering from combat can lead to violent, abusive, or threatening behaviors. And **chronic stress can disrupt the body's normal patterns**, putting you at greater risk for illness, injury, and mental-health issues.

Conversations with healthcare professionals and fellow Warfighters about deployment experiences are healthy and can be cathartic. Military commands have embedded operational, combat-focused psychologists who are familiar with unit missions, demands, and lifestyles and are available to speak with you at any time. In addition, Family Services are available on Navy, Marine Corps, Army, and Air Force bases. These services provide resources to help you manage stress, relationships, money, and family and other personal issues.

It's important to remember that **not all stress is bad**. Change and stress are inevitable, but they often provide opportunities for growth and development. **Sleep, physical activity, and nutrition provide a foundation**



for effective stress management and maximize your opportunities for post-deployment growth.

SLEEP AND REJUVENATION

Most operations away from home prevent optimal sleep, so getting high-quality, restorative sleep should be high on a Warfighter's priority list upon returning home. In fact, **rest is one of the most important aspects of recovery**, especially during times of change and transition. The mental and physical stressors of deployment might make it necessary to reset your **stress-response system** upon returning home. Lack of sleep, stress, and inadequate nutrition disrupt your body's finely-regulated internal systems. You need time off when you return from deployment to reconnect with family and friends, normalize routines within your household, and recover both mentally and physically. But many Warfighters returning home from deployments experience a variety of behavioral and emotional responses—including sleep problems—related to their war experience and combat occupational stress.

Insomnia, nightmares, and sleep disturbances are common, as the often-unpredictable environment and thoughts of the war zone can disturb sleep cycles, sleep quality, and sleep quantity. Sleep disturbances also are core features of the most common post-deployment mental health diagnoses, including post-traumatic stress disorder (PTSD), depression, and traumatic brain injury (TBI). **Sleep is vital to re-establish the normal daily patterns** needed for optimal mental and physical performance, immune function, and growth. Sleep loss also can be a risk factor for the development of a number of mental-health issues, including panic disorders, PTSD, depression, and suicide.

While the amount of sleep needed varies among individuals, most adults need regular sleep of 7 or more hours per night for optimal health.[2] The time of day you sleep depends on circadian rhythms regulated by your brain. Circadian rhythm is linked to core body temperature, so the best time to sleep is at night, including the hours between 0300 and 0500 when core body temperature is lowest.[3]

Whether deployed or in garrison, Warfighters often don't have control over how much and when they sleep. To perform optimally under such conditions, you need to be aware how your sleep habits impact your ability to be mission ready. Once you're aware and mindful of what can disrupt your sleep, you can take an active role in cultivating healthy sleep habits to take advantage of the time you do have to recover.

Sleep disruptors

Many factors, including some within your control, can prevent a good night's sleep:

Caffeine blocks the receptors that trigger sleep, so limit your intake and avoid it at least 4–6 hours before bedtime.

Nicotine acts as a stimulant and decreases your ability to fall asleep. In addition, nicotine withdrawal might cause early awakening.

Alcohol is a sedative that prevents deep, restful sleep.

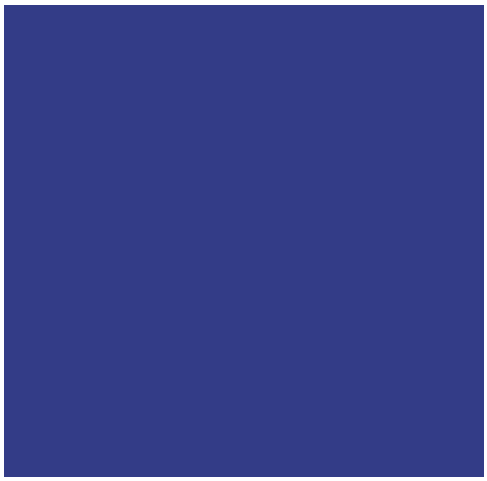
Pain and pain relievers. Some pain relievers contain caffeine, but if your pain is severe enough to interfere with your sleep, then it might be worthwhile to take one. Work with your healthcare provider to find what works best for you.

Exercise, done regularly (at least 150 minutes each week), can improve sleep quality.[4] For some people, exercising too close to bedtime might interfere with sleep, but you can experiment to find what schedule works best for you and your body.

Medications such as decongestants, steroids, and beta-blockers can reduce restorative sleep.

Late-night eating might throw off your body's internal clock and keep you awake.

Electronic devices such as smartphones, tablets, and computers give off "**blue light**," which can disrupt sleep. Avoid them within 2 hours of bedtime if possible.



Mission priorities often give Warfighters little choice but to exercise close to bedtime, eat late at night, and engage in other kinds of behaviors that disturb sleep while deployed. Among Warfighters, common sleep disruptors such as caffeine and nicotine are widespread downrange and often help Warfighters perform optimally. However, habitual use of caffeine (such as from energy drinks) and tobacco is difficult to change and can contribute to sustained sleep problems upon returning home.[5]

Healthy sleep habits

A very important habit you can develop, especially when you're back home, is to prepare your body, mind, and space for good sleep. Consider these preparations:

Take a warm bath or shower before bed.

Find a therapeutic pillow that cradles your neck and allows you to sleep on your side.

Make your bedroom a place to sleep, so your body knows it's a place for rest.

Making certain your bedroom has adequate airflow and isn't too hot or too cold.

Use a fan to block out potentially disturbing noises.

Dim the lights; darkness tells your body it's time to sleep.

Turn off all electronic devices at least 2 hours before bed.

Follow the same relaxing sleep ritual every night.

You can use questionnaires such as the **Epworth Sleepiness Scale** and the **Pittsburgh Insomnia Rating Scale** to assess the overall quality of your sleep and your risk of experiencing daytime sleepiness due to poor sleep. Tracking your sleep also can help you be more aware of patterns that help or hurt your sleep habits. Try a sleep log such as HPRC's **two-week sleep diary** or a sleep-tracking function on a mobile or wearable device to shed light on your existing sleep routines and what might impact your quality of sleep. If you continue to have a hard time sleeping, the same tools also can help you gather information to share with your doctor, so you can work together better to improve your sleep habits. To learn more about how sleep impacts Warfighter performance and how to combat sleep debt, visit HPRC's **sleep infographic**.

PHYSICAL ACTIVITY

Learn more about exercise to improve your endurance, strength, and flexibility.

Physical activity can effectively relieve stress. The act of physical exertion causes your body to release chemical substances (endorphins) similar in nature to opiates (sleep-inducing chemicals). Endorphins make you feel good and have no adverse effects, unlike many drugs. Regular exercise should be a scheduled part of any return-home plan. It even can be in the form of enjoyable recreational activities such as camping, hiking, basketball, cycling, running, or weight lifting. You also can share exercise activities with family members and friends to help your reintegration process. Or you can use exercise to create "alone time" if you need it. Making room for exercise will help keep life issues under control and promote relaxation.

ALCOHOL

Post-deployment, Warfighters often turn to alcohol to cope with stress and insomnia.[6] In fact, returning home from deployment is a common time for alcohol abuse to surface. However, alcohol provides no nutritional value, and it's high in calories (see Table 15–1), even more so when mixed with sugar-sweetened beverages such as soda or juice.

TABLE 15–1. CALORIC CONTENT OF ALCOHOLIC BEVERAGES[7]*

Alcoholic Beverages	Serving Size (ounces)	Total Calories
Beer	12	153
Light beer	12	103
Red wine	5	125
White wine	5	121
Dessert wines	3.5	157–165

Alcoholic Beverages	Serving Size (ounces)	Total Calories
Distilled spirits (gin, rum, vodka, whisky; 90 proof)	1.5	110
Mixed drinks	8	**

* Content can vary with brand or variety.

** Mixed drinks can contain even more calories due to the addition of soda, juice, and/or syrups.

Furthermore, alcohol affects mental health and performance, making it more difficult for a Warfighter to readjust to home life. Heavy alcohol consumption can have other negative effects on the body:

Liver. Your liver processes alcohol, which is why so many alcoholics and heavy drinkers experience liver damage that might not be reversible.

Pancreas. Alcohol also can damage your pancreas, which is involved in digestion. Pancreas damage can affect what you're able to eat and drink.

Heart. Alcohol increases blood pressure and puts you at risk for stroke and cardiovascular disease.

Immune system. Excessive drinking puts your immune system at risk, so you're more susceptible to infections and diseases such as cancer.

How much alcohol is acceptable?

Drinking 1–2 servings of alcohol per day is considered moderate. See Table 15–1 for typical single-serving sizes. For many people, red wine in moderation (2 drinks a day for men and one drink a day for women) can increase good cholesterol (HDL) and protect from heart disease. However, beyond these amounts, alcohol has many harmful effects.[8]

Binge drinking

Approximately one-third of active-duty Military Service Members report binge drinking.[9] Binge drinking is defined as a pattern of drinking that leads to a blood alcohol concentration of 0.08 g/dL or more.[8] In practical terms, this means 5 or more drinks for men and 4 or more drinks for women in a period of about 2 hours. Repeated intoxication prevents full participation in normal activities and fulfillment of other obligations and significantly increases the risk for alcohol-
related hospitalizations. Binge drinking is a sign of being overstressed.

To learn more about the dangers of binge drinking and how to get help, visit **Military OneSource**.

PUTTING IT ALL TOGETHER WITH TOTAL FORCE FITNESS

Health behaviors are all interconnected. **Total Force Fitness (TFF)** is the concept that optimal performance requires a connection between mind, body, spirit, and family and social relationships. Eight domains make up TFF: physical, nutritional, medical and dental, environmental, behavioral, psychological, spiritual, and social. HPRC provides in-depth information and resources for most of these.

When your health in one domain takes a downturn, another domain likely will be affected, causing you to get stuck in a vicious cycle. Stress and insufficient sleep often go hand-in-hand because stress keeps you awake, and in turn, your inability to sleep might increase your feelings of stress. During sleep your body releases important hormones. If you don't get enough sleep, the altered levels of these hormones can have serious repercussions for your health and well-being, including increased risk of obesity, diabetes, cardiovascular disease, and mood disturbances. Lack of sleep also affects your ability to make sound moral judgments and other decisions and regulate your emotions. It also increases cognitive impairments. Sleep loss even can affect your family and social relationships by lowering your ability to interact, communicate, and interpret the emotions of others.

Sleep impacts your eating habits too. **Sleep deprivation can cause you to make poor food choices**, which can increase your risk of diabetes.[10] Shorter sleep times also are associated with higher Body Mass Index (BMI) and imbalances in the hormones that regulate hunger and appetite. Weight gain can give rise to sleep apnea and other issues that further negatively impact sleep, creating a vicious cycle.

USE NUTRITION TO BREAK THE CYCLE

When you return home from deployment, you might go for "comfort" (high-fat and high-sugar) foods. Research continues to show **strong relationships between nutrition and stress and between exercise and stress**. A high-fat, high-sugar diet combined with chronic stress is a major factor in developing obesity. In contrast, meals rich in vegetables, fruits, whole grains, and lean protein provide essential nutrients that promote mental health and contribute to a healthy weight.[11] The minerals zinc and magnesium and vitamins C, B complex, and E are important to combat stress.[12] B vitamins and magnesium also are involved in producing serotonin, a hormone that helps regulate mood and relieve stress. Making wise food and exercise choices will promote faster readjustment when returning home from deployment.

Substances likely to aggravate stress include:

Caffeine
Alcohol
Tobacco
Fried and highly-processed foods

Around the world, traditional foods are served to promote healthy sleep. In many Western countries, a glass of warm milk or a cup of chamomile tea before bed is considered a tranquilizing beverage with sleep-inducing capability. Cherries are a natural source of the sleep hormone melatonin, and tart cherry juice has been found beneficial to improve sleep duration and quality.[13] Tryptophan, found in foods such as turkey and pumpkin seeds, might affect sleep, but it depends on what else you eat at the same time. In general, it requires large amounts of tryptophan-containing foods to affect your sleep. Finally, almonds and spinach are rich in magnesium, which is known to promote sleep and relax muscles.

Taking care of yourself in all the domains of **TTF is essential for optimal health, wellness, and resilience**, especially if you're a Warfighter returning home. Nutrition plays an integral part in recovery after deployment. Positive nutrition habits can promote positive changes in the other domains, leading to a successful return to home base.

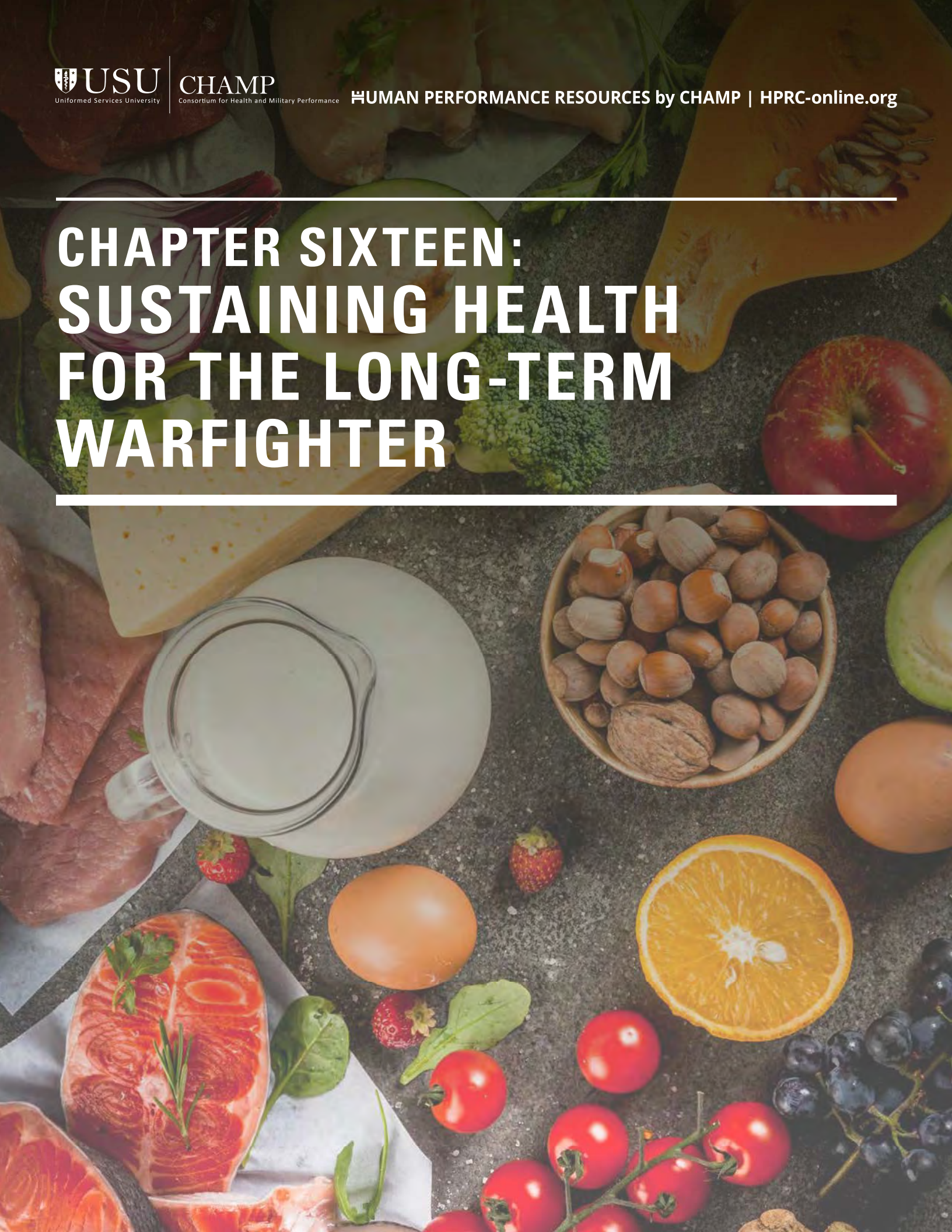
CHAPTER 15 REFERENCES

1. Adler, A. B., Britt, T. W., Castro, C. A., McGurk, D., & Bliese, P. D. (2011). Effect of transition home from combat on risk-taking and health-related behaviors. *Journal of Traumatic Stress*, *24*(4), 381–389. doi:10.1002/jts.20665
2. American Academy of Sleep Medicine, & Sleep Research Society. (2015). Recommended amount of sleep for a healthy adult: A joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society. *Journal of Clinical Sleep Medicine*, *11*(6), 591–592. doi:10.5664/jcsm.4758
3. Caldwell, J. L. (2002). Efficacy of napping strategies to counter effects of sleep deprivation, in *Sleep/Wakefulness Management in Continuous/Sustained Operations* (pp. 4.1–4.11). Neuilly-sur-Seine Cedex, France: North Atlantic Treaty Organisation, Research and Technology Organisation.
4. Loprinzi, P. D., & Cardinal, B. J. (2011). Association between objectively-measured physical activity and sleep, NHANES 2005–2006. *Mental Health and Physical Activity*, *4*(2), 65–69. doi:10.1016/j.mhpa.2011.08.001
5. Toblin, R. L., Clarke-Walper, K., Kok, B. C., & Thomas, J. L. (2012). Energy drink consumption and its association with sleep problems among U.S. service members

on a combat deployment—Afghanistan, 2010. *Morbidity and Mortality Weekly Report*, *61*(44), 895–898.

6. Roehrs, T., & Roth, T. (2001). Sleep, sleepiness, sleep disorders and alcohol use and abuse. *Sleep Medicine Reviews*, *5*(4), 287–297. doi:10.1053/smrv.2001.0162
7. United States Department of Agriculture Agricultural Research Service. (2016). USDA Food Composition Databases. Retrieved 26 April 2017 from National Agricultural Library https://ndb.nal.usda.gov/ndb/
8. National Institute on Alcohol Abuse and Alcoholism. Alcohol's effects on the body. Retrieved 26 April 2017 from http://www.niaaa.nih.gov/alcohol-health/alcohols-effects-body
9. Barlas, F. M., Higgins, W. B., Pflieger, J. C., & Diecker, K. (2013). *2011 Department of Defense health related behaviors survey of active duty military personnel*. TRICARE Manage Activity, United States Coast Guard, Fairfax, Virginia. Retrieved from: https://www.documentcloud.org/documents/694942-2011-final-department-of-defense-survey-of.html
10. Boyko, E. J., Seelig, A. D., Jacobson, I. G., Hooper, T. I., Besa Smith, Smith, T. C., & Crum-Cianflone, N. F. (2013). Sleep characteristics, mental health, and diabetes risk: A prospective study of U.S. military service members in the Millennium Cohort Study. *Diabetes Care*, *36*(10), 3154–3161. doi:10.2337/DC13-0042
11. Jacka, F.N., Maes, M., Pasco, J.A., Williams, L.J., & Berk, M. (2012). Nutrient intakes and the common mental disorders in women. *Journal of Affective Disorders*, *141*(1), 79–85. doi:10.1016/j.jad.2012.02.018
12. Kennedy, D.O., Veasey, R., Watson, A., Dodd, F., Jones, E., Maggini, S., & Haskell, C.F. (2010). Effects of high-dose B vitamin complex with vitamin C and minerals on subjective mood and performance in healthy males. *Psychopharmacology*, *211*(1), 55–68. doi:10.1007/s00213-010-1870-3
13. Howatson, G., Bell, P.G., Tallent, J., Middleton, B., McHugh, M.P., & Ellis, J. (2012). Effect of tart cherry juice (Prunus cerasus) on melatonin levels and enhanced sleep quality. *European Journal of Nutrition*, *51*(8), 909–916. doi:10.1007/s00394-011-0263-7

CHAPTER SIXTEEN: SUSTAINING HEALTH FOR THE LONG-TERM WARFIGHTER



IN THIS CHAPTER

KEY POINTS

- Eating a variety of foods is one key to healthy living and lifelong performance.
- Promote lifelong health by eating many different colorful foods, which contain important protective compounds such as antioxidants and phytonutrients.
- Omega-3 fatty acids reduce the risk of several diseases. However, try to get your omega-3s from food instead of supplements.
- Plants are rich sources of fiber, which contributes to a healthy gut and reduces the risk of certain chronic diseases.
- Products containing probiotics (yogurt, kefir, sauerkraut) might help you maintain a healthy digestive tract.
- Foods rich in vitamin C and omega-3s can help with joint health. But talk to a healthcare provider before you start using a joint supplement.

Years of heavy physical activity can take a toll on Warfighters. However, it is possible to be a long-term Warfighter if you build good habits early and sustain them throughout life. These good habits include a well-balanced eating plan, structured exercise program, and healthy body weight. A health-promoting lifestyle can minimize your risks of many of the chronic diseases or conditions associated with aging, such as arthritis, musculoskeletal injuries, weight gain, hypertension, **heart disease**, Type II diabetes, metabolic syndrome, and cancer. This chapter discusses some nutrients that might help you maintain a healthy life for the long run.

PRINCIPLES OF HIGH-PERFORMANCE EATING

The 3 principles of high-performance eating are variety, moderation, and quality. These principles are especially important for the long-term Warfighter to

optimize health and performance. Consuming a **variety** of foods will help you obtain all the essential nutrients for a strong, healthy body. Eating the same foods is not only boring but decreases the opportunity to obtain all the essential nutrients from your diet. However, eating in **moderation** also promotes good health. Eating too much of anything can lead to overconsumption of calories, resulting in unhealthy weight. Finally, eat a variety of foods that are of high **quality**. Fruits, vegetables, whole grains, nuts, seeds, eggs, dairy products, lean meat, poultry, and fish are all high-quality nutrition. They provide a ready supply of energy, vitamins, minerals, and other nutrients to keep your body healthy.

ANTIOXIDANTS AND PHYTONUTRIENTS

Antioxidants and phytonutrients in foods offer potential health benefits beyond basic nutritional needs. Possible benefits of antioxidants and phytonutrients include:

Optimizing muscle strength and endurance
Preventing muscle and joint injuries or fatigue
Enhancing immune function
Preventing heart disease and diabetes
Preventing high blood pressure
Reducing pain and inflammation

It's better to get antioxidants and phytonutrients from whole foods rather than supplements. Research suggests eating more of **foods rich in antioxidants might protect against disease**, but the same result has not been found for antioxidant supplements.[1]

Antioxidants

Oxidation, or the production of **free radicals**, is a normal consequence of metabolism, strenuous exercise, and exposure to sunlight, pollutants, chemicals, and extreme environments. Accumulation of free radicals in your body can result in structural and functional damage such as inflammation, infection, and muscle injury from exercise. It also contributes to aging and a host of illnesses, including cancer and heart disease. Antioxidants are molecules that can neutralize free radicals and render them harmless.

A well-balanced eating plan that consists of fruits, vegetables, whole grains, nuts, and seeds will provide antioxidants and other nutrients to **support the body's natural defense against free-radical threats** and protect against tissue damage. The most well-known antioxidants are vitamins A, C, and E,

beta-carotene, and the mineral selenium. However, those are only a few of the many substances. For a list of major antioxidants and food sources, see Table 4–2, Chapter 4.

Phytonutrients

Phytonutrients are chemical compounds found in plants that have numerous desirable effects on the human body. They can act as antioxidants, anti-inflammatory agents, or other protective agents. Eating a variety of colorful foods that contain phytochemicals (Table 16–1) might decrease the risk of developing certain cancers, diabetes, hypertension, and heart disease. At present, a recommended daily allowance for phytonutrients does not exist, but eating a variety of foods—including plenty of fruits and vegetables—will ensure adequate intake.

For more information on phytonutrients, visit the **Produce for Better Health Foundation**.

TABLE 16–1. COMMON TYPES AND FOOD SOURCES OF PHYTONUTRIENTS[2]

Type	Food Sources
Anthocyanins	Red and blue fruits such as acai, blueberries, blackberries, raspberries, cherries, plums; and vegetables such as eggplant, red onions, red potatoes, and radishes
Beta-carotene	Leafy green, orange, and yellow vegetables such as broccoli, spinach, collard greens, kale, sweet potatoes, carrots, and cantaloupe
Flavanones	Citrus fruits
Flavonols	Apples, apricots, beans, broccoli, cherry tomatoes, kale, pear, onions, cherries, tea, and dark chocolate
Flavones	Celery, parsley, thyme, and oregano
Isoflavones	Soybeans and soybean products such as tofu and soy milk, and edamame
Lutein	Leafy green vegetables such as kale, spinach, turnip greens, and lettuces, as well as broccoli, Brussels sprouts, and artichokes

Type	Food Sources
Lycopene	Tomatoes, watermelon, pink grapefruit, and red peppers
Zeaxanthin	Green vegetables, citrus fruits, and eggs

OMEGA-3 FATTY ACIDS

Omega-3 fatty acids are polyunsaturated fatty acids (PUFA) that are important for cell and tissue development and, particularly, heart and brain health. The important omega-3 fatty acids are alpha linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA).

Fish (particularly oily fish such as sardines, salmon, trout, mackerel, herring, and anchovies) and seafood are excellent sources of EPA and DHA. The American Heart Association recommends eating two 3½-ounce servings of fatty fish per week.[3] In general, the health benefits of eating fish outweight any risks associated with heavy metal (mercury) toxicity.

Sources of ALA include tofu and other soybean products, canola and soybean oils, walnuts, Brazil nuts, and flaxseed. Flaxseed (linseed) oil is the most concentrated source of ALA.

HPRC's article on **omega-3 fatty acids in food** has more information, including a list of various foods high in omega-3s.

Fish-oil supplements

It's best to get omega-3s from foods, but many people do not like or do not have access to foods high in omega-3s, so they commonly take fish-oil supplements. As with other dietary supplements, fish-oil supplements should be taken only under the supervision of a healthcare provider, especially if you have health conditions or take medications, because fish-oil supplements can prolong bleeding time and interact with some medications and health conditions.[4] Fish-oil supplements are generally well tolerated, but possible unwanted effects include fishy aftertaste and gastrointestinal complaints.

DIETARY FIBER

Dietary fibers—non-starch forms of carbohydrate obtained from plants—are structural components that the human body cannot digest.[5] Dietary fibers are classified as soluble or insoluble, and most fiber-rich foods contain some of both types (Table 16–2). These two types function differently in the body.

TABLE 16–2. FIBER-RICH FOODS

Insoluble Fiber	Wheat bran, whole grains, whole wheat, nuts, seeds, barley, brown rice, celery, broccoli, onions, tomatoes, grapes, and dark leafy vegetables
Soluble Fiber	Oatmeal, barley, nuts, seeds, beans, lentils, peas, apples, oranges, pears, berries, cucumbers, and carrots

TABLE 16–3. DAILY FIBER RECOMMENDATIONS[6]

Age	Men	Women
19–30	34 g	28 g
31-49	31 g	25 g
over 50	24 g	22 g

Insoluble fiber adds bulk to stools and promotes regular bowel movements. A diet high in insoluble fiber commonly helps your body digest and eliminate meals faster and increases stool weight.

Soluble fiber absorbs water and turns into gel in the intestines. This helps slow digestion and might have a positive effect on your cholesterol levels.

Because your body doesn't digest or absorb dietary fiber, it isn't considered a nutrient (unlike vitamins, minerals, protein, fats, and carbohydrates), but it is still an essential part of a healthy diet. Dietary fiber plays a role in reducing your risk for various chronic conditions such as gastrointestinal diseases, hypertension, diabetes, heart disease, and several types of cancer, including colon cancer. For these reasons, it's important to get the daily recommendation for fiber (Table 16–3).

It's important to increase your intake of fiber gradually because eating too much fiber in a short period of time can cause bloating, cramping, and gas until your gut gets used to more fiber. Also remember to drink plenty of fluids throughout the day to help fiber pass through your gut. Fruits, vegetables, whole grains, and beans and legumes are great sources of fiber. Table 16–4 includes examples of foods and their fiber content. You also can find the grams of fiber in packaged foods by looking at the Nutrition Facts label. In general, Americans don't consume enough fiber because their intake of fruits, vegetables, and whole grains is low.[6]

TABLE 16–4. FIBER CONTENT OF VARIOUS FOODS[7]

Food	Grams of Fiber
Apple with skin (3" diameter)	4
Orange (3" diameter)	3
Banana (7–8 inches long)	3
1 cup whole strawberries	3
½ cup black beans	8
1 cup cooked green beans	4
1 cup cooked asparagus	4
1 cup cooked spinach	4

PROBIOTICS AND PREBIOTICS

Both probiotics and prebiotics can help you maintain a healthy gastrointestinal tract.[8, 9] Probiotics are "good" or "friendly" bacteria, while prebiotics are food compounds that promote the growth of "good" bacteria.[10]

Probiotics

Probiotics are live microorganisms (in most cases, bacteria) that help maintain the natural balance of bacteria in your intestines and promote a healthy digestive system. **Food sources of probiotics include:**

Yogurt
Fermented milk such as kefir or buttermilk
Aged cheeses such as cheddar or Gouda
Tempeh, a food made by controlled fermentation of cooked soybeans
Soy beverages
Sauerkraut, finely sliced cabbage fermented by various lactic acid bacteria
Kimchi, a fermented dish made of seasoned vegetables, often cabbage
Kombucha, a beverage produced by fermenting sweet tea with a culture of yeast and bacteria
Miso, a Japanese food produced by fermenting rice, barley, and/or soybeans with salt and a mold

Daily consumption of probiotic-containing foods not only **improves gut health** but also might offer **other health benefits** such as reducing your risk of colon cancer, lowering blood pressure, improving immune function, preventing infections, and improving mineral absorption.

Consuming probiotics can be especially important during times of illness or injury when the "good bacteria" in your gut can be destroyed. This includes preventing the diarrhea caused by antibiotics. Antibiotics eliminate harmful bacteria that might cause illness, but they also destroy your "good bacteria." A decrease in the number of beneficial bacteria can lead to other complications, such as intestinal illnesses and flare-ups of inflammatory bowel disease. Taking probiotics might help replace the "good bacteria" destroyed by antibiotics and restore the balance between "good" and "bad" bacteria in your intestines.

Prebiotics

Prebiotics are non-digestible carbohydrates that support the growth and activity of probiotics in your intestines.[8] Prebiotics occur naturally in plants such as garlic, asparagus, and onion. Other foods containing prebiotics include

oatmeal, barley, beans, whole grains, leafy green vegetables, berries, bananas, yogurt, and milk. Because **prebiotics can boost the effects of probiotics**, food manufacturers add synthetic prebiotics to many foods. Two prebiotics added to many foods are inulin and fructo-oligosaccharides (FOS).

It's important to consume both probiotics and prebiotics for optimal gut health, ideally those that occur naturally in foods. For example, combining Greek yogurt with a banana offers both probiotics and prebiotics.

JOINT HEALTH

Military training puts stress on your body. Over time, this can lead to damaged joints and other musculoskeletal injuries. A healthy weight and nutrient-rich foods, along with regular exercise (with rest days) and stretching, can help optimize the long-term health and performance of your joints. In particular, eat foods—such as oranges, Brussels sprouts, strawberries, red peppers, and kiwis—that are rich in vitamin C, an antioxidant that plays a role in the formation of collagen (the main component of connective tissue). Other foods such as salmon and other fish, English walnuts, flaxseeds and their oil, and canola oil provide omega-3 fatty acids, which help reduce your body's inflammation.

Many people with joint problems turn to dietary supplements to improve their joint health. Before taking dietary supplements for your joints, talk to your healthcare provider to determine the cause of your joint pain and appropriate treatment strategies. Much of the research looking at the effects of certain dietary supplements for joint pain have been conducted in patients with knee osteoarthritis. Although some people with osteoarthritis might experience small reductions in joint pain, the use of any dietary supplement should be discussed with a healthcare provider. In general, there isn't enough scientific evidence to recommend any particular dietary supplement or ingredient to improve joint health.[11-20]

STRATEGIES FOR THE LONG-TERM WARFIGHTER

Good nutrition can keep you in top condition for a long and healthy career despite years of high stress, physically demanding trainings, and missions that take a toll on even the most agile Warfighter. As you think about your eating plan, focus on whole foods that are rich in vitamins, minerals, antioxidants, phytochemicals, omega-3s, and fiber.

Remember that good nutrition is a lifestyle. In other words, eating a recovery snack after a workout won't optimize your performance if you don't eat balanced meals throughout the day too. Once you have the basics down, special attention to nutrition and hydration before, during, and after exercise will help keep you mission ready. **Nutrition is an integral part of Warfighter health,**

performance, and readiness, but enough sleep and exercise, good mental health, and healthy relationships also are essential to achieve Total Force Fitness.

CHAPTER 16 REFERENCES

1. National Center for Complementary and Integrative Health. (2013, November 2013). Antioxidants: In Depth (NCCIH Pub No. D483). Retrieved 26 April 2017 from https://nccih.nih.gov/health/antioxidants/introduction.htm
2. Produce for Better Health Foundation. What Are Phytonutrients? *Fruits & Veggies: More Matters: Fruit & Veggie Info*. Retrieved 26 April 2017 from http://www.fruitsandveggiesmorematters.org/what-are-phytochemicals
3. American Heart Association. (2016, 24 March 2017). Fish and Omega-3 Fatty Acids. Retrieved 26 April 2017 from https://healthyforgood.heart.org/Eat-smart/Articles/Fish-and-Omega-3-Fatty-Acids - .WBthufkrK00
4. Natural Medicines. (24 April 2017). Fish oil (monograph). *Natural Medicines Comprehensive Database*. Retrieved 26 April 2017 from http://naturaldatabase.therapeuticresearch.com/nd/Search.aspx?cs=DOD&s=ND&pt=100&id=993&ds=&name=FISH+OIL&searchid=60821242
5. Institute of Medicine, Food and Nutrition Board, Panel on Macronutrients, Subcommittee on Upper Reference Levels of Nutrients, Subcommittee on Interpretation and Uses of Dietary Reference Intakes, & Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. (2005). *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids*. Washington, DC: The National Academies Press. doi:10.17226/10490
6. U.S. Department of Health and Human Services & U.S. Department of Agriculture. (2015). Shifts needed to align with healthy eating patterns *2015–2020 Dietary Guidelines for Americans* (8th ed., pp. 37–62). Washington, DC: Health and Human Services Dept. and Agriculture Dept.
7. United States Department of Agriculture Agricultural Research Service. (2016). USDA Food Composition Databases. Retrieved 26 April 2017 from National Agricultural Library https://ndb.nal.usda.gov/ndb/
8. Gibson, G. R., Rastall, R. A., & Fuller, R. (2008). The Health Benefits of Probiotics and Prebiotics. In R. Fuller & G. Peridigón (Eds.), *Gut Flora, Nutrition, Immunity and Health* (pp. 52–76). Oxford, UK: Blackwell Publishing Ltd.
9. Kechagia, M., Basoulis, D., Konstantopoulou, S., Dimitriadi, D., Gyftopoulou, K., Skarmoutsou, N., & Fakiri, E. M. (2013). Health benefits of probiotics: A review. *ISRN Nutrition*, *2013*(Article 481651), 1–7. doi:10.5402/2013/481651
10. Academy of Nutrition and Dietetics. (2016). Prebiotics and probiotics: Creating a healthier you. Retrieved 27 April 2017 from http://www.eatright.org/resource/food/vitamins-and-supplements/nutrient-rich-foods/prebiotics-and-probiotics-the-dynamic-duo

11. Cameron, M., & Chrubasik, S. (2014). Oral herbal therapies for treating osteoarthritis. *Cochrane Database of Systematic Reviews*. doi:10.1002/14651858.CD002947.pub2

12. Daily, J.W., Yang, M., & Park, S. (2016). Efficacy of turmeric extracts and curcumin for alleviating the symptoms of joint arthritis: A systematic review and meta-analysis of randomized clinical trials. *Journal of Medicinal Food*, 19(8), 717–729. doi:10.1089/jmf.2016.3705

13. Kongtharvonskul, J., Anothaisintawee, T., McEvoy, M., Attia, J., Woratanarat, P., & Thakkinstian, A. (2015). Efficacy and safety of glucosamine, diacerein, and NSAIDs in osteoarthritis knee: A systematic review and network meta-analysis. *European Journal of Medical Research*, 20(1). doi:10.1186/s40001-015-0115-7

14. Liu, X., Machado, G.C., Eyles, J.P., Ravi, V., & Hunter, D.J. (2018). Dietary supplements for treating osteoarthritis: a systematic review and meta-analysis. *British Journal of Sports Medicine*, *52*(3), 167–175. doi:10.1136/bjsports-2016-097333

15. Onakpoya, I.J., Spencer, E.A., Perera, R., & Heneghan, C.J. (2017). Effectiveness of curcuminoids in the treatment of knee osteoarthritis: a systematic review and meta-analysis of randomized clinical trials. *International Journal of Rheumatic Diseases*, 20(4), 420–433. doi:10.1111/1756-185x.13069

16. Ragle, R.L., & Sawitzke, A.D. (2012). Nutraceuticals in the management of osteoarthritis. *Drugs & Aging*, *29*(9), 717–731. doi:10.1007/s40266-012-0006-3

17. Rutjes, A.W.S., Nüesch, E., Reichenbach, S., & Jüni, P. (2009). S-Adenosylmethionine for osteoarthritis of the knee or hip. *Cochrane Database of Systematic Reviews*. doi:10.1002/14651858.CD007321.pub2

18. Senftleber, N., Nielsen, S., Andersen, J., Bliddal, H., Tarp, S., Lauritzen, L., . . . Christensen, R. (2017). Marine oil supplements for arthritis pain: A systematic review and meta-analysis of randomized trials. *Nutrients*, *9*(1). doi:10.3390/nu9010042

19. Simental-Mendía, M., Sánchez-García, A., Vilchez-Cavazos, F., Acosta-Olivo, C.A., Peña-Martínez, V.M., & Simental-Mendía, L.E. (2018). Effect of glucosamine and chondroitin sulfate in symptomatic knee osteoarthritis: a systematic review and meta-analysis of randomized placebo-controlled trials. *Rheumatology International*, *38*(8), 1413–1428. doi:10.1007/s00296-018-4077-2

20. Singh, J.A., Noorbaloochi, S., MacDonald, R., Maxwell, L.J., & Singh, J.A. (2015). Chondroitin for osteoarthritis. *Cochrane Database of Systematic Reviews*. doi:10.1002/14651858.CD005614.pub2

Main phone number
240-694-2000

Headquarters
6720A Rockledge Drive
Bethesda, MD 20817

FEBRUARY 2020