

# 18

## Sustaining Health for the Long-Term Warfighter

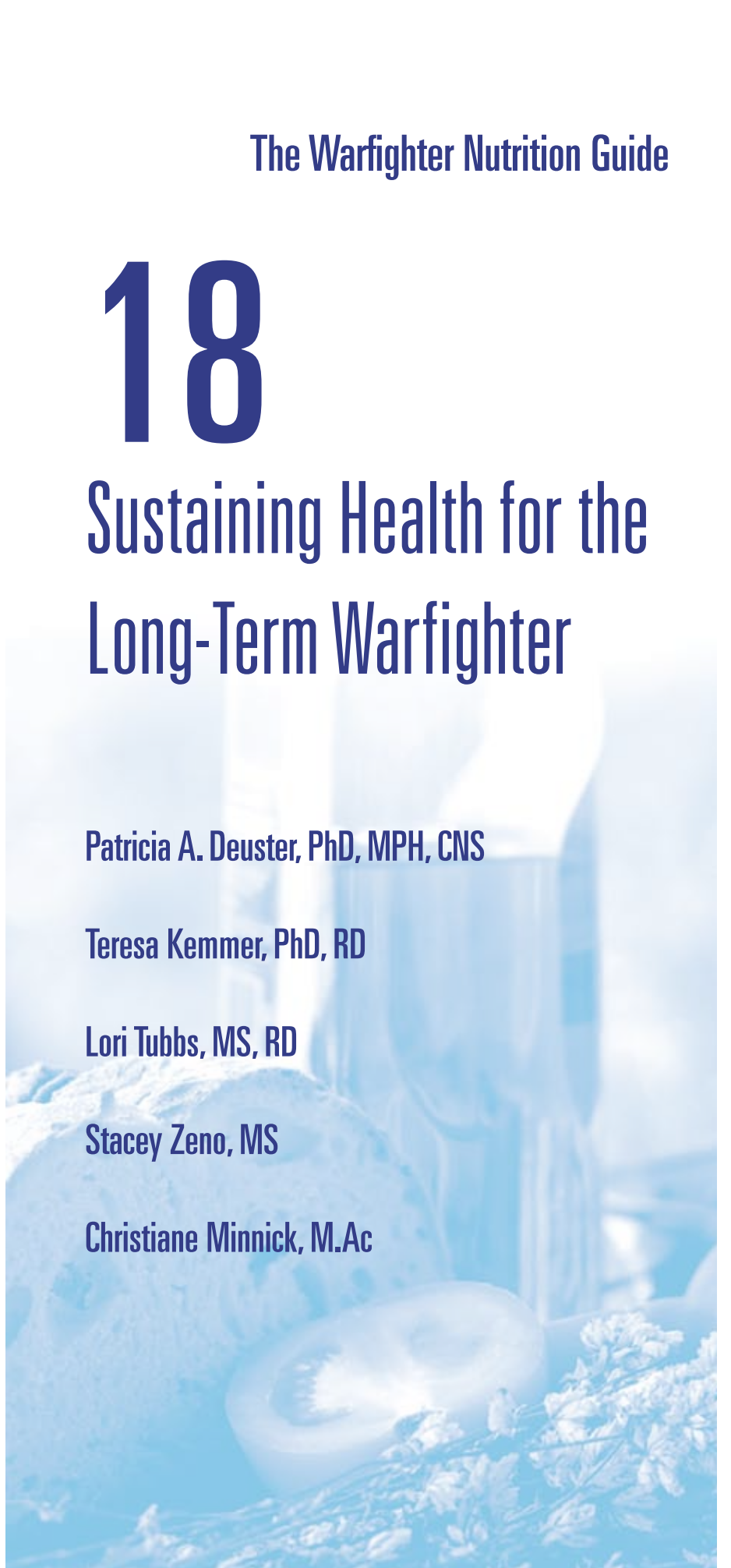
Patricia A. Deuster, PhD, MPH, CNS

Teresa Kemmer, PhD, RD

Lori Tubbs, MS, RD

Stacey Zeno, MS

Christiane Minnick, M.Ac



# 18 Sustaining Health for the Long-Term Warfighter

## In This Chapter

Principles of Good Eating

Mediterranean Diet

Omega-3 Fatty Acids

Bone Health

Phytochemicals

Dietary Fiber

Pro-/Pre-biotics

Alkaline Diet

## Key Points

- Eating a variety of foods is one key to healthy living.
- A Mediterranean Diet has been shown to confer a long, healthy life.
- Healthy bones require adequate calcium intake and regular physical activity.
- Eating many different colorful real foods, which contain important protective compounds—phytonutrients, promote life-long health.
- At least 3–5 servings of colorful vegetables, 2 or more servings of fruit, and 6 or more servings of whole grain products, should be consumed per day, whenever possible.
- Products containing probiotics (yogurt, kefir, sauerkraut) may be helpful for maintaining a healthy digestive tract.
- Alkaline-forming, rather than acid-forming, foods are important during periods of high stress.

It is possible to be a Long-Term Warfighter if good habits are developed at a young age and sustained throughout life. These “good” habits include a nutritious diet and a balanced exercise program. If good habits are developed, the risks of developing musculoskeletal injuries and many other chronic diseases associated with aging will be minimized. This chapter discusses the proper dietary plan to maintain a healthy life.

## Principles of Good Eating

- Variety.
- Balance.
- Moderation.

A variety of foods must be consumed to obtain all the requisite nutrients for a strong, healthy body. Eating the same foods is not only boring, but decreases the opportunity to include diverse nutrients in your diet; it can also mean taking in the many environmental pesticides and chemicals on



A healthy diet is achieved by balancing a variety of foods from the major foods groups.



Click for the Traditional Healthy Mediterranean Diet Pyramid.

those particular foods. For example, some fish are tainted with mercury, so eating the same kind of fish daily could result in accumulation of mercury. Likewise, if strawberries were the only fruit eaten, the body would accumulate the pesticides from the strawberries. In addition, the nutrients potentially derived from eating a variety of foods would be limited. Fresh and dried fruits, fresh vegetables, whole grains, nuts, eggs, dairy products, meats, poultry, and fish are all nutritious: they provide a ready supply of energy and nutrients to keep the body healthy.

Moderation is perhaps the most difficult goal to achieve without planning meals and snacks in advance. If one meal contains high-fat foods, another meal needs to be low in fat. Advance planning allows all foods to be eaten without incurring an energy deficit or surplus.

90% of your foods should be healthy.  
Limit junk food to only 10% of your diet.

## Mediterranean Diet

One diet singled out as healthy for all ages is the Mediterranean Diet. Research has shown that this type of diet, which is higher in monounsaturated fats than other diets, results in lower blood sugar and cholesterol levels and lower blood pressure than a typical American diet. This is attributed to using olive oil (a monounsaturated fat), consuming lots of fruits and vegetables, and also drinking some red wine. Grapes used to make the wine contain powerful antioxidants.

There is not an official “Mediterranean” diet because at least 16 countries border the Mediterranean Sea and not all of the same foods are eaten. However, there are similarities to the dietary patterns. They include:

- High intake of fresh fruits, vegetables, bread, wheat and cereals, potatoes, beans, nuts and seeds.
- Weekly intake of up to 4 eggs.
- Minimal intake of red meat.
- Low to moderate intake of dairy products, fish, and poultry.
- Frequent and regular use of olive oil.
- Low to moderate intake of red wine.

## Omega-3 Fatty Acids

Omega-3 fatty acids were discussed in Chapter 3, but more information on these “polyunsaturated” fatty acids (PUFA) is important because of their health benefits. The important omega-3 fatty acids are alpha linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). The body cannot make these “fats,” but interconversions with omega-6 fatty acids can occur. For example, vegetarians rely on the conversion of ALA into EPA and DHA.

Fish and seafood, particularly oily fish (sardines, salmon, trout, mackerel, herring, and anchovies) are excellent sources of omega-3s. Green vegetables and some nuts and seeds (tofu and other forms of soybeans, canola and soybean oils, walnuts, brazil nuts, and flaxseed) are sources of ALA. Flaxseed (linseed) oil is the best concentrated source of ALA.

A low dietary intake of omega-3 fatty acids has been associated with heart disease, stroke, cancer, inflammatory conditions and auto-immune diseases, and possibly negative mood, depression and other mental health conditions. Thus, a diet that provides adequate amounts of omega-3 fatty acids is important.

### How Much is Needed?

Although the exact amount of omega-3s needed for optimal health is unknown, intakes  $\geq 650$  mg/day, or 0.3% of total calories, for EPA and DHA have been recommended. The recommended intake of ALA is 1.6 grams/day for men. An omega-3 deficiency is nonexistent in healthy individuals. Table 18–1 below provides the EPA and DHA content of various foods sources. Clearly, eating 3 ounces of tuna (or the like) each day provides the recommended amounts of omega-3s. Table 18–2 provides the ALA content of various plant products. Eating less than 1 oz of walnuts provides more than the amount recommended.

Diets of today are often high in saturated and trans fatty acids (discussed in Chapter 3), and low in omega-3 fatty acids. The ratio of omega-6 to omega-3 fatty acids in the diet today ranges from 14:1 to about 20:1. A healthier ratio would be 5:1. It should be noted that food sources of omega-6 fatty acids in the diet are ample: omega-6 are found in margarines and vegetable oils.

Table 18 1. Content of EPA and DHA in Various Fish Products

Fish (3 oz)	EPA (mg)	DHA (mg)	Total EPA+ DHA (g)	Total Fat (g)
Bass, Striped	184	637	0.8	2.5

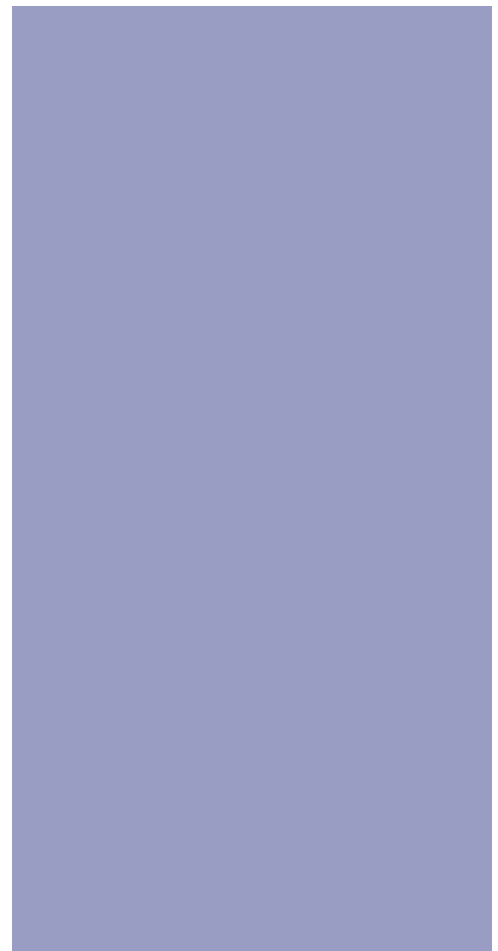


Table 18 1. Content of EPA and DHA in Various Fish Products

Fish (3 oz)	EPA (mg)	DHA (mg)	Total EPA+DHA (g)	Total Fat (g)
Catfish, farmed	42	109	0.2	6.8
Clams (9 small)	117	124	0.2	1.1
Fish sticks (~3 sticks)	126	212	0.3	11.1
Flounder & sole	207	219	0.4	1.3
Haddock	65	138	0.2	0.8
Halibut	77	318	0.4	2.5
Herring, Kippered	825	1,003	1.8	10.5
Mackerel, Pacific	555	1,016	1.6	8.6
Mackerel, Atlantic	428	594	1.0	15.1
Oysters, Eastern, wild, raw (~6)	228	248	0.5	2.1
Perch, Atlantic	88	230	0.3	1.8
Rockfish	154	223	0.4	1.1
Salmon, Atlantic, farmed	587	1,238	1.8	10.5
Salmon, Atlantic, wild	349	1,215	1.5	6.9
Salmon, Coho, farmed	347	740	1.1	7.0
Salmon, Sockeye, canned, drained	418	564	1.0	6.2
Salmon, Coho, wild	341	559	0.9	3.1
Sardines, Pacific, packed in tomato sauce	520	845	1.4	1.2
Sardines, Atlantic, oil-packed	402	432	0.8	9.1
Swordfish	111	579	0.1	4.4
Trout, Rainbow, farmed	284	697	1.0	6.1



Table 18 1. Content of EPA and DHA in Various Fish Products

Fish (3 oz)	EPA (mg)	DHA (mg)	Total EPA+ DHA (g)	Total Fat (g)
Trout, Rainbow, wild	398	442	0.8	4.9
Tuna, Bluefin	309	910	1.3	5.3
Tuna, White, water-packed, drained	198	535	0.1	2.5
Tuna, Light, water-packed, drained	40	190	0.2	0.7
Tuna, Light, oil-packed, drained	23	86	0.1	7.0

Table 18 2. ALA Content of Various Vegetable Products

Vegetable/Nuts/Seeds (3 oz)	ALA (mg)	Total Fat (g)
Brazil Nuts	30	56.5
Flaxseeds	19,400	35.8
Soybeans, green, boiled	301	5.4
Spinach, raw	56	0.13
Sunflower seeds, dry roasted	59	42.3
Tofu	495	7.4
Walnuts, English	7,700	55.5
Winter Squash	31	0.12

Source: United States Department of Agriculture: National Nutrient Database for Standard Reference, Release 19 (<http://www.nal.usda.gov/fnic/foodcomp/search/>). EPA and DHA values not available for all foods.

Eat a variety of fish at least twice a week and include other foods rich in ALA.

Increasing omega-3 intake through foods is preferable to supplements.

Despite being a rich source of omega-3 fatty acids, fish and seafood are potentially major sources of environmental contaminants. Thus, fish con-

sumption is an example where the potential benefits and risks may be in competition. However, it is still acknowledged that the health benefits of eating fish outweigh the risks.

## Fish Oil Supplements

Because many people do not like or do not have access to foods high in omega-3s, fish oil supplements are commonly taken. However, fish oil supplements should only be taken under the care of a physician. The most common side effect of fish oil supplements, which was discussed in Chapter 11, is gastrointestinal complaints. It is also possible high intakes of omega-3 fatty acids (> 3 grams/day) may result in prolonged bleeding time.

See [www.usp.org](http://www.usp.org) for USP-approved fish oils.

## Bone Health

The health status of bones is determined by various lifestyle behaviors between birth and age 30. Bone health is of great concern in military training because stress fractures can eliminate potential “wannabe’s” from the playing field. The major determinants of achieving “peak bone mass” during adolescence and early adult life are diet and physical activity.

The primary nutrients for achieving healthy bones are calcium, vitamin D, protein, and other essential minerals. Calcium is one of the most abundant minerals in the body, yet one frequently lacking in the diet of all individuals. On average, daily intake of calcium ranges from 500–700 mg, which is much lower than the suggested level of 1000 mg.

Milk, milk products, and calcium-fortified products are important to bone health. An inadequate intake of calcium can lead to borrowing calcium “reserves” from the bones to meet the body’s needs; with a prolonged deficit, osteopenia or low bone mass may develop. A list of foods with high calcium and vitamin D content is presented below. Note that non-fat milk products have a higher calcium content than their low- or full-fat counterparts.

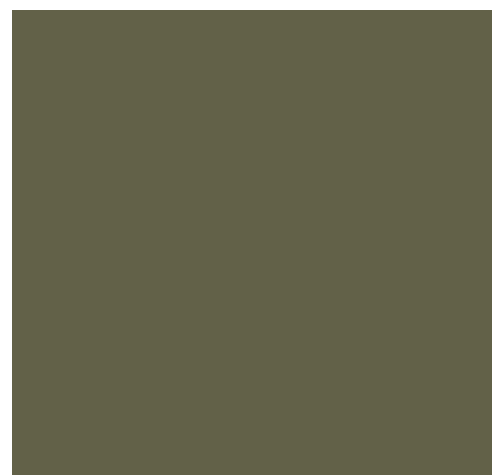
Table 18 3. Foods with High Calcium and Vitamin D Content

Food	Amount	Calcium Content (mg)
Yogurt, plain, non-fat	8 oz	450
Yogurt, plain, low-fat	8 oz	350–415



Table 18 3. Foods with High Calcium and Vitamin D Content

Food	Amount	Calcium Content (mg)
Yogurt, low-fat, with fruit	8 oz	250–350
Milk, skim	1 cup	302–316
Milk, 2%	1 cup	313
Cheddar cheese	1 oz	204
Provolone cheese	1 oz	214
Mozzarella cheese, part skim	1 oz	207
Ricotta cheese, part skim	1 cup	337
Swiss cheese	1 oz	272
Almonds	½ cup	173
Figs, dried	10 figs	269
Orange juice, calcium fortified	1 cup	250
Orange	1 medium	56
Rhubarb, cooked with sugar	½ cup	174
Collards, turnip greens, spinach, cooked	1 cup	200–270
Broccoli, cooked	1 cup	178
Oatmeal, with milk	1 cup	313
Salmon, canned, with bones	3 ½ oz	230
Sardines, canned, with bones	3 ½ oz	350
Halibut	Half fillet	95





One of the primary reasons for a low dietary intake of calcium is that sodas and colas have replaced milk as the beverage of choice: on average, 23 gallons of milk are consumed per person per year as compared to 49 gallons of soft drinks. Not only have soft drinks replaced milk as the beverage of choice with meals, but they also contain phosphoric acid, which may disturb the natural balance of bone growth. Cola soft drinks are especially harmful due to the caffeine content. Caffeine may interfere with the absorption of calcium from foods and/or supplements, and compromise bone mineral density.

Other reasons why bone health is not what it should be relates to physical activity patterns. Many young men of today are sedentary—playing video games may maintain healthy bones in the fingers and hands, but regular, weight-bearing aerobic exercise and an active lifestyle are essential for promoting good bone health. Other dietary and lifestyle patterns that may compromise bone health include:

- > 3 alcoholic beverages/day.
- An acidic diet.
- Smoking/smokeless tobacco.
- Excessive intakes of Vitamin A (i.e., retinol).
- Excessive intakes of protein.

## Stress Fractures

It is not uncommon for Warfighters to develop stress fractures, which is a consequence of poor bone health and physical fitness. Risk factors for stress fractures include:

- Short height.
- Low bone density or poor bone structure.
- Smoking.
- Alcohol consumption.
- Low calcium intake.
- Low fitness and/or activity levels before enlistment.
- Previous injury.
- Poor muscle strength.

However, in addition to the risk factors noted above, several aspects of military training may contribute as well. These include:

- Training schedules with too much, too soon.
- High running mileage.
- Excessive loss of calcium in sweat.
- Boot/shoe fitting and design.

## Phytonutrients

One reason the Mediterranean diet is so healthy is because most of the foods provide phytonutrients (phytochemicals). Phytonutrients are substances found in plants that protect against bacteria, viruses, and fungi. Eating a variety of many colorful foods that contain phytochemicals (fruits and vegetables, whole grains, cereals, and beans) appears to decrease the risk of developing certain cancers, diabetes, hypertension, and heart disease. The actions of phytonutrients vary by color and type of food: they may act as antioxidants, anti-inflammatory agents, and/or other nutrient protectors. Table 18–4 below provides a partial list of phytonutrients and food sources of these important nutrients. Phytonutrients may also be considered functional foods, as discussed in [Chapter 17](#).

Table 18 4. Types of Phytonutrients and Good Food Sources

Phytonutrients	Sources
Allicin	Onion, garlic.
Anthocyanins	Red and blue fruits (raspberries, cranberries, cherries, and blueberries) and vegetables.
Bioflavonoids	Citrus fruits.
Carotenoids	Dark yellow, orange, and deep green fruits and vegetables (tomatoes, parsley, oranges, pink grapefruit, and spinach).
Flavonoids	Fruits, vegetables, wine, green tea, onions, apples, kale, and beans.
Indoles	Bok choy, cabbage, kale, brussels sprouts, and turnips (cruciferous vegetables).
Isoflavones	Soybeans and soybean products.
Lignins	Flaxseed and whole grain products.
Lutein	Leafy green vegetables.
Lycopene	Tomato products.



Phytonutrients should be derived from real foods, **not** dietary supplements.

[Click here for more information on dietary fiber.](#)

#### **Dietary Fiber:**

A form of carbohydrate that is not classified as a nutrient and it cannot be digested.

#### **Insoluble Fiber:**

Absorbs water in the gastrointestinal tract and promote regular elimination of stools.



Table 18 4. Types of Phytonutrients and Good Food Sources

Phytonutrients	Sources
Phenolics	Citrus fruits, fruit juices, cereals, legumes, and oilseeds.

At present, a recommended daily allowance for phytonutrients does not exist. However, eating a variety of foods, including plenty of fruits and vegetables, will ensure an adequate intake. Phytonutrients are now being added to supplements, but it is most likely that their healthful effects are due to their natural packaging. Other foods high in phytonutrients include the following:

Broccoli	Berries	Soynuts	Pears	Turnips
Celery	Carrots	Spinach	Olives	Tomatoes
Lentils	Cantaloupe	Garlic	Apricots	Onions
Seeds	Soybeans	Green Tea	Apples	Cabbage
Brussels Sprouts	Bok Choy	Kale	Red Wine	Grapes

## Dietary Fiber

Dietary fiber is a critical component of the diet for health. However, during missions and operational scenarios when performance is critical to the end result, dietary fiber may need to assume a back-seat role.

### What is Dietary Fiber?

Dietary fibers, non-starch forms of carbohydrate obtained from plants, are structural components that cannot be digested by the body. Some types of dietary fiber are cellulose, dextrans, inulin, lignin, chitins, and pectins. Because dietary fiber is neither digested nor absorbed, it is not a nutrient like vitamins, minerals, protein, fats, and carbohydrates, but it is still an essential part of a healthy diet.

### Insoluble Fiber versus Soluble Fiber

Dietary fibers are classified as soluble or insoluble, and most fiber-rich foods contain some of both types. These two types function differently in the body. Insoluble fibers, the predominant fiber in most foods, absorb water in the gastrointestinal tract and promote regular elimination of stools.

An increase in stool weight and a faster time for meals to be digested and eliminated are common for diets high in insoluble fiber are ingested. In contrast, soluble fibers undergo processing to yield compounds that confer health benefits. For example, soluble fibers such as oat bran appear to lower serum cholesterol and help regulate blood sugar levels.

These special effects of dietary fiber have prompted many health agencies to make specific recommendations regarding how much dietary fiber a diet should provide.

## Eat More Fiber

The National Cancer Institute, the American Heart Association, the National Academy of Sciences, and the United States Department of Agriculture all have dietary recommendations for fiber because of its role in reducing the risk factor for various chronic diseases:

- Gastrointestinal diseases.
- Hypertension.
- Diabetes.
- Heart disease.
- Several types of cancer, including colon cancer.

In contrast, a high-fiber intake is associated with a decreased risk. For these reasons, increasing your intake of dietary fiber may be very important with respect to your future health. Recommendations for intake of dietary fiber include:

- Consuming at least 3–5 servings of various vegetables, 2 or more servings of fruit, and 6 or more servings of grain products
- Taking in between 20–35 grams of dietary fiber per day.

The first recommendation is easy to follow because their typical serving is likely a quarter of a Warfighter serving. As a rule of thumb: one serving of fruit would be one apple, one banana, one orange, or one pear. One serving of grain products would be one slice of whole wheat bread or one bagel. In addition, one serving of vegetables would be ½ cup of peas, one small potato, or ½ cup of carrots. It is likely that Warfighters are eating more than one serving at each meal.

The second recommendation is more difficult, since it is difficult to know how much fiber is in each food, unless the amount is on a label, which does list the total amount of fiber.

## When to Minimize Fiber Intake

Dietary fiber increases transit time, stool bulk and weight, and promotes regularity. During extended operations, “regular eliminations” may want to be **avoided** for as long as possible. A low-fiber diet may be preferred for these oc-

### Five Most Fiber Rich Foods



Legumes: 15–19 g/cup



Wheat bran: 17 g/cup



Prunes: 12 g/each



Asian pears: 10 g/pear



Quinoa: 9 g/cup

Eating more fruits and vegetables, whole wheat breads, whole grain cereals, beans, rice, nuts, and seeds is the best way to add fiber to your diet.

casions. Also, many high-fiber foods can cause bloating and gas if they are not regularly consumed, or if not enough water is consumed as well. High-fiber foods should be tested during training to find out how your system reacts. No dietary modifications should be tried before a mission or operational scenario.

## Probiotics and Prebiotics

Probiotics and prebiotics are both of interest because they can help maintain a healthy gastrointestinal tract. Probiotics are live microorganisms (in most cases, bacteria) that help maintain the natural balance in the intestines and promote a healthy digestive system. Over 400 types of “good bacteria,” “friendly bacteria,” or intestinal flora reside in the human tract (lactic acid bacteria), where they reduce the effects of harmful bacteria.

### Probiotics

#### Sources of Probiotics

Probiotics are found in real food, such as yogurt, kefir, and other cultured milk products, as well as added to capsules, tablets, beverages, and powders.



Yogurt: dairy product produced by bacterial fermentation of milk.	Fermented milk, such as buttermilk.
Unfermented milk.	Tempeh: fermented food made by the controlled fermentation of cooked soybeans with a <i>Rhizopus</i> mold.
Soy beverages.	Kefir: fermented milk drink.
Sauerkraut: finely sliced cabbage fermented by various lactic acid bacteria.	Kimchi: fermented dish made of seasoned vegetables, often cabbage.
Kombucha: sweetened tea or tisane that has been fermented by a macroscopic solid mass of microorganisms.	Miso: Japanese food produced by fermenting rice, barley and/or soybeans, with salt and the mold.

#### Uses of Probiotics

Because “good bacteria” can be destroyed by antibiotics, illnesses, and other insults to the body, probiotics are sometimes used. For example, people use probiotics to prevent diarrhea caused by antibiotics. Although antibiotics eliminate harmful bacteria that may cause an illness, they also destroy the “good bacteria.” A decrease in the number of beneficial bacte-



ria may lead to other complications, such as intestinal illnesses and flare-ups of inflammatory bowel disease. Taking probiotics may help replace the “good bacteria” that have been destroyed and restore the balance of “good” to “bad” bacteria. Some of the health claims of ingesting probiotics have been substantiated by research.

Purported health benefits of probiotics, when the probiotics are derived from food sources, include:

- Prevent colon cancer.
- Lower LDL “bad” cholesterol.
- Lower blood pressure.
- Improve immune function and prevent infections.
- Improve mineral absorption.
- Prevent harmful bacterial growth under stress.

## Prebiotics

In contrast to probiotics, prebiotics are the fuels used by the bacteria present in the gastrointestinal tract. Prebiotics are non-digestible carbohydrates that selectively stimulate the growth and/or activity of beneficial bacteria (probiotics) in the colon. Unlike probiotics, prebiotics naturally occur in plants, such as garlic, asparagus, and onion. Other foods containing prebiotics include oatmeal, barley, beans, whole grains, leafy green vegetables, berries, yogurt, and milk. Two prebiotics added to many foods are inulin and fructo-oligosaccharides (FOS). Because prebiotics may boost the effects of probiotics, food manufacturers have created synthetic prebiotics and added them to foods.



## An Alkaline Diet

The energy-providing nutrients of all foods are carbohydrates, proteins, fats (and alcohol). They combine the four basic elements: carbon, nitrogen, hydrogen, and oxygen. When these nutrients are used for energy, they result in “acids,” which need to be disposed of through urine, sweat, and the like. If too many acid-products are formed due to lifestyle behaviors and exposures (ingesting too much alcohol, overwork, over-indulgence, insufficient rest, inadequate water intake, tobacco use, pollution, etc.), the body has a difficult time removing all of them. Eating foods that are alkaline (such as fruits and vegetables that contain calcium, magnesium, sodium, potassium, etc.) can help remove excess acid. Overall, it is healthier to strive for a balanced middle ground—acid and alkaline foods. However, when under significant physical and mental stress, a diet high in alkaline foods is recommended.

The acidity of the body is usually determined by testing the first urine of the morning, before any food has been eaten. Urine tends to have wide variations (pH of 4.5–8) based on the acid or alkaline potential of foods eaten the day before. Blood is basically neutral or slightly alkaline (pH = 7.41). Urine strips can be purchased to test urine, but overall, it is best to select foods that are both acid and alkaline.

[Click here for an acid-alkaline food chart.](#)

“The Warfighter is the primary weapons platform. There is an imperative to extend the operational life and maximize the battlefield performance of Warfighters. Nutrition is a critical component in human performance strategies.”

CAPT “Pete” Van Hooser, Former Commodore,  
CNSWG-Two