By Suzanne Girard Eberle, M.S., R.D.

The Refueling Window

Maximize recovery with early eating

As a dedicated runner, you've most likely heard of the so-called "refueling window." Contrary to popular belief, this is not the drive thru at your local Pizza Hut or Taco Bell. It refers to the benefits of rehydrating and refueling shortly after completing a training run or race. Runners of all ages and abilities can enhance the recovery process and reduce their risk of injury by wisely using the time immediately following exercise to refuel on carbohydrate-rich foods and beverages.

THE RECOVERY PROCESS

For most runners, whether preparing for a specific race or simply aiming to remain fit, consistency in training is the key to success. In other words, it means lacing up your shoes day after day and gearing up for high-quality workouts while minimizing time lost to chronic fatigue, injury or illness. Recovery, then, is the crucial process a runner must go through to return to a performance-ready ate. Recovery involves restoring nutrient and fuel stores, repairing muscle fibers, and lessening muscle soreness and the irritability of the "brain fog" associated with extreme fatigue.

Research plus practical experience over the past 35 years clearly demonstrates the important role carbohydrates play in reducing fatigue and improving performance. Glycogen, the chief storage form of carbohydrates within the body, is constantly synthesized and degraded for energy as demanded. During exercise, glycogen, which is stored in limited amounts in muscles and the liver, is converted into glucose which fuels working muscles, as well as the brain (via blood sugar). When muscle glycogen and blood glucose concentrations are low, you will be forced to slow down and run at a much lower intensity as your body can only slowly convert body fat stores into energy during exercise.

Poor training days are often linked to poor eating days. Repeated bouts of daily exercise accompanied by a low-carbohydrate diet (40% or less of total calories) will produce a day-to-day decrease in muscle glycogen. It takes the body almost 24 hours to fully replenish muscle glycogen stores. Heavy or sore legs, a lack of your usual desire, and perceiving workouts and races as "feeling harder than they should," can all indicate insufficient recovery from prior physical efforts. Runners who exercise with low muscle glycogen stores also incur more nagging injuries.

THE CARBOHYDRATE WINDOW

Providing your body with the fluids and other nutrients it needs following exercise is the key to a speedy recovery. Diets that contain edominately carbohydrates (approximately 60% of total calories consumed) are crucial for runners who train daily, and especially for those who attempt double workouts or ultra-endurance events. The timing of your carbohydrate intake matters as well. During the first 60 minutes (especially the initial 15-30 minutes) immediately following exercise, the so-called "carbohydrate window" opens and muscles convert carbohydrate-rich foods and beverages into glycogen up to three times faster than at other times. Unfortunately, activities such as stretching, socializing, showering or jumping into the car to pursue other commitments often take precedence during this window of opportunity.

Peter Sherry, age 33, with PR's of 13:30 5K/28:10 10K and a 2:20:38 marathon debut at the 2001 New York City Marathon, runs 90 miles weekly, divided among 12 training sessions. In 1992, "I started looking for that extra edge that would boost my results," claims Sherry. After morning sessions, Sherry now refuels with a large glass of a sports drink, followed by a smoothie made with fresh fruit, juice, rice milk and a protein powder. He follows up with additional carbohydrate-rich foods such as a bagel, cereal with milk, oatmeal or pancakes. "I make sure I eat all of this within 30 minutes of finishing my workout," says Sherry. In the afternoon, he times his run so he promptly sits down to a healthful dinner.

Exercise tends to elevate body temperature, which in turn can depress your appetite, so don't rely on hunger cues to prompt refueling, especially following prolonged or intense efforts. "I don't need to use any tricks to remind myself, I simply do it because it's an integral part of my training routine," says Sherry. To make it easy, keep a powdered sports drink in your locker or desk drawer, or pre-fill a bottle and toss it into your car or have it ready and take it into the shower with you. Ease in high-carbohydrate foods, such as yogurt, fruit, a low-fat milk shake or smoothie, bagels, cereal or energy bars as tolerated.

You should consume at least one-half gram of carbohydrate per pound of body weight immediately following exercise. Numerous options abound in liquid form when you don't feel like eating immediately after exercise: sports drinks (14 to 19 grams per cup), high carbohydrate or meal replacement drinks (check the label, some provide as many as 50 grams/serving), fruit juice (25 to 40 grams per cup), milk (12 grams per cup) or in a pinch, soda (40 or more grams in a typical 12-ounce can).

Evidence is now emerging that protein immediately following exercise may have benefits as well, by jump-starting the muscle building and repair process. Nevertheless, physiologists and sports nutritionists both agree that the hierarchy of needs following exercise remains the same—fluids first, followed by carbohydrates, then, relatively speaking, a small amount of protein. It certainly doesn't hurt to include protein, as found in some recovery drinks, energy bars, yogurt and milk, but another strategy is to include a quality protein at your next meal—eggs, meat, poultry, fish, beans, dairy or soy foods—within one to two hours following exercise.

Suzanne Girard Eberle, M.S., R.D., author of Endurance Sports Nutrition, *lives and runs in Portland, OR.*

13–3 FOOD INTAKE

13–3.1 NUTRIENTS

Fluids

Exhibit 13–3.1.1
IMPORTANCE OF FLUIDS

Nearly two thirds of the human body is water, which provides the aqueous environment needed for all the biochemical processes of life. Of all the nutrients essential to good athletic performance, water is perhaps the most critical—and least appreciated.

Experts agree that fluid replacement is important not only after but before and during a workout. The body needs to maintain water balance as a part of homeostasis, our "steady state" of smooth functioning and good health. Water is essential to regulate body temperature, maintain proper circulation, and remove wastes through urine production.

Exercising muscles generate increased amounts of heat that must be eliminated from the body. Water acts as a coolant to working muscles by evaporating through the skin as sweat. This cools the skin and the blood circulating near the skin surface. Inadequate cooling can result in heat exhaustion or, in severe cases, heat stroke.

Unfortunately, thirst is not among the early symptoms of dehydration. It is possible to lose up to 2 qt of water before becoming noticeably thirsty. In addition, thirst is quenched before body fluids are fully replaced. Most people stop feeling thirsty when they have drunk only about two thirds of the fluid they have lost.

For these reasons, it is important to prepare for endurance events by compensating for fluid losses before, during, and after the workout. Most sports physiologists concur with these guidelines for runners and other endurance athletes recommended by the American Dietetic Association and the American College of Sports Medicine:

- **Before.**
  –Drink at least eight 8-oz glasses of fluids the day before.
  –Drink 16 to 20 oz of fluids about 2 hr before exercising.
  –Drink 6 to 16 oz of fluid 15 to 30 min before the workout.
- **During.** Drink 3 to 7 oz of fluid every 15 to 20 min during the workout.
- **After.** After exercising, drink 16 oz of fluid for each pound lost.

Although athletes involved in endurance sports can benefit from special sports drinks that contain calories and sometimes electrolytes (sodium and potassium), simple fluid replacement is the goal for recreational athletes.

Plain water, iced tea, sugar-free sodas, and fruit and vegetable juices are all appropriate choices. In general, cool drinks (40–50°F) are absorbed more quickly than warm or room temperature drinks. In addition, cool drinks are recommended during warm weather because they can help lower body temperature.

Although sugar is often thought of as a quick source of energy, heavily sugared beverages and juices are ill advised in the final hour before exercise. Sugar stimulates the release of insulin from the pancreas and slows the release of glucose—the form of energy needed by the muscles—from the liver. Insulin's job is to speed the removal of glucose from the blood. Hence, if an athlete drinks a heavily sugared beverage and then begins to exercise strenuously, glucose is removed too quickly and blood sugar drops sharply. Muscles are deprived of the fuel they need most, and the athlete experiences fatigue.

Source: *Tea: A Natural Fitness Beverage*, The Thomas J. Lipton, Inc., Englewood Cliffs, New Jersey.

Fluid Replacement Drinks

The following dilutions are recommended to meet the American College of Sports Medicine recommendations:

Brake-time	1 part mixed*	+	1 part water
Gatorade	1 part mixed*	+	1 part water
Quenchade	1 part mixed*	+	2 parts water
Quick-kick	1 part mixed*	+	2 parts water
Sportade	1 part mixed*	+	3 parts water
Colas	1 part cola	+	4 parts water
Apple juice	1 part juice	+	4 parts water
Orange or grapefruit juice	1 part juice	+	8 parts water
Pineapple juice	1 part juice	+	6 parts water

*mixed according to label directions.

Using an example from the above table, 1 part Quenchade could equal 1 cup. This means that 2 parts water is equal to 2 cups to get the right dilution. For people who mix their own fluid replacement beverages, the guideline is: Do not exceed 50 grams of sugar per hour, in proper dilutions (50 grams = 4 T. sugar or 2½ T. honey in total of 2 liters or 8 cups).

Source: *"Nutrition Care for You: Athletes,"* Copyright 1989 Board of Regents, University of Wisconsin Systems, University Hospital & Clinics, all rights reserved.

Exhibit 13–3.1.2
FLUID INTAKE

Time/Interval of Ingestion for Competition or Workout	Amount to Ingest
2 hours prior to competition or workout	21 oz fluid
10–15 min prior to competition or workout	14–17 oz fluid
At 10- to 15-min intervals during competition or workout	4–6 oz fluid
After competition or workout	Replace each pound of weight lost with 1 pt fluid

*From American College of Sports Medicine Position Paper (44).

Source: Journal of the American Dietetic Association, 86:6, American Dietetic Association, 1986.

Exhibit 13–3.1.3
CAN YOU DRINK TOO MUCH WATER?

Is there a hazard in drinking too much water and becoming water-logged? No. It has been shown that drinking 1.0 to 1.5 liters (4 to 6 cups) of water 5 min before exercise has no adverse effect on performance times in swimming and track events. *There is no physiological reason to rigidly restrict water intake before or during athletic contests.* For the occasional athlete who suffers from nausea on ingestion of large amounts of water, smaller amounts of water taken more frequently, beginning well in advance of competition or practice, can ensure this athlete's good performance.

Drink water before, during, and after an event or practice session.

Source: *Nutrition for Sports Success*, American Alliance for Health, Physical Education, Recreation, and Dance, Reston, Virginia, © 1984.

Carbohydrate

Exhibit 13–3.1.4
IMPORTANCE OF CARBOHYDRATE

• **Carbohydrate is the primary fuel for exercise.** Therefore, the athlete's extra caloric needs are best met through increasing the amount of complex carbohydrate in the diet. At least 55% of the athlete's calories should come from carbohydrates. After digestion, carbohydrate is stored in the liver and muscles as glycogen. The amount stored equals about 1,800 calories for a 150-lb male; a trained/conditioned athlete will store more.

• **Under conditions of short-term, high-intensity exercise, carbohydrate is used almost exclusively as the fuel source.** During prolonged exercise the greatest use of carbohydrate occurs during the first 4 to 5 min. As exercise continues, the fuel source shifts to a progressively greater amount of fat.

• **Carbohydrate is stored in limited quantities; this limits our ability to perform endurance exercise.** Endurance events, such as running or cross country skiing lasting 60 min or more, can deplete the stored glycogen. As these stores are used up, the exercise intensity cannot be maintained and the athlete will begin to tire.

• **Day after day of continuous activity will cause progressive depletion of the glycogen stores because the body has not had enough rest time to replenish them.** The mixed American diet (containing approximately 200 g of carbohydrate) does not provide enough carbohydrate to replenish these stores adequately. A high-carbohydrate diet (at least 450 g) along with training increases the muscles' glycogen storage capability by 2 to 3 times the normal level.

• **Several studies have indicated that the provision of exogenous carbohydrate during prolonged endurance exercise can delay the onset of exhaustion.** The effect is related to overall conservation of muscle glycogen. During long-term exercise, the working muscles depend to some extent on blood glucose as a major source of fuel. If this level decreases to 50 or 40 mg per dL, the exercising muscle fibers cannot obtain enough sugar from the blood. Muscle glycogen is metabolized, causing it to be used up more rapidly. Therefore, the provision of small quantities of a cool, carbohydrate drink after the onset of exercise and approximately every 15 to 20 min thereafter, may delay the onset of fatigue. The drink should not exceed a 2.5% solution, to avoid slowing gastric emptying time. Commercial sports drinks do not provide the amount of carbohydrate needed without a high osmolality. Glucose polymers, however, can provide this energy with a low osmolality. Glucose polymers are medium chain carbohydrates produced by controlled hydrolysis of cornstarch. Glucose polymer solutions are rapidly absorbed and so do not tend to delay gastric emptying. An example of a glucose polymer is the product Polycose.

Courtesy of Major Jeanine B. Davies, *Nutritional Needs for Sports*, U.S. Army Medical Department, Silver Spring, Maryland.

Exhibit 13–3.1.6
SIMPLE AND COMPLEX CARBOHYDRATES

DEFINITIONS

Carbohydrates, both simple and complex, are found in foods of plant origin: grain products, fruits, and vegetables. Complex carbohydrates such as cereal, bread, pasta, and rice form the dynamic, central core of an athlete's diet. Simple carbohydrates (sugar, honey, syrup) provide only calories (energy) but do have an important role; they are included in the diet in amounts sufficient to provide the additional energy needed for exercise.

Complex carbohydrates also contain small amounts of protein, fat, and B-complex vitamins to help release energy; minerals essential to normal body function and the increased demands of exercise; fiber to serve many normal body functions; and long chains of glucose, the ideal energy source for exercising muscles. Each of these foods, however, has a slightly different nutrient composition, so it is important to include all of them every week. Whenever possible, select whole grain products, both for the higher fiber content and the increased amounts of vitamins and minerals.

High-energy vegetables, such as potatoes, winter squash, and corn, are also complex carbohydrates. They are similar in their glucose content to grain products but contain different amounts of vitamins, minerals, and fiber.

Complex carbohydrates have approximately the same number of calories per serving and a similar nutrient composition. In general, 70% of the calories in a complex carbohydrate are obtained from the carbohydrate content; 16% of calories come from the protein; and 14% of calories are obtained from fat. Examples of one serving of a complex carbohydrate are 1 slice bread; ½ ear corn; ½ cup rice, potatoes, or pasta; 1 oz dry cereal. One serving from this food group contains approximately 70 calories, 12 g carbohydrate, 2.5 g protein, and less than 1 g fat.

Other fruits and vegetables are a mixture of complex and simple carbohydrates, a small amount of protein, a very small amount of fat, a wide range of vitamins and minerals, and fiber.

DIETARY REQUIREMENTS

In conjunction with a small amount of sucrose (table sugar), these foods should provide approximately 15% to 25% of an athlete's total calories per day. Added to the recommended amounts of complex carbohydrates, this amount brings the daily intake of total carbohydrates to approximately 65%. Most fruits, or an 8-oz glass of fruit juice, contain 20 g of carbohydrate. Vegetables (broccoli, carrots, etc.) contain 10 g of carbohydrate per cup. Three or four servings of fruits per day, combined with salads and other vegetables, easily provide the extra calories needed for energy.

A female athlete requires a minimum of 2,000 calories/day. It is generally recommended that 40% to 50% of those calories (200 to 250 g) be derived from complex carbohydrates. This minimum can be obtained in 16 to 20 servings of foods high in complex carbohydrates. An additional 75 to 100 g of simple carbohydrates would meet the carbohydrate needs of this athlete. A sample menu might include the following:

- *breakfast* (4 servings): 1 cup oatmeal, 2 slices toast, 8 oz juice;
- *snack* (2 servings): 1 bagel, fruit;
- *lunch* (5 servings): 1½ cups spaghetti, 2 slices garlic bread, vegetable salad;
- *snack* (4 servings): 2 muffins, fruit;
- *dinner* (5 servings): 1 baked potato, 2 small ears of corn
- *snack* (1 serving): fruit.

A male athlete requiring 3,500 calories/day would need 30 to 36 servings of complex carbohydrates, plus additional servings of fruits, vegetables, and other simple carbohydrates. A sample menu might divide the servings of complex carbohydrates as illustrated: 6 servings for breakfast, 8 servings for lunch, 8 servings for dinner, and 5 servings in each of three snacks. Some athletes can eat this much food quite easily. During heavy training sessions, the same athletes may find it difficult to eat this much bulk. There are excellent high-carbohydrate nutritional supplements that can be used to provide a concentrated form of complex and simple carbohydrates during these periods.

Source: Susan W. King and Bonnie K. Chandler, "Nutrition Counseling for Recreational Athletes," *Topics in Clinical Nutrition*, 4:3, Aspen Publishers, Inc., © 1989.

Exhibit 13–3.1.7
CARBOHYDRATE LOADING

INTRODUCTION

Glycogen is the form in which carbohydrate is stored in limited amounts in muscle and liver. Carbohydrate loading (also called glycogen loading) is the process of manipulating the diet and amount of exercise in an effort to increase glycogen stores in the muscles. There is much misunderstanding concerning glycogen storage and the practice of carbohydrate loading, which may be both useful and hazardous.

In the 1960s, several investigators reported that there is a significant decrease in muscle glycogen after prolonged exercise. Investigators then *theorized* that at high aerobic (occurring in the presence of oxygen) workloads the amount of glycogen stored in the exercising muscles will influence the capacity for prolonged strenuous work. In 1973, researchers testing three trained male cyclists reported that the availability of muscle glycogen was important in determining work time to exhaustion on a bicycle ergometer.

The effects of exercise and diet manipulation on glycogen deposition and use have also been studied. In the early 1970s, two studies demonstrated benefits of carbohydrate loading on runners in a 19-mile race and skiers in an 85-kilometer (approximately 53 miles) cross-country race. In a more recent study, however, glycogen loading did not improve the performance of trained runners competing in a 13-mile race.

EFFECT ON ATHLETES

What does this mean to the competing athlete? For some athletes performing *continuous*, long, exhausting exercise (such as long-distance running), carbohydrate loading may be beneficial. It is of no value for short-time competition, no matter how intensely exhausting the effort. It has been found that a high-carbohydrate (70% carbohydrate) diet may also be beneficial when athletes are performing at high altitudes (more than 8,000 ft); however, this is of little practical importance to most athletes since few game sites are at such altitudes.

There is no known advantage of carbohydrate loading in events lasting less than 2 hr of *continuous, noninterrupted* effort. It is also important to recognize that the maximum storage of glycogen is limited and that during prolonged effort the body must also use other energy sources. Hence, at best, carbohydrate loading is of limited value to performance. In addition, it can have undesirable effects that reduce performance, particularly for short periods of competition.

Coaches and athletes should be aware of the possible detrimental effects of carbohydrate loading. When glycogen is stored in the muscle—so is water. For each gram of glycogen, approximately 2.7 g of water are also stored. Athletes have reported stiffness from glycogen loading due to the deposition of water in the muscle. Stiffness and a resulting loss of flexibility can be a detriment in some sports.

Any new diet plan or even a new food should not be tried just before an important competition. Some people react adversely to alterations in food intake. If you carbohydrate load, experiment early in the season, not prior to the big event.

Source: *Nutrition for Sports Success*, American Alliance for Health, Physical Education, Recreation, and Dance, Reston, Virginia, © 1984.

CARBOHYDRATE LOADING DIET (Approximately 3,200 Calories)

Sample Menu	Exchange List
Breakfast	
8 oz orange juice	Fruit—2
6 tbsp Grape-Nuts	Bread—2
1 medium banana	Fruit—2
8 oz low-fat milk	Milk—1
1 whole wheat English muffin	Bread—2
1 tsp margarine	Fat—1
Lunch	
2 oz turkey	Lean meat—2
2 slices bran bread	Bread—2
Lettuce/tomato slices	Vegetable—1
8 oz apple juice	Fruit—2
1 cup lemon sherbet	Bread—4
Snack	
⅔ cup frozen fruit yogurt	Bread—2
Dinner	
2 cups spaghetti (6 oz uncooked)	Bread—4
⅔ cup tomato sauce with mushrooms	Vegetable—1
2 tbsp parmesan cheese	Medium—fat meat—1
4 slices French bread	Bread—4
1 cup apple sauce with 2 tbsp raisins	Bread—1, Fruit—2
12 oz cranberry juice	Fruit—4
½ cup ice cream	Bread—1, Fat—2
Snack	
6 cups popcorn, hot air	Bread—2
3 gingersnaps	Bread—1
8 oz selzer water w/lemon	Free

Source: Modified from *The Athlete's Kitchen*, by Nancy Clark. Copyright 1981, CBI Publishing Co., Inc.

Protein

Exhibit 13–3.1.8
IMPORTANCE OF PROTEIN

Protein is the primary structural material for our bodies; however, muscular activity from extensive training and physical conditioning does not dramatically increase the amount of protein needed to develop muscle tissue. The normal adult RDA for protein is 0.8 g/kg body weight. If the athlete consumes 15% of his or her calories as protein (an amount consistent with good nutrition guidelines and easy for the athlete to live with), he or she will easily obtain and surpass this amount and have sufficient protein for the increased demands of exercise (1 g/kg). Protein supplements, tablets, and powders are unnecessary.

Courtesy of Major Jeanine B. Davies, *Nutritional Needs for Sports*, U.S. Army Medical Department, Silver Spring, Maryland.

Fat

Exhibit 13–3.1.9
IMPORTANCE OF FAT

AN ESSENTIAL NUTRIENT

Fat is an essential nutrient. It serves as a carrier for the fat-soluble vitamins A, D, E, and K. It is an important part of all cell membranes, it is the preferential energy source for heart muscle, it protects vital organs, and it is a great energy source for skeletal muscles in endurance events. A diet high in complex carbohydrates supplies enough fat to meet these needs. Often, the athlete's energy requirements exceed his or her ability to eat enough carbohydrate calories. In these instances, small servings of olive oil or highly unsaturated oils (safflower, canola, and sunflower) can be added to the diet so that the athlete has sufficient calories to meet energy needs and can maintain an appropriate weight for height.

ROLE IN ATHLETICS

Fat is our most abundant energy reserve and provides the majority of energy used during aerobic, long-term, lower intensity exercise. The most important role of fat for the athlete is to spare carbohydrate, therefore saving it for the final, more intense stage of training or competition. During light-to-moderate aerobic exercise, fat supplies 50% to 60% of the energy needed. With prolonged aerobic exercise, its contribution increases up to 70%. Likewise, as the intensity of exercise increases, less fat and more muscle glycogen will be used, causing a depletion of the glycogen stores and the resultant fatigue.

Although fat plays such an important role for the athlete, it should comprise no more than 30% of the athlete's calories. Consuming a high-fat diet will result in a larger amount of fat used during exercise, but it will limit the amount of carbohydrate stored, ultimately limiting endurance.

Courtesy of U.S. Army Medical Department, Silver Spring, Maryland.

Source: Susan W. King and Bonnie K. Chandler, "Nutrition Counseling for Recreational Athletes," *Topics in Clinical Nutrition*, 4:3, Aspen Publishers, Inc., © 1989.

Vitamins and Minerals

Exhibit 13–3.1.10
IMPORTANCE OF VITAMINS AND MINERALS

VITAMINS

Due to their involvement in energy metabolism, the athlete experiences an increased need for the B vitamins. However, an athlete eating a balanced, high-carbohydrate, varied diet that meets his or her caloric needs will obtain sufficient quantities of these nutrients and other vitamins. There is little evidence to support an increased need for vitamins or that supplementation with any vitamins enhances performance.

MINERALS

The body requires several minerals to facilitate athletic performance. Magnesium helps control muscle contraction and regulates the conversion of carbohydrate to energy. Calcium also helps control muscle contraction. Sodium and potassium help control the balance of water in the body and help cool the body. Iron is a component of hemoglobin, the oxygen-carrying portion of the red blood cell.

Sodium and other electrolytes are lost in sweat. However, in the trained athlete, sweat is hypotonic and the losses are low and not so significant. Sweating has a much greater effect on the loss of body fluids than on the loss of sodium. The result is actually a higher concentration of sodium in the body. Using salt tablets at this time only aggravates the dehydration by drawing water from the body tissues to the stomach to dilute the tablets. Since the amount of sodium and other electrolytes found in a normal balanced diet exceeds our daily requirement, the best treatment for electrolyte loss during exercise is eating balanced meals.

Sports anemia, or dilutional anemia, has been referred to as an anemic or borderline anemic state in physically active individuals, particularly athletes. Reports vary on its etiology, but it appears to be associated with increased red blood cell hemolysis and a decreased hemoglobin concentration at the onset of a strenuous exercise program. It is usually a self-limiting condition and may not require treatment.

Sports anemia due to insufficient iron can occur in menstruating female athletes, endurance athletes, and vegetarian athletes. Since iron is a necessary component of hemoglobin, a lack of iron limits the oxygen supply to the muscles, therefore limiting energy production and decreasing aerobic capacity and exercise ability. Athletes in the high-risk groups must ensure that they get a minimum of the RDA for iron in their daily diet. Their hemoglobin and iron status should also be monitored. In cases of low levels, supplements may be recommended. Foods rich in vitamin C eaten along with foods high in iron will increase iron absorption; coffee and tea will decrease iron absorption. Also, foods cooked in cast iron pots will provide more iron.

A diet adequate in calcium is critical for the athlete to maintain a strong skeleton, which is an asset to physical performance. Because of their low estrogen levels, amenorrheic women are at risk of losing bone mass. Although menstruating women require about 1,000 mg of calcium, 1,500 mg a day is recommended for amenorrheic women.

In the otherwise healthy athlete, supplements of other minerals are not necessary since a balanced diet that includes a variety of foods will provide a sufficient amount of these nutrients.

Courtesy of Major Jeanine B. Davies, *Nutritional Needs for Sports*, U.S. Army Medical Department, Silver Spring, Maryland.

13–3.2 BASIC DIETARY GUIDELINES

Exhibit 13–3.2.1
BASIC PRINCIPLES OF YOUR DIET

- Keep food intake regular.
- Eat from the four basic food groups each day.
- Increase your use of complex carbohydrate foods (from the grain group).
- Monitor your weight and avoid drastic weight changes—eat to maintain your weight.
- Be sure to include good sources of iron in your diet: beans, beef, cereals enriched with iron, dried apricots, green leafy vegetables, liver, pork, prunes or prune juice, raisins, turkey, and foods cooked in cast iron pots.
- Always drink plenty of fluids!

Courtesy of Major Jeanine B. Davies, *Nutritional Needs for Sports*, U.S. Army Medical Department, Silver Spring, Maryland.