



Great athletic accomplishments are determined by a progressive training program, adequate rest, and a well-balanced diet. Good nutrition, though not a *guarantee* for athletic success, is still an important contributor to optimal performance. While most athletes understand the need for physical preparation, many could benefit by a better understanding of what constitutes a well-balanced “performance” diet.

Like many other people, athletes can fall prey to the latest diet and/or nutrition fad in their efforts to gain a competitive edge. Today that fad is the low-carbohydrate diet. Unfortunately, a low-carbohydrate diet is just the *opposite* of what the athlete’s body needs for optimal performance. That’s because carbohydrates are primary fuel for the exercising muscles and therefore absolutely essential for supporting an athlete’s training and performance. Thus, the well-balanced performance diet is one that provides sufficient energy (i.e., calories), mostly in the form of carbohydrates, with the balance of energy as proteins and fats.

The Role of Carbohydrates in Athletic Success

- Carbohydrates are the major fuel source for the brain and nervous system. If blood glucose and glycogen levels are low, athletes may feel irritable, tired and lack concentration that could interfere with even simple performance-related tasks.
- As the most efficient fuel for the exercising muscles, carbohydrates are the primary source of energy during both high- and low-intensity activities. Extensive research confirms the major role carbohydrate plays in endurance (aerobic) exercise and mounting evidence supports its importance for both strength and power events (1,2).
- Unlike protein and fat, the body has limited carbohydrate reserves. Dietary carbohydrates are stored in the body as glycogen primarily in the muscle and liver.

Athletic Performance and Carbohydrates

- During activity, the body relies on this stored glycogen to be released and used for by the muscles and brain for energy. The body’s limited glycogen stores can be depleted in a single bout of exercise of sufficient intensity and duration. Thus, daily carbohydrate intake is necessary to maintain these glycogen stores. If muscle and liver glycogen stores become depleted during exercise, the muscles will be left without fuel and fatigue will set in – a condition known as “hitting the wall.”
- Carbohydrates also aid in fat metabolism. The body requires the presence of carbohydrate in order to utilize fat for energy. There is an old saying that “fat burns in a carbohydrate flame” (3). Think of carbohydrates as the “kindling wood” for required for the fat-burning fire.
- Carbohydrates provide a “protein sparing effect” helping athletes to maintain the muscle mass they worked so hard to develop. As previously mentioned, the brain requires a constant and significant amount of carbohydrate. When glycogen stores become depleted and dietary carbohydrates are not consumed, the body will turn to protein (from muscle tissue muscle) to “make” carbohydrate in a process known as “gluconeogenesis.” (Note that fat cannot be used to make carbohydrate.) By consuming a diet with adequate carbohydrates and calories, the body will be less likely to have to make carbohydrate at the expense of muscle tissue.

Carbohydrate Requirements

For general health, the National Academy of Science’s Recommended Dietary Allowance (RDA) for carbohydrate is 130 grams/day for both adults and children. It should be noted that this recommendation represents the *minimal* amount of carbohydrate needed on a daily basis to support the brain. It does not take into account the carbohydrate that is needed to fuel the muscles during exercise.

Athletes require more carbohydrate than that specified by the RDA simply because they use more carbohydrate on a daily basis to fuel exercise (2). The precise amount of carbohydrate needed by a given

athlete is determined by the type of activity he or she does as well as the frequency, intensity and duration of activities performed (2). In general, endurance athletes require more carbohydrates than strength and power athletes as they generally utilize more carbohydrates during exercise. It is recommended that athletes consume between 3 to 5 grams of carbohydrate per pound body weight (6 to 10 grams of carbohydrate per kilogram body weight) (2,4). For example, a 150-lb distance runner may require between 450 to 750 grams of carbohydrate a day to fuel not only his or her workout but to also help the body replenish its glycogen store for the next day's workout (3).

Carbohydrate-Rich Foods in the Performance Diet

Athletes should choose carbohydrates that are high in "nutrient density"; these provide the most nutrients per calorie.

- Whole-grain versions of cereals, pastas, brown rice and bread products are ideal carbohydrate sources. Grain-based foods are rich in B vitamins, which help with energy production. Winning choices include oatmeal, whole-wheat bagels, brown rice or whole-grain pasta.
- Fruits and vegetables are excellent carbohydrate sources. They are also excellent sources of antioxidant nutrients, carotenoids and phytochemicals that can help the body recover from performance efforts. Some top nutrition

performers include potatoes, oranges, berries, bananas, and tomatoes. Low-fat dairy products also provide carbohydrate as well as bone-building calcium.

- As part of a performance diet, athletes should include *at least* two carbohydrate-rich foods at every meal, and *at least* one at every snack. Sports nutrition experts recommend athletes consume *at least* five servings of fruits and vegetables, eight or more servings of grain-based foods and three or more servings of low fat dairy on a daily basis (3).

Carbo-Loading

Carbo-loading is a practice some athletes use to "top off" carbohydrate stores prior to competition. Athletes who will compete for greater than 90 minutes can benefit from an increase of dietary carbohydrate in the days leading up to an event (3). Though carbohydrate-loading, itself, will not make an athlete any stronger or faster, it can help delay muscle fatigue that occurs during the latter part of many events. For most athletes, eating a diet that is high in nutritious carbohydrates (55 to 65 percent of total calories) is sufficient to provide adequate glycogen reserves on a daily basis to support athletic performance (1).

Plain and simple, if athletes want to perform consistently at the top of their game, carbohydrates have to be the foundation of their performance diet.

1. Wolinsky, I. and Driskell, J. (Ed.), *Nutritional Applications in Exercise and Sport.*, CRC Press, Boca Raton, FL, 2001.
2. Jackson, C. (Ed.) *Nutrition and the Strength Athlete.*, CRC Press, Boca Raton, FL 2001.
3. Eberle, Suzanne Girard. *Endurance Sports Nutrition: Eating Plans for Optimal Training and Recovery, Racing and Recovery.* Human Kinetics, Champaign, IL. 2000.
4. Nutrition and Athletic Performance: Position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine. *J Am Diet Assoc.* 2000;100:1543-1556.

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