

Nutrition for Athletes

Athletes regularly engaging in strenuous exercise programs should be aware of their daily nutritional needs. Maintaining a healthy diet that provides adequate energy and nutrients is vital to support intense training as well as to optimize immune system functions. The following is a summary of the 2009 guidelines from the *Nutrition and Athletic Performance* position paper of the American College of Sports Medicine, the American Dietetic Association, and the Dietitians of Canada.

Energy Requirements

In order for athletes to meet their energy needs, they must consume sufficient calories. If energy needs are not met, fat and lean body tissue will be used as fuel by the body. This will cause a loss of strength and endurance. Furthermore, immune, endocrine, and musculoskeletal function will be compromised. Over time, low calorie intake may result in a slower resting metabolic rate, and inadequate consumption of essential vitamins and minerals.

Athletes who participate in weight class sports such as boxing, kickboxing, and mixed martial arts are at risk for the adverse effects of poor energy intake if they undergo extreme measures to rapidly lose weight prior to a competition. Such energy restrictions may cause loss of muscle and may interfere with athletic performance.

For personalized information regarding appropriate calorie intakes for athletes, please visit:

http://www.health.gov/dietaryguidelines/dga2005/report/HTML/D3_DiscCalories.htm

Carbohydrate Requirements

Carbohydrates include both complex and simple sugars. Carbohydrates maintain blood sugar levels to fuel exercise. They also replenish glycogen which is the storage form of carbohydrates within muscles. The recommended daily carbohydrate intake for athletes ranges from 6-10 g/kg body weight.

Protein Requirements

Protein is the building block of muscle tissue. In addition, it has many other functions throughout the human body. Endurance athletes are advised to ingest between 1.2-1.4 grams of protein per kilogram of body weight each day. Ultra-endurance athletes who participate in continuous training for several hours or consecutive days should consume slightly more protein than this; however, consumption of more than 2 grams of protein per kg of body weight is not recommended. Strength athletes are encouraged to consume protein in the range of 1.2-1.7 g/kg body weight. This amount is generally easy to obtain through a normal diet without the use of supplements. High quality protein sources such as whey, casein, or soy are equally effective in the maintenance, repair, and synthesis of muscle proteins.

Fat Requirements

Adequate intake of fat is necessary for numerous metabolic activities that promote optimal health. For example, vitamins A, D, and E require fat for proper absorption. Fat intake for an athlete should range between 20-35% of total daily calories. Current dietary guidelines recommend that 10% of fat intake should come from monounsaturated sources, 10% from polyunsaturated sources, and no more

than 10% from saturated fat. Research does not show any beneficial effects from a diet that includes excessive fat intake (>70% of total energy).

Vitamin and Mineral Requirements

Micronutrients function in a variety of roles that optimize health. They are involved in energy production, blood synthesis, maintenance of bone health, immune function, and the prevention of oxidative damage. They also aid in the process of muscle and tissue repair during recovery from exercise or injury.

Generally, athletes consuming a healthy diet do not require any additional supplementation of micronutrients. However, a multivitamin supplement may be appropriate if an athlete is dieting, or avoids certain food or food groups. Supplementation of single nutrients such as iron may be required if a deficiency is diagnosed by a medical professional.

While supplementation with high doses of antioxidants (Vitamins C, E and B-carotene) is becoming a popular practice among athletes, there is little evidence to suggest that antioxidant supplements enhance performance. Athletes should be cautious of mega-dosing with these vitamins since higher doses are likely to promote a deleterious effect.

Vegetarian athletes may be at risk for low intakes of iron, calcium, vitamin D, riboflavin, zinc and vitamin B₁₂. Consultation with a sports dietitian is recommended to ensure adequate intakes of these nutrients.

Timing of Food and Fluid Intakes

Before Exercise

The pre-exercise meal or snack should be familiar to the athlete and contain small amounts of fat and fiber in order to promote quick digestion and minimize potential gastrointestinal discomfort. The meal should be high in carbohydrates and moderate in protein. The amount of carbohydrate shown to enhance performance generally ranges from 200-300 grams of carbohydrate eaten 3-4 hours before an event.

Fluid should be consumed at least 4 hours before an exercise event. A water or sport beverage is appropriate. The athlete should aim for 5-7 mL/kg (2-3 mL/lb) body weight of fluid for optimal performance. Hyperhydration with water and glycerol mixtures should be discouraged since no performance benefit has been established by this practice.

During Exercise

Sports drinks containing 6-8% carbohydrates are beneficial for exercise lasting longer than 1 hour in duration. For long workouts or events, athletes are advised to consume 0.7g carbohydrates/kg body weight (approximately 30-60 grams/hour.) Research has demonstrated an extended endurance performance from this practice. Sports drinks offer a significant benefit for athletes who exercise in the morning after an overnight fast when liver glycogen levels are low. Supplementing carbohydrates during this type of exercise will also benefit athletes who have not eaten a pre-exercise meal as well as those who are restricting calories for weight loss.

The greatest improvements in performance have been observed when sports drinks are used for hydration at 15-20 min intervals. Liquid mixtures of glucose, fructose or other simple sugars are equally effective. However, fructose alone is not as effective and may cause diarrhea.

Consumption of a sports beverage that contains electrolytes will help to maintain a fluid and electrolyte balance. Drinks that contain sodium and potassium will aid in the replacement of electrolytes lost in sweat. Sodium consumption will also encourage the drive to hydrate. Sweat losses of greater than 2% of total body weight negatively influence athletic performance so adequate fluid replacement during exercise is a chief priority.

After Exercise

The post-exercise meal depends on the length and intensity of the exercise, as well as the timing of the next exercise session. When multiple bouts of training are expected in the same day, carbohydrates should be consumed within 30 minutes after exercise in order to fully replenish glycogen stores in the muscles. Consuming 1.0-1.5 grams of carbohydrates/kg body weight at 2 hour intervals for up to 6 hours is recommended. Post-exercise glycogen synthesis with a combination of simple sugars is more effective than fructose alone. Including portions of protein after exercise will help to build and repair muscle tissue.

Recovery from dehydration during exercise is accomplished by drinking 16-24 oz (450-675 mL) of fluid for every pound (0.5 kg) lost in sweat. Eating salty foods will also help to restore electrolyte balance.

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Reference

Rodriguez, N. R., DiMarco, N. M., Langley, S., Denny, S., Hager, M. H., Manore, M. M., et al. (2009). Nutrition and Athletic Performance. [Review]. *Medicine and Science in Sports and Exercise*, 41(3), 709-731.