



## Nutrition and Physical Activity

### KEYWORDS

Nutrition, Sports Nutrition and Physical Activity

**BASANAGOUDA S LAXMESHWAR**

**Dr .K K Amarnatha**

Research scholar University College of Physical Education, Bangalore University, Bangalore.

Associate Professor University College of Physical Education, Bangalore University, Bangalore

**ABSTRACT** There is no doubt that the type, amount, composition, and timing of food intake can Dramatically affect exercise performance, recovery from exercise, body weight and Composition and health. When exercise or physical work increase to more than 1 hour per day, the importance of adequate energy and nutrient intakes becomes more critical. As the American public becomes more concerned with health and health issues, the interest in nutrition and physical activity has increased. This interest in health has also heightened the sale of supplements, herbal preparations, and weight loss products, all aimed at improving health, preventing or curing disease, improving sport performance, and changing body composition and weight. Sports nutrition's the practical science of hydrating and fueling before, during and after exercise. Executed properly, sports nutrition can help promote optimal training and performance. Done incorrectly or ignored, it can derail training and hamper performance. Active individuals need more energy (calories) each day than their sedentary counterparts assuming individuals are the same age, body size and participate in similar non-physically active daily activities. Maintaining fluid and electrolyte balance means that active individuals need to replace the water and electrolytes lost in sweat. Nearly 25% of Americans use dietary supplements daily and ~35-40% use them occasionally. For individuals engaged in physical activity, the estimates are as high as 50-100% (Sobal & Marquart, 1994). We now know that what you eat and drink can significantly impact health and exercise performance. The active individual needs to make sure they consume enough energy to maintain a healthy body weight for their activity level and sport, while reducing risks of chronic disease. Active individuals need more carbohydrate and protein than sedentary individuals, and should not restrict fat intake too severely. Keeping well-hydrated and replacing fluids lost during exercise is also a key part of feeling good and performing at one's best. Active individuals dieting for weight loss may need to supplement, but in general supplements should be used with caution and after careful examination of the diet.

### Introduction

There is no doubt that the type, amount, composition, and timing of food intake can Dramatically affect exercise performance, recovery from exercise, body weight and Composition and health. When exercise or physical work increase to more than 1 Hour per day, the importance of adequate energy and nutrient intakes becomes More critical. As the American public becomes more concerned with health and health issues, the interest in nutrition and physical activity has increased. This interest in health has also heightened the sale of supplements, herbal preparations, and weight loss products, all aimed at improving health, preventing or curing disease, improving sport performance, and changing body composition and weight. Sorting through this supplement soup is difficult because supplement manufacturers frequently make unsubstantiated claims about their products, leaving the consumer to sort the fact from the fiction. As stated in the 2000 Position Statement on Nutrition and Athletic Performance, published by the American Dietetic Association (ADA), Dietitians of Canada, and the American College of Sports Medicine (ACSM), any active individual "who wants to optimize health and exercise performance needs to follow good nutrition and hydration practices, use supplements and ergogenic aids carefully, minimize severe weight loss practices, and eat a variety of foods in adequate amounts" (ADA, 2000). Recently, the Food and Nutrition Board (FNB) of the Institute of Medicine (IOM) published new dietary reference intake (DRIs) for energy, macronutrients (protein, fat, and carbohydrate) (IOM, 2002). They have also published new DRIs for micronutrients (vitamins and minerals) and related compounds (IOM, 1997, 1998, 2000, 2001).

These DRIs are a set of reference values for energy and specific nutrients designed to be used as guidelines for making dietary recommendations to individuals or groups of individuals. For the first time, the specific needs of active individuals were considered for energy and some nutrients. The dietary recommendations summarized in this paper are based on extensive research in the area of nutrition and physical activity, and four current national and international publications (listed below) related to thenutritional needs of active individuals. These four publications are the Position Statement on Nutrition and Athletic Performance mentioned above (ADA, 2000), the IOM's report for energy, macronutrients (2002), the 2003 International Olympic Committee's (IOC) Consensus Statement on Sport Nutrition (Burke, 2003), and the accompanying research articles (Burke et al., 2004; Coyle, 2004; Hargreaves et al., 2004; Loucks, 2004; Maughan et al., 2004; Shirreffs et al., 2004; Tipton & Wolfe, 2004) recently published in the Journal of Sport Science in 2004. These recommendations are general in nature, since energy and nutrient needs can vary greatly depending on the age, gender, exercise training intensity and duration, health issues, and the sport in which one participates. This paper will address the current energy, macronutrient and fluid needs of active individuals, while briefly addressing micronutrients and supplements and specific nutrition and fluid recommendations for before, during and after exercise.

### Energy Needs

Active individuals need more energy (calories) each day than their sedentary counterparts – assuming individuals are the same age, body size and participate in similar

non-physically active daily activities. Exercise requires energy to fuel and repair the muscles, thus, meeting one's energy needs to maintain body weight should be a priority for any athlete or active individual. Energy balance is achieved when the energy consumed (sum of energy from food, supplements and fluids) equals energy expenditure (sum of all the energy expended by the body in movement or to maintain body functions) (Swinburn & Ravussin, 1993). Knowing whether one is in energy balance is simple: weight is maintained. If energy intake does not cover the costs of energy expenditure, then weight and muscle mass are lost, and the ability to perform strenuous exercise typically declines. Although weight loss is the goal of many Americans, weight loss in an active individual who is currently at a healthy body weight can decrease exercise performance and the health benefits associated with exercise training. When energy intake is restricted, fat and muscle mass will be utilized for energy to fuel the body, and the loss of muscle mass will result in the loss of strength and endurance. Additionally, chronically low energy intake usually results in poor nutrient intakes, including carbohydrate, protein, vitamins and minerals. Exactly how much energy an active individual needs each day will depend on a number of factors, including age, gender, body size, level and intensity of physical activity and activities of daily living. The Food and Nutrition Board of the IOM (2002) reviewed the energy needs of active and very active individuals and provided some general recommendations based on age and body size. In general, active individuals walk between ~6-10 mi/d, while very active individuals walk >10mi/d at 2-4 mph. For example, for a 30-year old male weighing 72.2 kg (160pounds) and having a body mass index (BMI) of 24.99 (kg/m<sup>2</sup>), the estimated energy needs are 2,959 and 3,434 kcal/d for active and very active individuals, respectively. For a 30-year old woman weighing 68 kg (150 pounds) and having a BMI of 24.99 (kg/m<sup>2</sup>), the estimated energy needs are 2,477 and 2,807 kcal/d for active and very active individuals, respectively. Thus, the first goal of an active individual is to maintain adequate energy intake to assure that a healthy body weight is maintained. Although this seems like a simple task, there are many active individuals who find this difficult to do. For these individuals, a dietary plan that assures meals and snacks are not skipped will improve energy intake and help maintain weight. Finally, energy needs typically decrease with age, so even if activity levels do not change, the amount of energy required maintaining body weight will decrease. For this reason, body weight typically increases with age, even if activity levels remain constant.

#### **Eating to achieve or maintain a healthy body weight and body composition**

Although active individuals typically have body weights that are within normal ranges for their height (BMI 19-25 kg/m<sup>2</sup>), it is not unusual for them to want to change their body weight (e.g., either increase or decrease) to meet the demands of their sport or their own perception of an "ideal weight." Weight change should be accomplished slowly during a period when the individual is not participating in competitive events. If weight gain is desired, this can be accomplished by adding ~500-1000 kcal/d into the diet per day, while participating in strength training exercises to assure that the extra energy consumed is contributing to muscle mass and not fat gain (ADA, 2000; Thompson & Manore, 2000). Increases in muscle mass usually occur slowly and depend on a number of factors, including one's genetic make-

up, degree of positive energy balance that has occurred, amount of rest received, and the type of exercise training program being used (Manore & Thompson, 2000). Any diet for weight loss should result in a gradual decrease in weight (~1-2 pound/wk or 0.5-1.0 kg/wk) and maximize fat loss, while preserving lean tissues (ADA, 2000). If energy restriction is too severe, the nutritional quality of the diet is compromised, lean tissue is lost, and the ability to exercise decreases. In addition, severe energy restriction can lead to preoccupation with food, loss of motivation, and the inability to stay on the diet (Thompson & Manore, 2000; Manore, 1999b,2000). In order to remain physical active while dieting, the diet needs to provide adequate carbohydrate for glycogen replacement and enough protein for the maintenance and repair of lean tissue. For these reasons, experts do not recommend fad diets that restrict energy too severely (typically <1800 kcal/d for women; <2000 kcal/d for men) or eliminate food groups (e.g., little or no carbohydrate; restricted to eating only certain foods) for active individuals. Before beginning a weight loss diet, an active individual needs to identify what constitutes a realistic healthy body weight for his/her activity level. This decision

should be made based on past dieting experiences, type of activity engaged in, the social setting around work and home, genetics (family size and shape), health risk factors, and psychological issues. A healthy weight is one that can be realistically maintained, allows for positive advances in exercise performance, minimizes the risk of injury or illness, is consistent with long-term good health, and reduces the risk factors for chronic disease (ADA, 2000; IOM, 2002). If an unrealistic weight goal is set, there is a high probability of failure, which has a number of emotional and psychological outcomes. Unfortunately, failure to meet weight loss goals in some sports can result in severe consequences, such as being cut from the team, restricted participation, or elimination from competition. These situations can result in active individuals chronically dieting to maintain a lower than healthy body weight, which can lead to disordered eating and in severe cases a clinical eating disorder. Nutritional strategies for identification, intervention and treatment of eating disorders in athletes have been presented elsewhere (ADA, 1994; Beals,2004; Sungot-Borgen, 1998). Dieting for weight loss in active women and girls can be especially problematic, especially if weight is already within medical norms. Low energy intake combined

with high energy output contributes to the development of menstrual dysfunction in women, which is characterized by a significant decrease in reproductive hormones and disruption of the normal menstrual cycle (Harber, 2000; Loucks, 2004; Manore,2002). The decrease in reproductive hormones, especially estrogen, can lead to loss of (or failure to gain) bone mass in young female athletes and active adult women. This pattern of low energy intake can put them at risk for one or more of the disorders in the female athlete triad (amenorrhea, disordered eating, osteoporosis) (ACSM, 1997)

#### **Macronutrient Requirements For Exercise**

Carbohydrate, protein and fat are important nutrients for active individuals, but the amounts of these macronutrients needed will depend on an individual's exercise intensity, duration and frequency, the type of exercise engaged in, and their health, body size, age and gen-

der. Macronutrient recommendations for those engaged in daily physical activity are given below and in Table 1.

**Table 1.**  
**Dietary Reference Intakes (DRIs) for macronutrients and Recommendations for active individuals**  
1IOM, 2002. 2FNB, 1989. 3Burke et al., 2004; Tipton and Wolfe, 2004.

Nutrient	New Guidelines – 2002	Old Guidelines – 1989	Guidelines for Active Individuals
Carbohydrate	45-65% of total energy	≥ 50% of total energy	The amount of carbohydrate required for moderate intensity exercise is 5-7 g/kg body weight; 7-12 g/kg body weight for high intensity endurance activities.
Protein	10-35% of total energy; 0.8 g/kg of body weight	10-15% of total energy; 0.8 g/kg of body weight	Protein requirements are typically higher in active individuals. Recommendations range from 1.2-1.7 g of protein/kg body weight. This level of protein typically represents 15% of total energy.
Fat	20-35% of total energy	≤ 30% of total energy	Fat intakes between 20-35%. Carbohydrate and protein needs should be met first.

### Carbohydrate needs

The mix of fuel (protein, fat, carbohydrate) burned during exercise depends primarily on the intensity and duration of the exercise performed, one's level of fitness, and prior nutritional status. All other conditions being equal, as exercise intensity increases the use of carbohydrate for energy will also increase (Brooks & Mercier, 1994; Brooks & Trimmer, 1995). The duration of exercise also changes substrates use. As duration of exercise increases (e.g., from 60 to 120 min), muscle glycogen becomes depleted, causing the body to draw on circulating blood glucose as a source of carbohydrate. If blood glucose cannot be maintained within physiological range during exercise, the ability to perform intensity exercise will decrease (Coyle et al., 1986). Fat can be used as a source of energy over a wide range of exercise intensities; however, the proportion of energy contributed by fat decreases as exercise intensity increases. In these circumstances, carbohydrate becomes the dominant fuel source while the contribution from fat decreases (Bergman et al., 1999). Protein can also be used for energy at rest and during exercise; however, in well-fed individuals it probably provides <5% of the energy expended (El-Khoury et al., 1997; Phillips et al., 1993). As

the duration of exercise increases, the energy contribution of protein may increase to maintain blood glucose. The amount of carbohydrate, fat and protein used for energy during exercise will also depend on when exercise occurs relative to the last meal and the level exercise intensity performed. For example, when subjects are tested after an overnight fast, the contribution of fat to the energy pool is greater than when these same individuals are tested after a meal (Bergman and Brooks, 1999). In both situations, the exercise performed was moderate (~50% of VO<sub>2</sub>max). For higher intensity exercise (>65% of VO<sub>2</sub>max) neither prior feeding nor exercise training significantly altered fuel used (Bergman & Brooks, 1999). Currently there is no research available suggesting that active healthy individuals need significantly different proportions of energy from carbohydrate, protein and fat than those proposed in the 2002 IOM report from the Food and Nutrition Board on Dietary Reference Intakes: Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein and Amino Acids (45-65% of energy from carbohydrate, 10-35% of energy from protein, and 20-35% of energy from fat). This report determined an Acceptable Macronutrient Distribution Range (AMDR), which is defined as arrange of intakes that are associated with reduced risk of chronic disease, while providing adequate intakes of essential nutrients. These new AMDRs for the macronutrients are very broad and allow for developing flexible dietary recommendations across a variety of activity levels, body sizes, food preferences, and health-related dietary issues. Although high carbohydrate diets (>65% of energy intake) have been advocated in the past for endurance athletes, the use of proportions in making dietary recommendations for active individuals is generally not practical (ADA, 2000). It is more helpful to make macronutrient recommendations for protein and carbohydrate based on body size (e.g., gram/kg body weight). For example, if energy intake is 5000 kcal/d for an active adult male, even a diet containing 50% of the energy from carbohydrate will provide 625 g of carbohydrate (~9 g/kg for a 70 kg body weight person). This level of carbohydrate is adequate to maintain muscle glycogen stores for a highly active individual (Coyle, 1995). Similarly, if protein intakes in this diet were as low as 10% of energy intake, absolute protein intake (125 g/d; 1.8 g/kg) would easily meet the protein recommendations for athletes (1.2-1.7 g/d or 84-119 g in a 70 kg body weight person, see protein section below). Conversely, when energy intakes are low (≤ 1800 kcal/d) even a diet providing 60% of the energy from carbohydrate may not maintain optimal carbohydrate stores (≤ 5 g/kg in a 55-kg body weight person) in an active individual. In general, it is recommended that active individuals doing moderate duration/low-intensity physical activity consume 5-7 g/kg of carbohydrate per day. If exercise is intense and heavy endurance training is being done, then 7-12 g/kg of carbohydrate per day is recommended (Burke et al., 2004). Thus, dietary carbohydrate recommendations for the active individual will depend on the level of physical activity being performed.

### Protein needs

Active individuals often think that they need to consume high protein diets to cover the building and repair of their muscle tissue. Although not reflected in the new IOM report on energy and macronutrients (2002), exercise physiologists and sport nutritionists generally agree that exercise increases the need for protein (g/kg body weight) (ADA, 2000; Tipton & Wolfe, 2004). Exercise may increase the need for protein in three ways: 1) increased need for protein to repair exercise-induced damage to muscle fibers; 2) support gains in muscle mass that occur with exer-

cise; and 3) provide energy source during exercise (Lemon, 1998). How much additional protein is needed may depend on the type of exercise performed (endurance vs. resistance), the intensity and duration of the activity, body composition (e.g., kg of lean tissue mass), and whether weight loss is being attempted. Lemon (1998, 2000) examined the research on the protein needs of athletes and recommends 1.2-1.4 g/kg body weight/day for individuals participating in endurance sports and 1.6-1.8 g/kg body weight/day for those involved in resistance or speed exercise. The higher protein recommendations for individuals participating in resistance training allows for the accumulation and maintenance of lean tissue (Lemon, 1998, 2000; Tarnopolsky et al., 1992). Although these recommendations are higher than the current RDA for protein (0.8 g/kg body weight) (IOM, 2002), they do not typically exceed the habitual protein intakes of most active individuals. As illustrated earlier, if energy intake is 3000-5000 kcal/d for a 70 kg active male, a diet providing 10% of energy from protein would contain 75-115 g of protein per day or 1.1-1.8 g/kg of protein for this individual. In reality, this individual would probably consume closer to 15% of energy from protein. Thus, there is usually little need to recommend that active individuals consume more protein. Increasing protein intakes beyond the recommended level is unlikely to result in additional increases in lean tissue, since there is a limit to the rate at which protein tissue can be accrued (Lemon, 1998, 2000). Those individuals at greatest risk for low protein intakes are active individuals who restrict energy intake for weight loss or follow vegetarian diets, especially active women (Manore, 1999a, 2002).

### Fat needs

Over the years the amounts and types of fat recommended for good health have changed, which is frustrating and confusing for the consumer. Dietary recommendations for active individuals have typically focused on getting adequate intakes of carbohydrate and protein, and keeping fat intake to 25-30% of energy intake, which is within the new AMDR for fat (20-35% of energy). Although fat is seen by many individuals as something to avoid, fat is a necessary component of a normal diet. Fat provides energy and essential elements for cell membranes, and is associated with the intakes of the fat-soluble vitamins E, A and D. However, the type of fat consumed is important since the long-term negative effects of high saturated fat diets on health are well known. In addition, low fat intakes (<15-17% of energy) are generally not recommended for active individuals (Horvath et al., 2000a, 2000b), since they are reported to decrease energy and nutrient intakes and exercise performance. Currently, there appear to be no health benefits to consuming a very low fat diet (<15% of energy from fat) in healthy individuals compared to more moderate fat intakes (Dreon et al., 1999). Thus, unless there is some medical reason for restricting fat, dietary intakes should be within the AMDR for fat. The new IOM report for macronutrients (2002) also gives recommendations for the types of fat to be included in the diet. These recommendations apply to all individuals, regardless of activity level. Diets should be low in saturated and trans fats, while providing adequate amounts of essential fatty acids (linoleic and linolenic acids). The essential fatty acids are required to make a number of potent biological compounds within the body that help regulate blood clotting, blood pressure, heart rate and the immune response. Linoleic acid is found in vegetable and nut oils (e.g., sunflower, safflower, corn, soy, peanut oil) and it is recommended that adult men consume 14-17 g/day and adult women consume 11-12 g/day. Americans appear to get adequate amounts of

linoleic acid, due to the high amount of salad dressings, salad oils, margarine, and mayonnaise-based foods they consume. The second essential fatty acid,  $\alpha$ -linolenic acid, is found primarily in leafy green vegetables, walnuts, soy oil and foods, canola oil, and fish products and fish oils. Americans are most likely to have low intakes of this essential fatty acid. The recommended intakes for  $\alpha$ -linolenic is 1.6 g/day for adult men and 1.1 g/day for adult women. If active individuals consume very low fat diets (<15% of energy), getting adequate amounts of the essential fatty acids can be a problem (Horvath et al., 2000a). Research has also examined the impact of high fat diets (40-70% of energy intake) on fat utilization during exercise and athletic performance (Muio et al., 1994; Lambert et al., 1994). It was hypothesized that consuming a high fat diet would enhance fat oxidation and utilization during exercise. Unfortunately, most individuals cannot tolerate these high fat levels for long, nor can health professionals recommend them for long-term health; thus, there is little support for recommending these diets to active individuals (Jeukendrup & Saris, 1998).

### Hydration

It is well-documented in the research literature that exercise performance is optimal when athletes and active individuals maintain fluid balance during exercise (Coyle, 2004). Conversely, exercise performance is impaired with progressive dehydration (Barr et al., 1999; McConnell et al., 1997; Walsh et al., 1994), which can eventually lead to potentially life-threatening heat injury if action is not taken (Noakes, 1993). Thus, it is imperative that all active individuals attempt to remain well hydrated. The ACSM and the National Athletic Trainers' Association (NATA) have position statements that provide comprehensive overviews of the research and recommendations on maintaining hydration before, during and after exercise (ACSM, 1996a; Casa et al., 2002). Active individuals exercising in special environmental conditions (heat, cold, altitude) need to take extra precautions to remain hydrated (ACSM 1996a; Brinkley et al., 2002; Freund & Sawka, 1996).

### Maintaining water and electrolyte balance

Maintaining fluid and electrolyte balance means that active individuals need to replace the water and electrolytes lost in sweat. This requires that active individuals, regardless of age, strive to hydrate well before exercise, drink fluids throughout exercise, and rehydrate once exercise is over. As outlined by ACSM and NATA (ACSM, 1996a; Casa et al., 2000), generous amounts of fluids should be consumed 24-h before exercise and 400-600 mL of fluid should be consumed 2-h before exercise. During exercise, active individuals should attempt to drink ~150-350 mL (6-12 oz) of fluid every 15-20 minutes. If exercise is of long duration (usually >1 h) or occurs in a hot environment, sport drinks containing carbohydrate and sodium should be used. When exercise is over most active individuals have some level of dehydration. Drinking enough fluids to cover 150% of the weight lost during exercise may be needed to replace fluids lost in sweat and urine (Shirreffs et al., 1996). This fluid can be part of the post-exercise meal, which should also contain sodium, either in the food or beverages, since diuresis occurs when only plain water is ingested (Maughan & Leiper, 1995; Maughan et al., 1996; Shirreffs et al., 2004). Sodium helps the rehydration process by maintaining plasma osmolality and the desire to drink.

### Micronutrient Requirements For Exercise

Micronutrients, such as vitamins and minerals, play an important role in maintaining the health of the active in-

dividual. They are involved in energy production, synthesis of hemoglobin for the production of red blood cells, maintenance of bone health, adequate immune function, building and repair of muscle tissue, and the protection of body tissues from oxidative damage (Manore & Thompson, 2000; ADA, 2000). There are a number of ways that exercise is hypothesized to alter the need for vitamins and minerals. For example, exercise stresses many of the metabolic pathways in which these micronutrients are required, while exercise training may cause muscle biochemical adaptations that increase micronutrient needs. Exercise may also increase the turnover and loss of micronutrients from the body, and the need for these micronutrients to repair and maintain the higher lean tissue mass of the active individual (ADA, 2000). It is assumed that the current DRIs are appropriate for athletes and active individuals, unless otherwise stated (IOM 1997,1998, 2000. 2001). Those individuals at the greatest risk of poor micronutrient status are those individuals who restrict energy intake or use severe weight loss practices, eliminate one or more of the food groups from their diet, or who restrict or eliminate one or more food groups from the diet (e.g., no or little carbohydrate or fat). Individuals participating in these types of eating behaviors may need to use a multivitamin or mineral supplement to improve overall micronutrient status. Current discussions of the micronutrient needs and supplement issues of active individuals are covered elsewhere (Manore, 2000, 2002; Manore & Thompson, 2000; Maughan et al., 2004; Powers et al., 2004; Spriet & Gibala, 2004)

#### **Eating for good health and exercise performance**

Compared to their sedentary counterparts, the diet of an active individual requires additional fluid to cover sweat losses, energy to fuel physical activity, protein for building and repair of muscle tissue, and carbohydrate for the replacement of muscle glycogen. In some cases the need for other nutrients also increases (e.g., B-complex, antioxidant vitamins, iron). As more energy is consumed to cover the cost of exercise, it is assumed the intake of these other nutrients will also increase. Thus, as energy requirements increase, the first goal should be to consume nutrient-dense carbohydrate-based food groups (e.g., whole grain breads and cereals, vegetables, and fruits) and lean protein sources (e.g., lean meats, fish, poultry, dairy, legumes). The aim should be to increase energy intake to maintain weight using nutrient-dense foods that will also provide vitamins and minerals, instead of meeting additional energy needs with high-fat and sugar foods. This is especially true for active individuals who are small (low BMIs) or have lower energy needs. Timing of food intake is also important for active individuals. Eating sensibly before exercise assures that there is enough energy to fuel the exercise event, while eating after exercise will help refuel the body. We know that being wellfed before exercise can improve performance (ADA, 2000), and that the post-exercise meal helps replace muscle glycogen and repair muscle tissue damage (Burke et al., 1996). Depending on the sport, eating or using a sport drink during exercise can also improve performance and delay time to fatigue (McConnell et al., 1996). Active individuals, who exercise more than once per day, may need to time eating around exercise, use sport drinks during exercise, and make sure that meals are not skipped (Benardot & Thompson, 1999). Specific recommendations for what to eat and drink before, during and after exercise have been discussed in detail elsewhere (Burke et al., 2004; Hargreaves et al., 2004; ADA, 2000; Manore & Thompson, 2000).

#### **Supplements**

Nearly 25% of Americans use dietary supplements daily and ~35-40% use them occasionally. For individuals engaged in physical activity, the estimates are as high as 50-100% (Sobal & Marquart, 1994). This high use of supplements has created a 14 billion-dollar industry, which constantly bombards consumers with Advertisements for their products (Sarubin, 2000). It is not surprising that the American consumer is very confused about whether they should use vitamin or mineral supplements, how much to take, and which product to buy. Unfortunately, there is no governmental body that regulates dietary supplements and verifies that what is on the label is also in the bottle. In addition, there is little or no regulation as to the claims made on the bottle. The Dietary Supplement Health and Education Act of 1994 allows supplement manufacturers to make claims regarding the effect of products on the structure and function of the body, as long as they do not claim to "diagnose, mitigate, treat, cure or prevent" a specific disease (103rd Congress, 1994). This allows supplement manufacturers to make a "broad" range of health statements for their supplements, which may or may not be accurate and substantiated by clinical research. Thus, the consumer is left with the task of evaluating the product and the claims of the product. How does the consumer know which supplement to buy or recommend? Listed below are some general guidelines an active individual can follow when selecting a supplement.

Use a multivitamin/ mineral supplement that contains micronutrients in amounts close to recommended amounts (e.g., one-a-day type supplements). This approach helps avoid nutrient-nutrient interactions or reaching toxic levels of any one nutrient. However, most multivitamin/mineral supplements do not contain the recommended amount for some minerals, such as calcium. For individuals who avoid or cannot use dairy products, a major source of calcium in the US diet, calcium supplements or calcium-fortified foods may need to be used. Look for supplements that provide ~50-100% of the Daily Value (DV) or Recommended Dietary Allowance (RDA), and avoid those that provide many times the recommended amounts.

Use individual supplements sparingly unless warranted due to a health problem or a lack of the nutrient in the diet. Individuals should avoid the 5-10 pill/day routine. Using large doses of vitamins and minerals will increase the risk of nutrient-nutrient interactions and may lead to toxic effects. Some supplements can also interfere with prescription and over-the-counter medications, so keeping closer to the RDA or DV will help avoid these pitfalls.

Select supplements from a reputable, well-established company and look for supplements that carry the US Pharmacopoeia (USP) or National Formulary (NF) notation. These notations mean that the manufacturer has voluntarily complied with a strict set of standards regarding product purity, strength, packaging, labelling and weight variation. The Food and Drug Association (FDA) does not inspect vitamin and mineral supplements, so using supplements from a reputable company will help assure that you get what is listed on the label.

#### **Summary**

We now know that what you eat and drink can significantly impact health and exercise performance. The active individual needs to make sure they consume enough energy to maintain a healthy body weight for their activity level and sport, while reducing risks of chronic disease. Active



individuals need more carbohydrate and protein than sedentary individuals, and should not restrict fat intake too severely. Keeping well-hydrated and replacing fluids lost during exercise is also a key part of feeling good and performing at one's best. Active individuals dieting for weight loss may need to supplement, but in general supplements should be used with caution and after careful examination of the diet.

## REFERENCE

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