

Sports Nutrition for Young Athletes

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ABSTRACT: Nutritional needs for peak athletic performance include sufficient calorie intake, adequate hydration, and attention to timing of meals. Student athletes and their advisors often are misinformed or have misconceptions about sports nutrition. This paper identifies nutritional needs of young athletes, reviews common misconceptions, and examines the nutrition knowledge of athletes and their sources of nutrition information. Topics covered include energy, carbohydrate, protein, fat and micronutrient needs, hydration requirements, timing of meals, and issues related to age, gender, and specific sports. Other issues addressed include "making weight" and ergogenic aids. Proper nutrition for young athletes is critical not only to their athletic success, but more importantly to their growth, development, and overall health. Nutritional recommendations should be based on the most current scientific data; we provide information about appropriate resources for the school nurse when advising student athletes and their coaches and parents.

KEY WORDS: nutrition, sports, student athletes

INTRODUCTION

Nutrition is important to athletic performance regardless of the age of the athlete. Appropriate information regarding diet should be provided to athletes so they can make healthy food choices. Athletes have unique needs that include sufficient caloric intake for sport, adequate hydration, and timing of meals for peak performance; however, they often are misinformed or have misconceptions about these topics. Those who interact with athletes and may be in a position to influence nutritional intake, such as coaches, parents, and school nurses, also may need current information about nutritional needs of the athlete. It is important that those who provide nutritional guidance to athletes have the appropriate knowledge base and dispense accurate information. The purpose of this paper is to identify the nutritional needs of young athletes, to review misconceptions about nutrition

and sports, and to provide information on appropriate resources for the school nurse when advising not only athletes, but also their parents and coaches.

NUTRITIONAL NEEDS OF THE ATHLETE

Adequate nutrition to cover the biological needs for growth and development of all young people can be met by following the *Dietary Guidelines for Americans* (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2005). The latest edition of these guidelines was released in early 2005 and is available online (www.healthierus.gov/dietaryguidelines). However, in addition to normal nutritional needs, there are other nutritional concerns for young athletes that require consideration, including additional caloric needs, timing of food intake, adequate hydration, and use or misuse of dietary supplements.

Energy Needs

The energy-providing nutrients include carbohydrate, protein, and fat. The largest percentage of an athlete's caloric intake, at least 50%, should come from carbohydrates (Litt, 2004). It is important for athletes to consume enough carbohydrate in order to meet high-intensity energy needs, to maintain blood

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glucose, and to restore muscle glycogen stores (Lemon, 1998).

Protein intake is also important for athletes. Protein is required for hormone and enzyme production, nutrient transfer in the blood, connective tissue support, and repair of tissue in response to periods of exercise. Protein needs for athletes are slightly higher than those for the general population. A typical intake of protein for most athletes should be 1.2–2.0 g/kg of body weight per day (Jenkins & Reaburn, 2000). There is a limit on protein synthesis that can occur; therefore, protein intake beyond these amounts is not necessary (American Dietetic Association, Dietitians of Canada, and American College of Sports Medicine [ADA/DC/ACSM], 2000). Protein needs can be satisfied by diet alone and should not require supplementation (ADA/DC/ACSM; Maughan, 2002). If protein intake is too high, it can produce extra urea, can increase risk of dehydration, and can cause calcium loss (Millward, 2003). Athletes should consume 10–15% of total calories from protein (ADA/DC/ACSM; Lemon, 1998).

Fat intake is important for producing energy, protecting organs, providing insulation to the body, and facilitating fat-soluble vitamin uptake and essential fatty acid intake. Fat intake should be 20–25% of total calorie intake. There is no benefit to athletes for a fat intake that is less than 15% or greater than 30% of total calories (ADA/DC/ACSM, 2000).

The micronutrients—vitamins and minerals—also have an important role in the health of athletes. They are essential players in energy production, hemoglobin synthesis, bone health, immune function, and antioxidant activity (ADA/DC/ACSM, 2000). Micronutrient needs typically can be met by athletes consuming a high energy intake and a balanced diet. Therefore, supplementation with vitamins and minerals is usually unnecessary (Maughan, King, & Lea, 2004).

Eating Before, During, and After a Sports Event

Timing of food consumption based on the time of a competition or exercise event is important. The ability to perform and to recover from exercise can be positively or negatively affected by dietary intake before, during, and after the event. The pre-event meal should be low in fat, fiber, and caffeine; moderate in protein; and high in complex carbohydrates and fluid. Meals are best consumed at least 3–4 hours before competition to minimize gastric distress, nausea, vomiting, cramps, and sluggishness (Clark, 2003). During exercise, especially long endurance events, it is beneficial to maintain blood sugar by consuming about 30–60 g/hr of carbohydrate via sports drinks (ADA/DC/ACSM, 2000).

After the event, adequate energy in the form of carbohydrate must be consumed to replenish glycogen stores. Protein also should be consumed in moderate amounts for muscle repair. Therefore, a mixed carbo-

hydrate and protein meal should follow a workout, with balanced meals following every 2–4 hours.

Water Needs

Hydration is a very important aspect of sports nutrition that must be monitored closely. Disturbances in fluid and electrolyte balance include dehydration and low sodium concentration (Barr, 1999). During exercise, athletes sweat in order to help control rises in core body temperature that cause fluid loss and may cause a loss of sodium, iron, and calcium through sweat (ADA/DC/ACSM, 2000; Maughan, 2002). An athlete who loses too much water due to dehydration may respond with decreased performance and may increase the risk of heat stroke (Coyle, 2004). Fluids are necessary for hydration and maintenance of electrolyte balance (Maughan, 2002). Ten to 12 cups (80–96 oz) of water a day should be consumed to maintain adequate hydration. An intake of about 12–20 oz of fluid 2–3 hours before exercise is beneficial (Casa, 2000). During exercise, 6–12 oz of fluids should be consumed every 15–20 minutes. Carbohydrate and electrolyte drinks, also referred to as sports drinks, of about 4–8% carbohydrate are useful for endurance athletes to consume during competition for maintenance of blood sugar and hydration, although plain water is also appropriate (Convertino et al., 1996). During recovery, an intake of about 16–24 oz of fluid per pound lost is sufficient (ADA/DC/ACSM). To ensure proper hydration, it is important for athletes to consume enough fluids throughout the day, during exercise, and during recovery from periods of exercise.

SPECIFIC NUTRITION NEEDS

Athletes have unique nutritional needs based on age, gender, level of athletics, sport, and weight. It is important to understand the characteristics of athletes, because this affects energy, macronutrient, micronutrient, and fluid needs.

For the child athlete, energy intake should be high enough to support growth and maturation while providing enough energy and fluids for the additional physical activity.

Age

The dietary needs of child athletes younger than 11 years of age are different than those of older athletes (Steen, 1996). For the child athlete, energy intake should be high enough to support growth and maturation while providing enough energy and fluids for

the additional physical activity. Percentage body fat and weight should not be used as criteria for sports participation. Children do not tolerate temperature extremes as well as older athletes. Their higher relative body surface area causes them to acclimate to heat more slowly. They also sweat less, produce more heat, and are less able to transfer heat from muscle to skin—all increasing the risk of dehydration. Special emphasis should be placed on ensuring adequate fluid intake in child athletes before, during, and after activity.

For the adolescent athlete, increasing independence and peer pressure that can influence food selections may lead to suboptimal dietary intake with potential nutrient deficiencies (Steen, 2000). Adolescent athletes have an increased risk of iron deficiency. Calcium intake by adolescents is also well below recommended amounts. It is important to monitor the height, weight, and body mass index of children as they enter puberty to ensure that the additional nutrients and energy needed to fuel growth spurts that occur at this time are provided. However, it should be kept in mind that athletes may weigh more than chart recommendations because they are more muscular. When nutrient intake becomes suboptimal, the adolescent athlete may be at considerable risk for negative health consequences, such as an increase in fractures and anemia, as well as a lack of stamina to perform in athletic events (Litt, 2004). Food restriction among adolescent athletes has been associated with stunted growth, loss of lean body mass, and altered metabolism (Beals, 2004).

Gender

Athletes may choose to participate in sports that require them to be in classes of weight or where weight is stressed as a priority for peak performance. Sports of this type include gymnastics, running, figure skating, wrestling, and boxing.

A sport that has received considerable attention among boys is wrestling. A common myth in wrestling is that the athlete can have an advantage if he competes at a lower weight class; this often leads to the practice of "cutting weight" for a competitive edge (Perriello, Almquist, Conkwright, Cutter, Gregory, & Pitrezzi, 1995). Athletes in weight class sports have been observed to have a higher risk of developing eating disorders when frequently measured for weight (Rockwell, Nickols-Richardson, & Thye, 2001). Rapid weight loss, as commonly observed among wrestlers, is a major concern among school nurses and other health professionals. Aggressive weight loss in these athletes has been associated with decreased strength and power, decreased endurance and performance, growth retardation, eating disorders, increased health risks, and other negative effects (Perriello et al.).

The sports of football, weight events, track and field, power lifting, bodybuilding, and basketball can

require high elements of strength, power, or speed. An emphasis on a structured body weight or low body weight usually is not observed in these sports. As a result, athletes in these sports report eating disorders less frequently than do those in sports that emphasize leanness (Parks & Read, 1997; Sundgot-Borgen, 1999). Over the past 3 decades, the height, weight, and body mass index of elite high school football linemen has increased. This has been attributed to better nutrition and training (Wang, Perko, Downey, & Yesalis, 1993).

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Girls' participation in sports has risen dramatically (Van de Loo & Johnson, 1995). Female athletes may have problems with menstruation, stature, and inadequate nutrition when workouts become too intense and energy intake is too restricted at a young age (Beals, 2004). The athlete who must remain lean or must have an aesthetically appealing appearance to compete and to perform with power is of considerable concern to health professionals. Athletes participating in figure skating, diving, synchronized swimming, running, rhythmic dance, gymnastics, cheerleading, long-distance sports, bodybuilding, and weight-class sports are more inclined to eating disorders due to pressure to be thin (Van de Loo & Johnson; Ziegler, Sharp, Hughes, Evans, & Khoo, 2002). Key nutrients such as iron and calcium often are missing from the diets of female athletes who restrict calories (Ziegler, Hensley, Roepke, Whitaker, Craig, & Drewnowski, 1998). Severe food restriction due to distorted views of leanness may compromise both health and performance.

Disordered eating, defined as any of several psychological disorders (such as anorexia nervosa or bulimia) characterized by serious disturbances of eating behavior, may cause impaired performance, increased risk of injury, depression, fluid and electrolyte imbalance, and thermoregulatory changes (Sundgot-Borgen, 1999). Restricted eating has been identified as a mechanism for avoiding overdevelopment and appearing prepubertal among young girls participating in aesthetic sports. Weight loss techniques such as starvation have become a mechanism for avoiding overdevelopment and appearing prepubertal in an attempt to maintain a competitive figure. Arrival of menarche is often associated with increases in weight, and this can be seen as a problem in the eyes of the aesthetic female athlete. The combination of disordered eating,

amenorrhea, and osteoporosis is known as the female athlete triad (Sherman & Thompson, 2004).

Typically, girls participating in sports such as basketball, softball, volleyball, and soccer report fewer incidences of eating disorders than do those involved in sports such as dance, running, gymnastics, and figure skating (Manore, 2002). Despite this, female athletes tend to have a greater concern about weight than male athletes have (Parks & Read, 1997). This puts them at increased risk for developing eating disorders.

NUTRITION ISSUES OF CONCERN

Nutrition Knowledge of Athletes

Athletes do not demonstrate a sufficient knowledge of nutrition for their performance needs despite a reported high interest in nutrition. Lack of nutrition knowledge has been observed at the high school level and may be attributed to the sources to which athletes look for nutrition guidance. Knowledge of protein needs, vitamin and mineral needs, and fluid needs has been shown to be lacking among athletes (Shifflett, Timm, & Kahanov, 2002). Nutrition misconceptions also were observed among athletes regarding fluids and hydration, precompetition meals, and protein needs. Examples include the following: never eat after 5 p.m.; 800 kcal/day is adequate energy intake; eat only when the food is cold; no eating of meat, bread, or potatoes, no drinking of fluids during training (Sundgot-Borgen, 1996). Those with misinformation may make wrong food choices that may affect their performance (Rosenbloom, Jonnalagadda, & Skinner, 2002). Athletes' knowledge and use of ergogenic aids are of particular importance. Many athletes use supplements and ergogenic aids without knowledge of their efficacy (Burns, Schiller, Merrick, & Wolf, 2004). High school athletes with aspirations of playing collegiate sports have reported being more likely to use supplements to improve athletic performance (Sobal & Marquart, 1994). Despite little knowledge of the use of ergogenic aids, athletes may spend a lot of money on these products.

Sources of Nutrition Information

Athletes tend to get nutrition information from magazines, health food store personnel, coaches, gym owners, and other athletes (ADA/DC/ACSM, 2000). Due to the fact that athletes know that they have unique nutritional needs, they often seek guidance or accept prescribed diets. One study reported that 10% of athletes had been on an "individualized" training diet prescribed for them by an unreliable source (Schmalz, 1993). They tend to turn to resources other than health professionals, which may lead to continued lack of good nutrition education (Habash, 2000).

Most athletes are likely to look to their parents for nutrition information and guidance, but also rely on

coaches and trainers (Habash, 2000). Other resources include physicians, nutritionists, teammates, friends, and crash-diet books (Congeni & Miller, 2002; Rockwell, Nickols-Richardson, & Thye, 2001). Certain sports have athletes who may rely on coaches most often for nutrition guidance. When coaches are misinformed about nutrition, this becomes a potential problem for the athlete.

Inappropriate Nutrition Recommendations by Coaches

Coaches often play a role in influencing the dietary habits of athletes, especially in sports such as wrestling and gymnastics. Gymnasts and wrestlers have been observed to rely less on parents and health professionals and more on coaches for nutrition guidance (Sundgot-Borgen, 1996). A study of high school wrestling coaches showed that nearly half rated themselves as knowledgeable about nutrition, yet the majority either agreed with or were undecided about the statement that "weight loss gives a competitive edge" (Sossin, 1997). Coaches have been reported to recommend inappropriate macronutrient intake, fluid restriction, and weight gain for athletes (Shifflett et al., 2002). Many suggest multivitamin and protein supplement use despite lack of documented scientific evidence supporting these practices (Rockwell et al., 2001). Most coaches have limited knowledge and training in nutrition, yet often provide nutritional advice.

Weight Control

In order to maximize or maintain sports performance, some athletes may be seeking either to gain weight (such as for football) or to lose weight (such as for gymnastics, skating, wrestling). In either case, the weight change should be achieved gradually and should be initiated early—well before the start of the competitive season or event (ADA/DC/ACSM, 2000; McArdle, 1999). Weight gain can be accomplished through additional calorie intake and strength training, whereas weight loss can be accomplished with a reduced calorie intake and/or increased calorie expenditure (ADA/DC/ACSM; Manore, 1999; Thompson & Manore, 2000; Ziegler, Nelson, Barratt-Fornell, Fivash, & Drewnowski, 2001). However, calorie restriction should never jeopardize normal growth. The appropriateness of weight restriction for certain sports such as wrestling, skating, and gymnastics has been an area of great concern. Wrestling guidelines about safe practices for making weight are available from most state high school athletic associations (Denehy, 2002). Some are available on the Internet (for example, www.iahsaa.org) and are reliable resources for the school nurse. Guidelines for figure skaters and gymnasts also have been published (LaPiana & Bramble, 2000; Ziegler & Jonnalagadda, 2000).

Ergogenic Aids

Athletes are in a very competitive environment. In a world where success is so important, it is easy to understand why athletes turn to methods such as using ergogenic supplements to give them an edge. Ergogenic aids are any substance or procedure that may aid physical work or athletic performance. There are several ergogenic aids that claim to enhance athletic performance or to improve exercise capacity. Athletes may waste a lot of money on supplements that do not work as claimed or, more importantly, that jeopardize their health.

A recent study has shown that 88% of college athletes used one or more nutritional supplements (Burns et al., 2004). Although supplement use has not been studied thoroughly in younger athletes, it is not outside the realm of possibilities that many of them are using supplements as well. Students should be questioned about the types of supplements they use and what they think the effects are. A common misconception among young athletes is that vitamins provide energy or increase muscle strength, yet there is no evidence to support this.

The National Collegiate Athletic Association (NCAA) does not ban dietary supplements because they are not considered drugs; however, the NCAA does indicate that the use of supplements is at the student athlete's own risk (NCAA, 2005). Counseling of athletes about ergogenic aids should be done after careful evaluation of the safety and efficacy of the supplement (ADA/DC/ACSM, 2000). A separate article in this issue is devoted to the topic of ergogenic aids.

IMPLICATIONS FOR SCHOOL NURSING PRACTICE

Sports nutrition guidance for athletes can take many forms. Nurses might provide individual counseling, distribute handouts or booklets, present or make arrangements for seminars to be presented to high school teams to capitalize on peer ties, develop a structured referral system with the support of a coach so that athletes with eating disorders can obtain qualified counseling, or tap into standardized state-wide or nationwide programs to establish and to promote healthy weight management among athletes.

Credible sports nutrition resources include the ADA, the ACSM, and the American Academy of Pediatrics. The ADA's book entitled *Sports Nutrition—A Guide for the Professional Working with Active People* contains a wealth of resources, including guidelines for evaluating sports nutrition information on the Internet, how to evaluate ergogenic aids, and lists of credible sports nutrition Websites.

Useful nutrition guidelines can be found online at the Websites of some sports-related national organizations. The NCAA has a link on its Website geared toward educating collegiate athletes, coaches, trainers, and other athletic department staff on sports nutrition

(www1.ncaa.org). Information on this site may be useful for high school athletes and coaches, as well. The student athlete link has a section on nutrition, performance, and a checklist with guidelines on healthy eating. Other resources for nutrition guidelines include the American Heart Association, textbooks, journals, registered dietitians (RDs), and education through classes and workshops. School nurses can network with local RDs who have sports nutrition expertise. They can find these individuals by accessing the Website of the American Dietetic Association (www.eatright.org), linking to "Find a Nutrition Professional" and entering the local ZIP code.

CONCLUSION

Proper nutrition for young athletes is critical not only to their athletic success, but, more importantly, to their growth, development, and overall health. In general, neither athletes nor coaches have sufficient knowledge in nutrition to create an environment that can result successfully in enhanced performance and optimal health.

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The school nurse should be an important resource for young athletes. The 2005 *Dietary Guidelines for Americans* can serve as the foundation for baseline nutritional recommendations for good health. If nurses are knowledgeable about sports nutrition and have a support network for nutrition information, they can help young athletes understand their sports nutrition needs.

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