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Sports Nutrition Practices for the Adolescent Athlete: A Literature Review

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Abstract

Sports nutrition is an important aspect of an athlete's training and improvement, yet it is often overlooked when it comes to younger competitors. Four posters were created with the intent of providing adolescent athletes, their parents, and their coaches with information about important topics in sports nutrition including a general overview of nutrition goals, hydration strategies, recovery nutrition, and nutritional considerations for vegetarian and vegan youth athletes. The posters were designed to appeal to adolescents from the ages of 13 to 18, and each poster covers its designated topic in detail appropriate for middle and high school-aged athletes. The accompanying literature review reflects the research that was done prior to the creation of the graphics. Research on sports nutrition for adolescent athletes is limited and usually based on adjusted adult recommendations. The nutrition recommendations found on the posters and throughout this review were based on common trends seen in the literature.

Keywords: Nutrition, athletes, sports nutrition, poster, youth athletes, adolescents

Introduction

In 2019, a survey found that 55.1% of children in the United States from the ages of 6-17 participated in some type of organized sport, a percentage that equates to almost 27 million adolescent athletes (Child and Adolescent Health Measurement Initiative). While many of these children may only be playing recreationally, nutrition is an important part of every athlete's training. For adult athletes, sports nutrition is about providing the body with energy, enhancing performance, and aiding recovery, among other things. These goals are just as important for youth athletes, but there is the added challenge of supporting their growth and development as they get older. In order to make sure that youth athletes make the best decisions possible when it comes to their nutrition, it is important to provide them with the necessary information. A majority of young athletes get information about nutrition primarily from their coaches and parents (Cotugna et al., 2005). This is why it is important to focus on educating the athlete as well as their support network. Youth athletes require special nutritional considerations and those considerations will be detailed in this literature review.

Review of Literature

Carbohydrates

Recent "low-carb" diet trends may lead many to believe that carbohydrates are unimportant or even detrimental to their diet, but this is not true. The body needs carbohydrates to fuel many essential bodily functions. Carbohydrates are not inherently unhealthy, and this disconnect may stem from many people not understanding what is considered a carbohydrate (Harvard T.H. Chan School of Public Health, n.d.-a). The three main types of carbohydrates include fibers, starches, and sugars, and can be differentiated by the amount of time they take to digest. Sugars are simple carbohydrates that are digested quickly so that they can be converted

and used for energy soon after consumption (Sizer & Whitney, 2008). Starches are complex carbohydrates that are digested slowly. Fibers are never fully digested. The majority of the athlete's dietary carbohydrate intake should be made up of complex carbohydrates (Nemet & Eliakim, 2009). This includes fibers and starches such as pasta, potatoes, and oats. Fruits and vegetables can also be good sources of complex carbohydrates, but athletes should remain conscious of their sugar content.

Values may vary for different ages, but most sources agree that carbohydrates should make up the majority of a young athlete's diet. This is in agreement with the U.S. Department of Agriculture's "MyPlate" (formerly known as the food pyramid) that many children are taught in school. The difference is that "MyPlate" separates carbohydrates into categories that are more understandable for the general public like fruits, vegetables, and grains. Older studies suggest the exact amount of carbohydrates that should make up a young athlete's caloric intake is at least 50% (Cotugna et al., 2005; Nemet & Eliakim, 2009). More recent research widens that amount to 45-65% of the athlete's total caloric intake (Purcell, 2013).

While young athletes could follow the daily recommended carbohydrate intake for children in their age group, this amount is only based on providing enough glucose for the brain and does not factor in the need for glucose in restoring muscle glycogen (Nemet & Eliakim, 2009). It is recommended that children consume a minimum of 180 grams per day to support simple bodily functions, but the pediatric athlete needs to consume more than this to keep up with energy demands, around 200-500 grams per day (Bonci, 2010). The importance of carbohydrates in the athlete's diet cannot be understated. For athletes that wish to compete at a high intensity, carbohydrates are essential because they help to maintain blood glucose levels

throughout the competition and replenish muscle glycogen stores in recovery (Cotugna et al., 2005).

Proteins

Young athletes may be told to cut back on many different nutrients like carbohydrates and fats to improve their performance but it is very unlikely that they will be told to consume less protein. The protein requirement for athletes is higher than it is for non-athletes. In the body, protein serves many functions. Proteins assist in the production of hormones, which are very important for a developing child (Cotugna et al., 2005). Protein also plays a major role in muscle tissue repair, which is why it is so important in recovery (Nemet & Eliakim, 2009). Protein is not the primary energy substrate for short-duration exercise, but as time goes on it can be used to keep up blood glucose levels (Purcell, 2013).

Sources varied on the exact amount of protein a young athlete should be consuming. One stated that 10-30% of the athlete's total caloric intake should be made up of protein (Purcell, 2013). Other sources agreed that 10-15% is a sufficient amount to meet nutritional and energy needs (Bonci, 2010; Cotugna et al., 2005). These amounts should be attainable in a normal diet, so supplementing with protein is usually unnecessary. Protein can be obtained in many different forms including but not limited to animal products like eggs, fish, poultry, and lean meat, and plant sources such as beans, nuts, and tofu. Plant and animal protein sources are preferable to protein powders because they offer more nutrients than a protein isolate (Harvard T.H. Chan School of Public Health, n.d.-c; Bonci, 2010).

Consuming too little protein can result in malnutrition and the loss of muscle mass but it is also important that athletes do not consume too much protein, as it can cause adverse metabolic effects. Excess amino acids from the overconsumption of protein can result in

dehydration and increased urea accumulation in the urine (Millward, 2004). Urea is a nitrogen-based waste product that results from protein metabolism. A buildup of this metabolic product can cause kidney damage long-term (Ko et al., 2020).

Fats

Many may consider fats to be something that needs to be avoided but the consumption of dietary fats serves many important purposes, especially in adolescents. Fat is a very energy-dense nutrient. One gram of fat provides nine kilocalories while one gram of protein and one gram of carbohydrate both contain four kilocalories (Purcell, 2013). Aside from providing energy during exercise, fat is also needed to support general growth and development in children. Fat is needed for insulation and providing cushioning for the organs as well as for assisting with the absorption of fat-soluble vitamins (Purcell, 2013).

The majority of sources are in agreement that fat should make up somewhere between 20-30% of the youth athlete's daily caloric intake (Bonci, 2010; Cotugna et al., 2005). A 2000 joint position released by the American Dietetic Association, the American College of Sports Medicine, and Dietitians of Canada found there to be no benefit to a daily caloric intake of less than 15% fat (American Dietetic Association [ADA], Dietitians of Canada [DC], American College of Sports Medicine [ACSM], 2000). A later position changed their stance to say consuming less than 20% of an athlete's daily caloric intake as fats was not beneficial to the athlete's performance (Rodriguez et al., 2009).

There are three types of fat: trans fats, unsaturated fats, and saturated fats. When talking about fats to avoid, the usual subject is trans fats. This type of fat is primarily found in processed foods and is made through hydrogenation (Chong et al., 2006). Trans fats are also known to contribute to heart disease because they cause an increase in LDL, commonly known as "bad

cholesterol,” and a decrease in HDL, commonly referred to as “good cholesterol” (Harvard T.H. Chan School of Public Health, n.d.-b). Unsaturated fats are considered to be “good” fats and can be broken down into monounsaturated fats and polyunsaturated fats based on the number of carbon bonds in their structures. This type of fat includes omega-3 fatty acids and is considered good because it can reduce inflammation and improve heart health. Saturated fats are not considered to be as harmful as trans fats but can still have a negative impact on an individual’s health. For this reason, it is recommended that saturated fats do not exceed 10% of a young athlete’s caloric intake (Purcell, 2013).

Hydration

Many adolescent athletes may not realize that not drinking enough fluids can have just as detrimental an effect as not eating enough food. Dehydration can diminish performance so it is in the athlete’s best interest to stay adequately hydrated. Exercise causes an increase in body temperature. To combat this rise, the body thermoregulates by producing sweat to cool down. Children usually experience more heat stress than adults because they absorb more heat from the environment at a faster rate than adults do (Petrie et al., 2004). This is because children have a higher ratio of surface area to body weight than adults (Gomes et al., 2013). The same principle applies to cold environments which is why children also lose heat more rapidly than adults.

As a general rule, young athletes should be consuming 0.5 to 1 liter per day above the baseline amount for a child not participating in sports (Petrie et al., 2004). This amount accounts for the amount of sweat they lose during their sport. Sweat rates vary based on individual characteristics such as age, sex, and sport. Older adolescent athletes that are playing outdoors or at a very high level may need more than this. In older youth athletes, sweating rates can get as high as 2.5 liters per hour (Bergeron, 2015).

One way to monitor and combat sweat loss is by having athletes weigh in before and after practice. By doing this, coaches or trainers can compare the athlete's pre-exercise weight to their post-exercise weight and encourage fluid consumption that brings the athlete back to their pre-exercise weight (Nemet & Eliakim, 2009). Hydration status can also be assessed using urine color. Low urine production combined with dark coloring can indicate underhydration while frequent, clear urine can indicate overhydration (Bergeron, 2015). Rehydration is essential during the recovery period following physical activity. The body loses a good deal of fluids in the form of sweat during exercise. For this reason, adolescent athletes should replenish their fluids by consuming 1.0 to 1.2 liters of fluid for every kilogram lost in body weight (Bergeron, 2015). Having athletes consume water along with a salty snack or water with a sodium tablet can be beneficial for supporting fluid retention (Thomas et al., 2016). Some athletes may prefer sports drinks with flavoring over plain water which is acceptable. Adding a flavoring to water may make the drink more appealing to younger athletes and make it more likely that they will voluntarily stay hydrated without needing reminders (Unnithan & Goulopoulou, 2004).

Vegetarian and Vegan Athletes

All youth athletes and their parents should keep an eye on their diets to ensure they are getting an adequate amount of nutrients, but vegetarian and vegan athletes must pay special attention to what they are eating. Cutting out just meat or animal products entirely means having to find other sources of essential nutrients, especially protein. Animal protein can be replaced with plant-based protein. Protein isolates are recommended over protein powders as they only provide protein while the powders often contain many other micronutrients (Bonci, 2010). Iron is a mineral that many believe vegetarian athletes need to heavily supplement due to not eating meat, but the research does not entirely support that claim. Few studies have observed any

significant differences in the intake of dietary iron between vegetarians and non-vegetarians (Desbrow, 2021). One longitudinal study looked at growth differences between vegetarian and non-vegetarian children ages 7 to 11 and found there to be no significant differences in measurements, except the vegetarian children were marginally taller (Nathan et al., 1997).

This does not mean that there are no nutritional concerns with a vegetarian or vegan diet. Youth athletes still need to ensure that they are getting enough of the nutrients that they may be missing out on in meat products, such as protein or iron. Vegetarian or vegan children with high-fiber diets that are low in caloric density may struggle with meeting energy requirements for their sport (Barr & Rideout, 2004).

Vitamin B-12 can also be a concern for vegan and vegetarian athletes because it is found primarily in animal products like meat, fish, eggs, and dairy. This vitamin is utilized in the body to make red blood cells and synthesize DNA (Green et al., 2017). It also supports nervous system development, which is crucial for children. While vegetarian athletes are still able to obtain vitamin B-12 relatively easily through dairy and other non-meat animal products, vegan athletes may have a more difficult time consuming vitamin B-12 in their usual diet. However, this does not mean their only option is supplementation. Vitamin B-12 can be found in tempeh and foods that have been fortified with vitamin B-12, like cereals (UK National Health Service, n.d.).

Vitamin D is another concern, but there are many more food options available for vegan athletes, such as leafy vegetables and dried fruits. In terms of minerals, vegan athletes may not consume enough zinc, calcium, or iron but most of these minerals can be found in foods like legumes, nuts, and seeds.

The Use of Supplementation with Youth Athletes

The use of supplements with young athletes can be a very taboo subject. Supplement usage in young athletes is seen predominately in male athletes and more specifically in football players (Jagim et al., 2021). The official position of the American College of Sports Medicine, American Dietetic Association, and Dietitians of Canada is that the use of supplementation with youth athletes is unnecessary and unjustifiable as these athletes are able to improve through proper nutrition, practice, and normal development (Thomas et al., 2016).

Limitations and Future Directions

There are many limitations when it comes to making recommendations for adolescent athletes. In general, research studies in youth sports nutrition are limited due to concerns about the effect they may have on normal growth and development. For this reason, most of the current recommendations for adolescent athletes are based on research done on adult athletes, which is not ideal. Children have different metabolic needs that recommendations that are tailored to adults may not account for. Youth sports nutrition must be able to give accurate macronutrient recommendations based not only on the child's activity level but also on their physiological needs. Further research is needed to create accurate nutrition and hydration recommendations for adolescent athletes. There are some general recommendations for youth athletes, but they are not very specific in comparison to the recommendations for adults. While adults are able to calculate the number of grams of macronutrients per kilogram of body weight, children are given percentages of daily caloric intake. More research needs to be done to ensure that youth athletes are receiving the most accurate nutrition recommendations to help them perform their best.

Conclusion

In conclusion, proper sports nutrition is not just important for youth athletes, it is vital. Ensuring youth athletes are eating right and consuming enough fluids is the key to helping them perform at their best. Carbohydrates are important for restoring blood glucose and providing energy during exercise. It is recommended that carbohydrates make up 45-65% of a young athlete's caloric intake. Protein is necessary for repairing muscle tissue after exercise and plays an essential role in recovery. Protein should make up 10-20% of a young athlete's caloric intake and should be a part of any recovery meal. Fats are needed for normal child development, so they must not be cut out of an adolescent athlete's diet. Fats should make up 20-30% of an athlete's caloric intake as anything less than 20% has not been found to be beneficial to performance. Hydration recommendations will change based on the age, sex, sport, etc. of the athlete but as a general rule, these athletes should be consuming 0.5 to 1 liter more than a child who does not participate in sports. It is also important that athletes are replenishing the fluids that they lost during exercise by drinking 1-1.2 liters of fluid for every kilogram that was lost in body weight during the activity.

When it comes to athletes following vegetarian or vegan diets, a closer eye may need to be kept on their nutrient intake to ensure that they are consuming enough of the vitamins and minerals that they may be missing out on with a plant-based diet. It is essential that these athletes still meet the energy requirements for their sport and normal development. Vegetarian and vegan diets do not seem to have any adverse effects on the growth and development of youth athletes, so it is not necessary to dissuade this choice. Supplementation for vitamins and minerals like vitamin B-12 is an option but most of these should be attainable in the diet. In general,

supplementation is not recommended for children as they are able to improve their performance through practice, normal development, and proper nutrition.

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