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Nutrition for young athletes in early to middle childhood: A narrative review

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Abstract

In addition to facilitating the best possible growth and development, nutrition has a significant role in the athletic performance of young athletes in the early to middle childhood years. Adequate physical activity is essential for preventing obesity and promoting general health and well-being at a developmental age. Young athletes must understand what, when, and how to eat and drink before, during, and after an exercise in order to perform at their best. In order to prevent both nutrient deficiencies and excessive or inadequate supplement intake, physicians should provide children and their families with appropriate advice. This is because nutritional requirements vary depending on the intensity, frequency, and type of physical activity or sport being played. For young, active athletes, the right proportions of macro- and micronutrients in the diet, together with proper hydration, are essential to supply energy for growth, development, and overall athletic performance. Research on improving the nutrition, timing of nutrients, hydration, and dietary supplementation of young athletes in their early to middle childhood is still ongoing, and there aren't many studies on dietary needs and consumption.

Keywords: Athletes; Nutrition; Children; Sport; Physical activity

1. Introduction

Adequate physical exercise during developmental age is essential for maintaining general health and well-being as well as preventing overweight and obesity [1]. Children can achieve their growth and neurodevelopmental objectives by establishing active behavior [2, 3]. Participation in sports is also encouraged, and many students begin playing sports at a high level of competition. In this regard, nutrition is essential for promoting kids' development and growth [4].

Athletes now compete at a higher level from an early age thanks to the deliberate roles played by the media in general and sports media in particular in spreading innovative training techniques [5]. Even though adolescent and adult athletes compete fiercely, we cannot prescribe the same diet for both groups because, aside from physiological changes in growth stages, there are prominent differences in substrate storage and metabolism [6]. Young athletes who receive inadequate counseling make dietary decisions that negatively affect their health and athletic performance. These decisions include skipping meals, consuming fast food, and participating in high-risk behaviors like self-induced vomiting, dehydration, restrictive eating, overexercising, using diuretics, laxatives, or taking diet medications [7, 8].

In order to promote training, increase physical activity, lessen weariness during exercise, and prevent injuries, recent studies emphasize the significance of providing children with a well-balanced diet that includes both macronutrients and micronutrients [6, 7, 9, 10]. Young athletes have higher nutritional needs than their counterparts of the same age who do not participate in sports [11, 12]. Additionally, young athletes in their early to middle childhood may not achieve the optimal peak bone mass due to a lack of energy and nutrition, which could postpone their growth and raise their

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chance of developing osteoporosis later in life. The nutritional requirements, dietary intake, healthy eating, and eating disorders of young athletes in early to middle childhood are not well understood; pertinent data from older populations is cautiously included to help guide practical recommendations. The nutritional status of young athletes in their early to middle childhood is thus the subject of this narrative review, which combines research and review papers in a unique way. It describes the dietary requirements for growing young athletes both quantitatively and qualitatively, as well as in terms of wholesome food, food choices, and eating disorders.

2. Growth and Development

In terms of growth, the growth hormone (GH) axis is altered by malnutrition brought on by an inappropriate nutritional intake in relation to the level of physical activity. Growth is ultimately slowed down by peripheral resistance to the GH and a decrease in the insulin-like growth factor (IGF-I). Nonetheless, sports—particularly those that require flexibility, like basketball or volleyball—help to attain optimal growth when combined with a healthy diet [13]. The hormone leptin, which is produced in adipose tissue, is crucial for bone metabolism. Because it promotes osteoblast growth and suppresses adipocyte proliferation, it is thought to be a preventive factor against osteoporotic fractures. While short exercise cycles may not alter leptin levels, prolonged physical activity lowers them [14]. Three concepts that are essential to any conversation about youth are growth, maturation, and development. These words refer to three distinct criteria, even though they frequently appear simultaneously in young people. Similar to business, demand (i.e., energy expenditure) determines calorie supply (i.e., energy intake). Basal/resting metabolic rate, thermic effect of food, thermic effect of exercise, and the energy requirements of growth are the four main components that make up children's energy expenditure [15]. The term "thermic effect of activity" refers to the calorie cost of movement and is the most changeable aspect of energy expenditure. The youth athlete population is a prime example of vigorous lifestyle physical activity due to the high levels of participation in high-energy-demanding activities [16]. A larger percentage of caloric consumption is attributed to growth, which varies according to the pace of maturational development and is particularly rapid during infancy and early childhood [15].

3. Energy Requirements

Growth, maintaining excellent health and academic performance, and supplying energy all depend on basic nutrition. By reducing fatigue and the danger of illness and injury, sports nutrition improves athletic performance. It also helps athletes maximize their training and recuperate more quickly [17]. To avoid an energy excess or deficit, it is essential to maintain a balance between energy expenditure and intake. Short stature, delayed puberty, irregular menstruation, muscle loss, and heightened vulnerability to exhaustion, injury, or disease are all consequences of energy deficiencies [18, 19]. Overweight and obesity can be caused by an excess of energy [20]. Boys and girls in early to middle childhood have similar minimum nutritional and energy needs (caloric needs) before to puberty. Young athletes' energy needs vary greatly based on their age, level of activity, pace of growth, and physical maturation stage (Table 1) [17]. These suggested calorie allowances are the very minimum required to guarantee healthy development and physiological processes. In order to restore the energy used during physical endeavors and during development spurts, more calories are required [17, 21, 22].

Table 1 Daily energy requirement in the early to middle childhood age with heavy physical activity (adapted from McKinney et al., 2019 [25])

Age (years)	**Daily Energy Requirement (kcal/day)**	
	Boys	Girls
6–8	1800–1950	1650–1775
8–10	2100–2275	1950–2125
10–12	2475–2700	2300–2475

For instance, a 60 kg boy playing ice hockey for 60 minutes would burn an average of 936 calories, while a 30 kg girl playing soccer would burn an average of 270 calories [22]. The difference between an individual's energy intake and expenditure is known as their energy balance [23]. In addition to altering body composition, excessive or insufficient changes in children's energy balance can also have an impact on maturation and the development of structural and functional tissues [24]. The surplus will mostly build up as body fat if the balance is favorable. A negative balance, on

the other hand, will result in fewer bodily compartments [23]. Due to the high demand for nutrients associated with the negative balance storage of bodily components, children's nutritional condition is particularly sensitive [24]. Since energy expenditure is mostly controlled by the training and competition load, it is challenging to determine the proper daily energy intake for young athletes in the early to middle childhood age range [11]. According to Table 1, daily energy consumption rises with age and differs for boys and girls starting at pubertal age.

4. Carbohydrates

Since they supply the glucose needed for energy, carbohydrates are the most crucial food source for athletes. Four kilocalories of energy are found in one gram of carbohydrates. Muscle glycogen is the most easily accessible energy source for working muscle and can be released faster than other energy sources. Glucose is stored as glycogen in the liver and muscles [17]. Young athletes' muscles primarily use carbohydrates (CHOs) as fuel, while the brain and neurological system use them exclusively. An essential part of giving young athletes the energy they need for development and growth is the CHO [26]. Young athletes benefit from muscle glycogen's ability to adapt to and undertake endurance exercises; its depletion causes early tiredness and subpar performance. Muscle glycogen is utilized more when exercise intensity increases, although blood glucose is used as an energy source when duration increases [27, 28]. For children aged four to eighteen, 45–65% of total calories should come from carbohydrates [17, 29]. Young athletes will benefit from consuming carbohydrates while exercising in order to improve their performance [30]. As a result, the athlete will require 4 g/kg of CHO three to four hours prior to a sporting event, 0.5 to 1 g/kg the hour before, 0.7 g/kg each hour while participating, and 1 to 1.5 g/kg following exercise [31]. They should ideally drink a beverage with 6% carbohydrates because beverages with 8% or more carbohydrates have been associated with gastrointestinal distress [32]. Glycogen is restored more quickly by beverages that contain fructose (found in fruit juices) and galactose (found in dairy products) than glucose [33]. Food and Agriculture Organization (FAO) of the United Nations stated that athletes require 6–10 g/kg/day of CHOs during endurance training programs (1–3 hours per day), and 8–12 g/kg/day during severe programs (4–5 hours per day) [16]. Table 2 provides a summary of the foods that contain carbohydrates, protein, fat, and a few micronutrients.

Table 2 Carbohydrate, protein, fat, and micronutrient content of several foods

Nutrient	**Food**
Fast absorption carbohydrates	Fruits, jelly, milk, and cake
Slow absorption carbohydrates	Cereal and its products (flour, pasta, rice, bread, corn, and oats), legumes (chickpea, bean, and lentil), and potatoes
Fats	Olive oil or other vegetable oil (less palm oil or coconut oil), oily fish, and nuts
Proteins	Fish, meats, milk, egg, and soya bean
Vitamin A (retinol)	Orange and green vegetables, liver, and milk
Vitamin B1 (thiamine)	Lean meat, liver, and whole wheat
Vitamin B2 (riboflavin)	Milk and its products, legumes, cereals, meats, and vegetable
Vitamin B3 (niacin)	Legumes, whole wheat, fish, and liver
Vitamin B5 (pantothenic acid)	Egg, milk and its products, legumes
Vitamin B6 (pyridoxine)	Fish, lean meat, and whole wheat
Vitamin B8 (biotin)	Legumes, fresh vegetables, nuts, dried fruits, meat, liver, and yolk
Vitamin B9 (folic acid)	Legumes, whole wheat, green leafy vegetables, nuts, orange, banana, and dried fruits
Vitamin B12 (cyanocobalamin)	Meat, fish, and yolk
Vitamin D (calciferol)	Oily fish, liver, and milk
Calcium	Milk and its products and dried legumes
Iron	Meat, fish, seafood, meat, egg, legumes, and whole wheat

5. Proteins

Given its critical role in growth, development, general athletic performance, and the improvement of exercise training, protein is a macronutrient that junior athletes must consume [26]. Skin, hair, nails, and muscle are all made and repaired by proteins. Since protein is an essential part of the diet for active individuals, it is required to meet increased energy demands, repair, recover, and develop skeletal muscle [34]. Normal cellular activity and the production of different body tissues depend on protein [35]. Compared to inactive people, athletes often have higher needs for dietary protein consumption [36]. Since proteins are necessary for the cellular production of many tissues, children have greater protein needs than adults to promote growth and physical development [37]. Ten to fifteen percent of calories must come from proteins, which are essential for muscle synthesis and repair [38]. Four kilocalories of energy are included in one gram of protein [29]. Proteins do not serve as the main source of energy during short-duration or mild exercise. However, through hepatic gluconeogenesis, proteins aid in blood glucose maintenance as exercise duration increases [18].

The natural breakdown of proteins in muscles or the food can both provide energy from amino acids. This can supply between 10 and 15 percent of the energy [13]. Exercise increases the breakdown of proteins by decreasing their production in the liver and muscles [24]. Since the body uses the carbohydrates from food before engaging in prolonged activity, the breakdown of muscle proteins is the primary source of amino acids utilized thereafter [13]. Lean meat and poultry, fish, eggs, dairy products, beans, and nuts, particularly peanuts, are all excellent sources of protein. Proteins with significant biological value and necessary amino acids are found in only a few foods. These foods contain animal-based proteins, particularly eggs, and to a lesser degree, fish, cow's milk, beef and chicken.

Table 3 Examples of recommended protein intake per age group and dietary restrictions [45]

	Breakfast	**Lunch**	**Dinner**	**Snack**
No Restrictions	Pork Sausage (5 g/link)	Turkey Sandwich (2 g/slice)	Chicken Breast (5 g/oz)	Sunflower Seeds (5 g/1 oz)
	5-8: 1 link	5-8: 2 slices	5-8: 4 oz.	5-8: 1 oz.
	9-13: 2 links	9-13: 3 slices	9-13: 6 oz.	9-13: 2 oz
	Bacon (3 g/strip)	Ham Sandwich (4.5 g/slice)	Baked Cod (6 g/oz)	String Cheese (7 g/stick)
	5-8: 1 strip	5-8: 1 slice	5-8: 4 oz.	5-8: 1 stick
	9-13: 2 strips	9-13: 2 slices	9-13: 6 oz.	9-13: 1 stick
	Skim Milk (8 g/cup)	Peanut Butter and Jelly Sandwich (10 g/sandwich)	Turkey Breast (5 g/oz)	Peanuts (8 g/32 nuts)
	5-8: 1 cup	5-8: ½ sandwich	5-8: 4 oz.	5-8: 32 nuts
	9-13: 1.5 cups	9-13: 1 sandwich	9-13: 4 oz	9-13: 48 nuts
	Large Egg (6 g/egg)	Shrimp (1.5 g/medium shrimp)	Ground Beef (7 g/oz)	Almonds (6 g/23 nuts)
	5-8: 1 egg	5-8: 4 shrimp	5-8: 4 oz.	5-8: 23 nuts
	9-13: 2 eggs	9-13: 6 shrimp	9-13: 5 oz.	9-13: 23 nuts
Vegan	Hummus (1.5 g/oz)	Black Beans (15 g/cup)	Tofu (2.5 g/oz)	Pumpkin Seeds (7 g/oz)
	5-8: 2 oz.	5-8: 1 cup	5-8: 4 oz.	5-8: 1 oz.
	9-13: 5 oz.	9-13: 1.5 cups	9-13: 6 oz.	9-13: 1 oz.

Both sexes are equivalent under the current recommendations (DRI), which are 1.1 g/kg/day for children ages 1 to 3 and 0.95 g/kg/day till puberty [38]. In contrast, the American Dietetic Association and the American College of Sports Medicine advise active adults to consume 1.2 to 1.8 g/kg body mass of protein, which is an adequate amount for young athletes [19, 39, 40]. Youth athletes generally require about 1.5 g/kg of protein intake per day, if overall energy

requirements are met (Table 3) [41, 42]. Young athletes can maintain positive whole-body protein balance for the longest durations of time by taking smaller protein doses (0.22–0.33 g/kg each meal) at regular 3- or 4-hour intervals [43]. For children aged four to eighteen, protein should make up between 10 and 30 percent of their overall energy intake [29]. A post-sport protein intake of 0.2 to 0.4 g/kg is recommended [31]. To assist replace glycogen and allow muscles to recover, they must be eaten within 30 minutes of exercise and again within the next 2 hours [22, 44].

Although protein-based supplements are quite popular, there is no scientific proof that they are better than whole foods high in protein, and taking too many of them can make the fat compartment bigger. Therefore, rather than depending on supplements, young athletes in their early to middle years should focus on protein from complete foods.

6. Fats

Fat is vital for all athletes, including young athletes [46], and is required for the absorption of certain fat-soluble vitamins, like vitamin D and K, also helps with proper bone growth, which is important for young athletes and performance, and prevents fat accumulation; as well, vitamins A, E, and D enhance strength, performance, and muscle recovery [47, 48]. The sensation of fullness is also brought on by fat. Although it is more challenging to use, it is a calorie-dense energy source (one gram contains nine kilocalories) [29]. According to the appropriate macronutrient distribution range (AMDR) [49], fats should make up 25–35% of junior athletes' total calorie intake. This is in line with dietary recommendations for both athletes and non-athletes, as well as current guidelines for public health [26, 50]. No more than 10% of total energy consumption should come from saturated fats [17, 19]. People who exercise have higher caloric demands, which could lead to a higher dietary fat content [39]. Young children consume a higher percentage of fat due to their adaptive response to meet their increasing requirements, growth demands, and increased energy expenditure during activity [11, 39, 51], and young athletes may be able to use a little more fat than sedentary individuals [11].

High-fat diets seem to preserve testosterone blood concentrations better than low-fat diets, according to a study [50]. Enhancing strength, power, and endurance requires testosterone, an anabolic hormone that builds muscle [52, 53]. To decrease stomach problems, which impair performance, the pre-workout breakfast should be minimal in fat [54, 55]. A 40% decrease in growth hormone secretion during exercise might result from eating high-fat meals before to working out, which hinders muscle growth and adaptability [19]. Lean meat and poultry, fish, nuts, seeds, dairy products, and olive and canola oils are all good sources of fat. Reduce the amount of fat in baked products, fried foods, candy, and chips.

7. Micronutrients

While numerous vitamins and minerals are necessary for optimal health, athletes should pay special attention to making sure they get enough calcium, vitamin D, and iron. Bone health, appropriate enzyme activity, and muscular contraction all depend on calcium. For children aged four to eight, the recommended daily intake of calcium is 1000 mg, and for those aged nine to eighteen, it is 1300 mg [29, 56]. Many foods and drinks, such as milk, yogurt, cheese, broccoli, spinach, and fortified grain products, contain calcium.

For children aged four to eighteen, the current guidelines for vitamin D are prescribed as 600 IU per day [56]. Additionally, normal vitamin D levels differ by race and geographic area. Vitamin D deficiency is particularly common among athletes who reside in northern latitudes or who train inside, such as dancers, gymnasts, and figure skaters [18]. Sunlight exposure and fortified foods, including milk, are sources of vitamin D. Vitamin D is absent from dairy products other than milk, like yogurt.

The supply of oxygen to bodily tissues depends on iron. More iron is needed during adolescence to maintain growth, as well as increases in lean muscle mass and blood volume [17]. To prevent iron-deficiency anemia and the depletion of iron reserves, boys and girls aged 9 to 13 should consume 8 mg daily [29]. Teenagers between the ages of 14 and 18 need additional iron, up to 11 mg per day for men and 15 mg per day for women [29]. Athletes frequently experience iron deficiency due to diets low in meat, fish, and poultry, as well as increased iron losses through perspiration, feces, urine, or menstrual blood [18].

Iron status should therefore be checked on a regular basis in athletes, especially female athletes, vegetarians, and long-distance runners [18]. Lean meat, eggs, leafy green vegetables, and fortified whole grains are among the foods high in iron. It is also advised to consume enough micronutrients, such as calcium, vitamin D, and iron, when participating in competitive sports [57]. Young athletes have a greater need for calcium because of their developing bones. According

to the American Academy of Pediatrics (AAP), children and adolescents aged 9 to 18 should consume 1300 mg of calcium per day, and those aged 1 to 18 should consume at least 600 UI of vitamin D per day, with supplements, especially if they are unlikely to receive enough sunlight [58].

Additionally, a healthy calcium and vitamin D balance lowers the risk of stress fractures, inflammation, and muscle cramping in athletes [13]. One essential micronutrient linked to peak athletic performance is iron. Due to growth, menstruation, or vegetarian and vegan diets, competitive adolescent athletes—particularly female athletes—are more likely to suffer from an iron deficiency. Therefore, oral iron supplementation is advised in cases of anemia or iron insufficiency [59]. A young athlete's performance may suffer from an inadequate diet that does not satisfy their needs for macronutrients and, more importantly, micronutrients.

Vitamin and mineral intake may be off even if the diet is high in macronutrients [60]. The usage of vitamin supplements, which many athletes take and which do not significantly improve performance during exercise, would be avoided by correcting these dietary errors and providing appropriate micronutrients [13]. Certain bodily metabolic processes depend on water-soluble vitamins, particularly B vitamins, including B1, B6, niacin, and folic acid. Vitamin B may thereby improve the Krebs cycle. Amino acid metabolism is intimately associated with vitamin B6 [24].

An essential component of the electron transport chain is niacin. Folic acid is involved in the metabolism of nucleic acids. In fact, the necessity of supplying these vitamins as supplements is currently up for dispute. The daily consumption of fresh fruits and vegetables, or, in the case of some athletes, amino acid supplements, can provide these vitamins [24]. Vitamin D is the most notable of the lipid-soluble vitamins.

8. Hydration and Fluids

Fluids, water in particular, are vital nutrients for athletes. What, how much, and when an athlete drink can have an impact on their athletic performance. Drinking fluids during exercise helps replenish lost perspiration and control body temperature [56, 61]. The temperature and humidity of the surrounding air can have an impact on an athlete's sweating rate and fluid requirements. A person needs more fluids to stay hydrated because they perspire more in hotter and more humid conditions [17, 61, 62].

Athletes who are dehydrated may perform worse and be more susceptible to heat exhaustion or heat stroke [17, 61, 62]. For young athletes to perform at their best in sports, they must maintain proper hydration levels because water loss of ≥ 2% of body weight impairs their performance [11, 32, 33, 63, 64, 65, 66]. Young athletes who do sports in the heat risk developing severe fluid deficiency and possibly losing more than 4% of their body weight as a result of perspiration [67]. According to one study, 20–44% of athletes are undehydrated even at the start of their training sessions, indicating that fluid shortage is frequent [68]. Fluids should be easily accessible for ingestion before to, during, and following activity sessions in order to prevent dehydration. In contrast to the habits of many young athletes, activity sessions should be farther spaced out in order to preserve their normal level of hydration [69, 70, 71, 72]. Athletes should drink 400–600 milliliters of cold water two to three hours prior to the workout. Athletes should drink 150–300 mL of fluid every 15–20 minutes while participating in sports [17, 61, 62]. Water is enough for events under one hour [20]. Sports drinks with 20 mEq/L to 30 mEq/L of sodium chloride and 6% carbohydrates are advised for events that take longer than 60 minutes and/or occur in hot, humid conditions [19, 20, 21, 61]. Athletes should consume roughly 1.5 L of fluid per kilogram of body weight lost after exercise [17, 62]. After exercise, sodium-containing drinks and snacks promote thirst and fluid retention, which aids in rehydration [17, 18, 62]. Furthermore, consuming fluids at will during practices is not enough to stop additional dehydration [70]. As a result, trainers ought to promote regular and planned fluid consumption.

9. Meal Planning

Athletes should learn the foods they enjoy eating in order to perform at their best. On the day of competition, athletes shouldn't try new foods or routines. For optimal digestion and to reduce the risk of gastrointestinal distress during exercise, meals should be taken at least three hours prior to an event [73]. Carbs, protein, and fat should all be included in meals. Fiber ought to be restricted. Avoid eating high-fat meals right before going out because they might create sluggishness and delay stomach emptying, which can negatively impact performance. Having a snack or liquid meal one to two hours prior to exercise and a full breakfast afterward will help ensure that you have enough energy to perform at your best during early morning practice sessions or events [73]. In order to allow for digestion prior to the start of exercise, pre-game snacks or liquid meals should be had one to two hours before an event. A bowl of cereal with milk, juice, or fruit-based smoothies is an example of snacks, as are dried fruit and fresh fruit. Fruit, granola bars, or sports

drinks can be consumed throughout an event to assist in replenishing and maintaining a high level of energy [73]. Eating the "right foods" at the "right time" is crucial. Hydrating and fueling your body before, during, and after a workout has an impact on overall comfort as well as training and performance. However, individual differences have been observed in the amount and time of food tolerated [74]. Some people depend on it to maintain proper blood sugar levels and replenish body resources, while others report digestive issues like nausea and cramping if they eat too soon before training begins. Long intervals between meals and snacks might also cause the body to become more stressed and exhausted [74].

10. Limitations

This review offers some helpful insights on the nutritional needs of young athletes in early to middle childhood, but there are clear weaknesses that must be addressed. Much of the supporting literature originates from studies of adolescent or adult populations, meaning the recommendations needed for these specific age-group athletes have been derived indirectly from older populations. The energy and nutrient demands differ with type of sports, intensity, frequency, and individual growth patterns, making it impossible to draft a universal dietary guideline for young athletes in early to middle childhood. Many dietary advisories, meanwhile, fail to detail the precise proportions of carbohydrate, fat, and protein or to recommend protein quality and type, or how vitamins and minerals should be added to the diet of children. Likewise, few studies examine the potential benefit of timing meals and snacks, staying well-hydrated, or nutrient-dense snack strategies for young athletes. Also, there are concerns about using inappropriate or excessive supplementation that regulatory authorities do not register, plus a few labelled studies of their health impact on pediatrics. As long as clearer evidence regarding the nutritional needs of young athletes is accumulated, sports dietitians are required to provide more personalized guidance when developing age-specific nutritional strategies.

11. Conclusion

Sports and physical exercise are essential for children's general health and well-being. At developmental stages of early to middle childhood, nutrition is essential for providing enough energy, macronutrients, and micronutrients for physical activity and sports. Children who engage in physical exercise should adhere to age-appropriate dietary recommendations; as long as they are properly hydrated, they typically don't require extra supplements to support their activity. On the other hand, in order to improve physical and physiological performance while adhering to age-specific nutritional and energy needs, elite athletes' nutrition necessitates multidisciplinary support from families, coaches, dietitians, nutritionists, and physiotherapists. In order to prevent health issues and achieve optimal athletic performance, close nutritional guidance ought to be required. During exercise, proper electrolyte balance must go hand in hand with nutrition. Hydration should start in the hours before doing out and should continue thereafter. The lack of research on the special needs of young athletes in their early to middle childhood highlights the need for more studies on the topic that take into account the particular nutritional needs of development and maturation at this age and ability level. The scientific community should pay more attention to this issue because of the growing demand for performance results and the popularity of young sports.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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