

# Sport nutrition for young athletes

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## Abstract

Nutrition is an important part of sport performance for young athletes, in addition to allowing for optimal growth and development. Macronutrients, micronutrients and fluids in the proper amounts are essential to provide energy for growth and activity. To optimize performance, young athletes need to learn what, when and how to eat and drink before, during and after activity.

**Key Words:** Adolescents; Athletes; Children; Nutrition; Sports

Proper nutrition is vital for child and adolescent athletes to attain proper growth and perform optimally in sports. Young athletes need to learn what foods are good for energy, when to eat certain foods, how to eat during an event, and when and what to eat to replenish after activity. A well-balanced diet containing appropriate amounts of macronutrients (protein, carbohydrates and fat) and micronutrients (vitamins and minerals) is essential to provide enough energy for growth and activity. Fluids are also essential for hydration to support growth and athletic performance.

## Energy requirements

Basic nutrition is important for growth, achieving good health and scholastic achievement, and providing energy.<sup>[1]</sup> Sports nutrition enhances athletic performance by decreasing fatigue and the risk of disease and injury; it also enables athletes to optimize training and recover faster.<sup>[1]</sup> Balancing energy intake with energy expenditure is crucial to prevent an energy deficit or excess. Energy deficits can cause short stature, delayed puberty, menstrual dysfunction, loss of muscle mass and increased susceptibility for fatigue, injury or illness.<sup>[2][3]</sup> Energy excess can result in overweight and obesity.<sup>[4]</sup>

Before puberty, minimum nutritional and energy requirements (caloric needs) are similar for boys and girls. Energy requirements for adolescents are more variable, depending on age, activity level, growth rate and stage of physical maturity ([Table 1](#)).<sup>[1]</sup> These recommended energy allowances are the minimum necessary to

ensure proper growth and bodily functions. Extra calories are needed during growth spurts and to replenish energy expended during athletic endeavours.[1][5][6] For example, a 30 kg girl playing soccer for 60 min would expend an average of 270 calories, or a 60 kg boy playing ice hockey for 60 min would expend an average of 936 calories.[6]

**TABLE 1**  
**Recommended energy requirements, Kcal/day**

<b>Age, years</b>	<b>Male</b>	<b>Female</b>
4–6	1800	1800
7–10	2000	2000
11–14	2500	2200
15–18	3000	2200

Adapted with permission from reference 1

## **Macronutrients**

Macronutrients, such as carbohydrates, protein and fats, provide the fuel for physical activity and sports participation.

### **Carbohydrates**

Carbohydrates are the most important fuel source for athletes because they provide the glucose used for energy. One gram of carbohydrate contains approximately four kilocalories of energy. Glucose is stored as glycogen in muscles and liver. Muscle glycogen is the most readily available energy source for working muscle and can be released more quickly than other energy sources.[1] Carbohydrates should comprise 45% to 65% of total caloric intake for four- to 18-year-olds.[1][7] Good sources of carbohydrates include whole grains, vegetables, fruits, milk and yogurt.

### **Protein**

Proteins build and repair muscle, hair, nails and skin. For mild exercise and exercise of short duration, proteins do not act as a primary source of energy. However, as exercise duration increases, proteins help to maintain blood glucose through liver gluconeogenesis.[2] One gram of protein provides four kilocalories of energy. Pro-

tein should comprise approximately 10% to 30% of total energy intake for four- to 18-year-olds.[7] Good sources of protein include lean meat and poultry, fish, eggs, dairy products, beans and nuts, including peanuts.

## Fats

Fat is necessary to absorb fat-soluble vitamins (A, D, E, K), to provide essential fatty acids, protect vital organs and provide insulation. Fat also provides the feeling of satiety. It is a calorie-dense source of energy (one gram provides nine kilocalories) but is more difficult to use. Fats should comprise 25% to 35% of total energy intake for four- to 18-year-olds.[7] Saturated fats should comprise no more than 10% of total energy intake.[1][3] Good sources of fat include lean meat and poultry, fish, nuts, seeds, dairy products, and olive and canola oils. Fat from chips, candy, fried foods and baked goods should be minimized.

## Micronutrients

Although there are many vitamins and minerals required for good health, particular attention should be devoted to ensuring that athletes consume proper amounts of calcium, vitamin D and iron. Calcium is important for bone health, normal enzyme activity and muscle contraction. The daily recommended intake of calcium is 1000 mg/day for four- to eight-year-olds and 1300 mg/day for nine- to 18-year-olds.[7][8] Calcium is contained in a variety of foods and beverages, including milk, yogurt, cheese, broccoli, spinach and fortified grain products.

Vitamin D is necessary for bone health and is involved in the absorption and regulation of calcium. Current recommendations suggest 600 IU/day for four- to 18-year-olds.[8] Normal values of vitamin D also vary depending on geographical location and race. Athletes living in northern latitudes or who train indoors (eg, figure skaters, gymnasts, dancers) are more likely to be vitamin D deficient.[2] Sources of vitamin D include fortified foods, such as milk, and sun exposure. Dairy products other than milk, such as yogurt, do not contain vitamin D.

Iron is important for oxygen delivery to body tissues. During adolescence, more iron is required to support growth as well as increases in blood volume and lean muscle mass.[1] Boys and girls nine to 13 years of age should ingest 8 mg/day to avoid depletion of iron stores and iron-deficiency anemia.[7] Adolescents 14 to 18 years of age require more iron, up to 11 mg/day for males and 15 mg/day for females.[7] Iron depletion is common in athletes because of diets poor in meat, fish and poultry, or increased iron losses in urine, feces, sweat or menstrual blood.[2] Therefore, athletes, particularly female athletes, vegetarians and distance runners should be screened periodically for iron status.[2] Iron-rich foods include eggs, leafy green vegetables, fortified whole grains and lean meat.

## Fluids

Fluids, particularly water, are important nutrients for athletes. Athletic performance can be affected by what, how much and when an athlete drinks. Fluids help to regulate body temperature and replace sweat losses during exercise.[8][9] Environmental temperature and humidity can affect how much an athlete sweats and how much fluid intake is required. [1][9][10] Hotter temperatures and higher humidity make a person sweat more, and more fluid is needed to maintain hydration. Dehydration can decrease performance and put athletes at risk for heat exhaustion or heat stroke.[1][9][10]

Proper hydration requires fluid intake before, during and after exercise or activity. The amount of fluid required depends on many factors, including age and body size (Table 2).<sup>[9][10]</sup> Before activity, athletes should consume 400 mL to 600 mL of cold water 2 h to 3 h before their event.<sup>[1][2][10]</sup> During sporting activities, athletes should consume 150 mL to 300 mL of fluid every 15 min to 20 min.<sup>[1][2][10]</sup> For events lasting less than 1 h, water is sufficient.<sup>[4]</sup> For events lasting longer than 60 min and/or taking place in hot, humid weather, sports drinks containing 6% carbohydrates and 20 mEq/L to 30 mEq/L of sodium chloride are recommended to replace energy stores and fluid/electrolyte losses.<sup>[3]-[5][9]</sup> Following activity, athletes should drink enough fluid to replace sweat losses (Table 2). This usually requires consuming approximately 1.5 L of fluid/kg of body weight lost.<sup>[1][10]</sup> The consumption of sodium-containing fluids and snacks after exercise helps with rehydration by stimulating thirst and fluid retention.<sup>(1,2,10)</sup> For non-athletes, routine ingestion of carbohydrate-containing sports drinks can result in consumption of excessive calories, increasing the risks of overweight and obesity, as well as dental caries and, therefore, should be avoided.<sup>[4]</sup>

## Recovery foods

Recovery foods should be consumed within 30 min of exercise, and again within 1 h to 2 h of exercise, to help reload muscles with glycogen and allow for proper recovery. These foods should include protein and carbohydrates.<sup>[2][6]</sup> Examples include graham crackers with peanut butter and juice, yogurt with fruit, or a sports drink with fruit and cheese.<sup>[6]</sup>

## Meal planning

One of the trickiest things to manage is meal planning around athletic events. The timing of meals is very important and needs to be individualized. It is important for athletes to discover which foods they like that also help to maximize performance. They should not experiment with new foods or new routines on the day of competition.

General guidelines include eating meals a minimum of 3 h before an event to allow for proper digestion and to minimize incidence of gastrointestinal upset during exercise. Meals should include carbohydrates, protein and fat. Fibre should be limited. High-fat meals should be avoided before exercise because they can delay gastric-emptying, make athletes feel sluggish and thereby adversely affect performance.<sup>[2][6]</sup> For early morning practices or events, having a snack or liquid meal 1 h to 2 h before exercise, followed by a full breakfast after the event, will help ensure sufficient energy to maximize performance.<sup>[2][6]</sup>

Pre-game snacks or liquid meals should be ingested 1 h to 2 h before an event to allow for digestion before start of exercise.<sup>[2][6]</sup> Snacks can include fresh fruit, dried fruit, a bowl of cereal with milk, juice or fruit-based smoothies. During an event, sports drinks, fruit or granola bars can be ingested to help refuel and keep energy levels high.

## Reaching the finish line

A well-balanced diet is essential for growing athletes to maintain proper growth and optimize performance in athletic endeavours. An ideal diet comprises 45% to 65% carbohydrates, 10% to 30% protein and 25% to 35% fat. Fluids are very important for maintaining hydration and should be consumed before, during and after athletic events to prevent dehydration. Timing of food consumption is important to optimize performance.

Meals should be eaten a minimum of 3 h before exercise and snacks should be eaten 1 h to 2 h before activity. Recovery foods should be consumed within 30 min of exercise and again within 1 h to 2 h of activity to allow muscles to rebuild and ensure proper recovery.

**TABLE 2**

**Recommended minimal fluid intake during and after exercise in child athletes, based on the calculation of 13 mL/kg during exercise and 4 mL/kg after exercise**

<b>Body weight, kg</b>	<b>Fluid replacement during exercise, mL/h</b>	<b>Fluid replacement after exercise, mL/h</b>
25	325	100
30	390	120
35	455	140
40	520	160
45	585	180
50	650	200
55	715	220
60	780	240

*Adapted with permission from reference 9*

## **Useful websites**

- [American Society for Nutrition \(http://www.nutrition.org\)](http://www.nutrition.org)
- [Australian Sport Institute \(http://www.ausport.gov.au/ais/nutrition\)](http://www.ausport.gov.au/ais/nutrition)
- The [Canadian Nutrient File \(http://www.hc-sc.gc.ca/fn-an/nutrition/fiche-nutri-data/user\\_guide\\_d\\_utilisation01-eng.php\)](http://www.hc-sc.gc.ca/fn-an/nutrition/fiche-nutri-data/user_guide_d_utilisation01-eng.php) is a searchable database containing average values for nutrients in foods

- [Coaching Association of Canada \(http://coach.ca/\)](http://coach.ca/)
- Dietitians of Canada: [Table of iron-rich foods \(http://www.dietitians.ca/Nutrition-Resources-A-Z/Factsheets/Minerals/Food-Sources-of-Iron.aspx\)](http://www.dietitians.ca/Nutrition-Resources-A-Z/Factsheets/Minerals/Food-Sources-of-Iron.aspx)

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