Team Physician Consensus Statement

Selected Issues for Nutrition and the Athlete: A Team Physician Consensus Statement

DEFINITION

Nutrition for sport is the provision of essential nutrients, including fuels and fluids, to provide energy for training, competition, recovery, and general health and wellness. The intake versus expenditure of these essential nutrients will be called *energy balance*. Optimum performance is promoted by adequate energy intake.

GOAL

The goal of this document is to help the team physician understand selected nutrition issues to advise athletes on issues related to health and optimal performance.

SUMMARY

This document provides an overview of selected medical issues that are important to team physicians who are responsible for the care and treatment of athletes. It is not intended as a standard of care and should not be interpreted as such. This document is only a guide and, as such, is of a general nature, consistent with the reasonable, objective practice of the healthcare profession. Adequate insurance should be in place to help protect the physician, the athlete, and the sponsoring organization.

This statement was developed by a collaboration of six major professional associations concerned about clinical sports medicine issues; they have committed to forming an ongoing project-based alliance to bring together sports medicine organizations to best serve active people and athletes. The organizations are the American Academy of Family Physicians, the American Academy of Orthopaedic Surgeons, the American College of Sports Medicine, the American Medical Society for Sports Medicine, the American Orthopaedic Society for Sports Medicine, and the American Osteopathic Academy of Sports Medicine.

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General Nutrition for Athletes

Nutrition for sport is the provision of essential nutrients, including both fluids and fuels, to provide energy for training, competition, recovery, and general health and wellness. Athletes can meet 100% of their dietary needs from a well-balanced nutrition plan that addresses performance, hydration, recovery, and health. In athletes with certain medical conditions (e.g., iron, calcium, and vitamin D deficiency), supplementation may be beneficial.

In this area of sports medicine, a sports dietitian (registered dietitian [RD] and preferably a board certified specialist sports dietetics [CSSD]) can be a member of the athletic care network. While many offer sports nutrition advice, an RD has met the minimum educational and training requirements of the Academy of Nutrition and Dietetics, formerly the American Dietetic Association. Only an RD can practice as a sports dietitian (1).

Athletes need to consume adequate energy (in the form of calories) to maintain or modify body weight and maximize health and training effects (1).

- Inadequate energy intake can result in muscle loss, increased risk of fatigue, increased risk of injury and illness, and prolonged recovery process.
- Excess energy intake can result in weight gain, which may increase body fat resulting in increased fatigue, risk of injury, and poor performance.

TABLE 1. Carbohydrate and protein recommendations based on body weight.

	Range of CHO 2.7–4.5 g·lb^{-1}	Range of Protein 0.55–0.77 g·lb^{-1}
Weight in Pounds (kg) (1 kg = 2.2 lb)	**Total Grams of CHO per Day**	**Total Grams of Protein per Day**
100 (45.5)	270–450	55–77
110 (50)	297–459	61–85
140 (63.6)	378–630	77–108
150 (68.2)	405–675	82–116
160 (72.7)	432–720	88–123
190 (86.4)	513–855	105–146
220 (100)	594–990	121–169
250 (113.6)	675–1125	138–193

- Energy is gained through the consumption of a combination of carbohydrates, proteins, and fats.

Carbohydrate (CHO) recommendations for athletes range from 6 to 10 g·kg^{-1} body weight per day and can range from 50% to 70% of total calories [(4), Table 1].

- CHO consumption maintains blood glucose (BG) levels during exercise and replenishes muscle glycogen stores.
- Decreased muscle glycogen levels appear to correlate with onset of fatigue.
- Replenishment immediately after training is important for subsequent optimal performance. Muscle glycogen resynthesis appears to occur most rapidly within the first 30 min postexercise and continues for up to 6 h after exercise.
- In periods of heavy training, the exact amount of CHO required may vary, depending on the athlete's daily energy expenditure, type of sport, and environmental conditions.

Protein recommendations for endurance and strength-trained athletes range from 1.2 to 1.7 g·kg^{-1} body weight per day and can range from 10% to 35% of total calories [(12,14), Table 1].

- Protein consumption facilitates muscle synthesis and repair. Exercise increases rates of protein synthesis in the exercised muscle that persists for up to 72 h after vigorous activity.
- Protein recommendations can typically be met through diet alone; most athletes exceed their daily protein requirements. Protein and amino acid supplements are not necessary.
- CHO intake sufficient to maintain body weight is necessary for optimal protein uptake and use.

Fat intake should range from 20% to 35% of total energy intake (7).

- Fat supplies a source of energy as well as essential fatty acids and fat soluble vitamins that are important in the athlete's diet.
- The recommended fat consumption is one-third saturated fat, one-third monounsaturated fat, and one-third polyunsaturated fat. Avoid trans fats.
- Consuming <20% of energy from fat does not benefit performance.
- Most athletes exceed 35% of total energy intake from fats; this is not recommended. High-fat diets may lead to decreased performance and adverse health effects.

Micronutrients are essential for athletic activity and should be consumed at the recommended dietary allowances (17).

- Micronutrients play an important role in energy production, hemoglobin synthesis, maintenance of bone health, immune function, and antioxidant protection against free radicals.
- Athletes' diets are often low in calcium, vitamin D, B vitamins, iron, zinc, magnesium, and antioxidants such as vitamins C and E, beta carotene, and selenium (Table 2).
- Vegetarians may need to seek additional advice on potential micronutrient deficiencies.

Fluids are required to maintain adequate hydration and regulate body temperature (thermoregulation) and may be a source of energy (in the form of calories).

TABLE 2. Food sources for nutrients that are often low in athletes' diet.

Selected Micronutrients	**B Vitamins**	**Calcium**	**Vitamin C**	**Magnesium**	**Selenium**	**Vitamin D**	**Iron**
Vegetables	Leafy green vegetables Asparagus Cauliflower Sweet potatoes	Broccoli Kale Turnip greens	Tomatoes Potatoes Broccoli Red peppers	Spinach Romaine Lettuce	Green beans Broccoli		Potatoes Spinach
Fruits	Dried prunes Bananas Orange juice	Fortified orange juice	Citrus fruits such as oranges, grapefruit and strawberries	Pineapple Banana	Banana		Raisins and dried apricots
Grains	Whole grain breads, cereals, pasta and rice	Corn tortilla Flour tortilla		Whole grain cereals and oatmeal	Spaghetti Rice	Fortified cereal	Oatmeal Spaghetti Fortified cereals
Dairy	Low-fat milk Yogurt	Low-fat milk and dairy products		Yogurt	Cottage cheese Cheddar cheese	Fortified milk and dairy	
Meats, eggs, nuts, and beans	Turkey, chicken, salmon, tuna, soy	Soybeans		Almonds, cashews Peanuts Baked beans Chick peas	Nuts, lean beef, chicken, tuna	Tuna, salmon, sardines, soy milk, eggs	Red meat, dark meat poultry, chickpeas, shrimp

- Dehydration has been defined as a loss of greater than 2% body weight and may compromise aerobic exercise performance, impair mental/cognitive performance, increase perceived effort, decrease balance control, and alter immune response.
- Hydration has an essential role in dissipating body heat and preventing potentially catastrophic heat-related illnesses (6).
- Fluid and electrolyte sources include water and other beverages as well as some foods.
- The key ingredients of a sports drink for athletic performance include 6%–8% CHO (14–19 g per 8 oz) and 110–165 mg sodium per 8 oz (13).
- Fluid/electrolyte balance must be addressed during fluid consumption and replacement, with consideration of the individual's physiology, type, and duration of activity and environmental conditions.
- For workouts longer than 1 h in duration, fluids with added CHO appear to help maintain hydration and performance levels. For workouts lasting more than several hours, fluids with sodium added as well appear optimal for performance and hydration.
- For optimal fluid absorption, sports drinks should not exceed 6%–8% CHO (14–19 g per 8 oz).
- *Ad libitum* fluid ingestion may not be sufficient to maintain hydration and performance levels, especially in young athletes; therefore, intake may be enhanced by fluids with flavor, color, carbohydrate, and sodium (5).
- Weight measurement is a good estimate of fluid loss (percent change pre- to postexercise change) to guide replacement amounts. For each pound lost during exercise, 16–24 oz of fluid need to be consumed.

Cautions

- Misinformation and/or myths about nutrition are common and come from widespread noncredible sources.
- Some athletes may experience gastric upset when attempting to implement appropriate fluid and fuel recommendations. Tolerance may be enhanced by increasing the rate of stomach emptying with the following steps:
    - Take small, frequent sips and meals rather than large volume.
    - Choose fluids with low concentrations of CHO (6%–8%) rather than water or beverages with higher CHO content.
    - Tepid fluids appear to empty more rapidly than cold fluids.
    - Some athletes will experience upset with fructose and should consider glucose- or sucrose-based CHO instead.
- When making dietary changes, consider the timing and implementation.
- In times of increased training, athletes may believe they need additional sources of protein. Higher balanced caloric intake will provide the necessary amount of protein. A common error is using protein supplementation to offset caloric deficit.
- While many practitioners refer to themselves as sports nutritionists, only those who hold the RD credential and is eligible for CSSD may practice as a sports dietitian.

Nutrition for Out-of-Season Training

Out-of-season training is defined in this document as the period an athlete is not in competition but training for that purpose. Overall nutritional principles for fluids and fuels remain the same in accordance with the goals of the off-season training regimen. These factors may be more important during out-of-season training:

- Depending on training activity, energy requirements may be increased or decreased.
- The well-balanced diet does not require protein or amino acid supplements, even during muscle-building in strength/weight training.
- Modification of energy intake for the purpose of weight gain or weight loss goals.

Nutrition for In-Season Training

In-season training is defined in this document as the period in athletic competition. Overall nutritional principles for fluids and fuels remain the same in accordance with the goals of the in-season training regimen. The following factors may be more important during in-season training:

- The distribution of fluid and fuel intake
    - Increased emphasis on CHO over protein and fat
    - Increased monitoring of fluid and electrolyte consumption and replacement
- Maintaining energy balance
    - Caloric expenditure often exceeds intake during in-season competition
    - Adequate energy balance spares protein from being used as fuel source and preserves lean body mass
    - Helps minimize fatigue
- Timing of fluids and fuels
    - Spread caloric intake throughout the day to maintain lean body mass and reduce body fat
    - Maintain hydration
    - Recovery window is necessary for optimal replenishment (see section)

TABLE 3. Food strategies for weight gain and weight loss.

Scenario	Types of Food
Weight gain These examples give food selection that provides more calories and carbohydrates that are beneficial for weight gain yet maintaining a balanced and adequate diet	• Cranberry juice has more calories than orange juice (170 vs 120) • Granola has more calories than bran flakes (780 vs 200) • Bananas have more calories than apples (170 vs 100) • Corn has more calories than green beans (140 vs 40) • Bean soup has more calories than vegetable soup (130 vs 80)
High carbohydrate/high calorie foods to help increase energy intake.	• Dried fruit such as raisins • Pretzels • Yogurt • English muffin with peanut butter • Fat-free fig bars • Fruit bread such as banana bread, blueberry muffins • Smoothies made with low fat milk, yogurt, and fresh fruit • Baked tortilla chips/salsa
When athletes have little opportunity to consume foods or the volume of foods becomes too much, they may try the following:	• Instant breakfasts or hot chocolate with added powdered milk • Cereal bars or trail mix or nuts • Carbohydrate loading drinks • Commercial-made shakes and meal replacements
The athlete may have a balanced diet but simply eat too much. Even low calorie foods can cause an athlete to gain weight when eating bigger portions than needed. Try and estimate portion sizes by using the following:	• A tennis ball is approximately 1/2 cup serving • Bagels should be about the size of hockey pucks • Three ounces of meat looks such as a deck of cards • A serving of fruit should be about the size of a tight fist • One cup of milk is 8 oz, 1 cup of yogurt is 8 oz • One slice of bread is a serving • 1/2 bun is one serving; the whole bun is two servings • One serving of cereal is 3/4 of a cup not a bowlful • One cup of lettuce is one serving • Five to six crackers are generally one serving.

It is essential the team physician understands the following:

- Nutrition and energy balance play a vital role in optimal athletic performance
- The role of nutrients: CHO, protein, fats and micronutrients
- An athlete can meet their training and competition demands with a balanced diet and without the need for supplements, except for certain medical conditions
- The timing and distribution of energy for optimal performance
- Nutritional adjustments may need to be made based on activity
- Fluids are important for hydration, thermoregulation and energy

It is desirable the team physician does the following:

- Understands the role and qualifications of a sports dietitian (RD, CSSD).
- Coordinates efforts with the athletic care network, including a sports dietitian who should provide nutritional education and individualized counseling as necessary for athletes.
- Counsels athletes on the importance and types of fluid and fuel choices for optimal training, recovery, and athletic performance.
- Recognizes fatigue and performance issues as possible manifestation of poor nutrition.
- Understands the proportion of CHO, protein, fats, and micronutrients in the diet.

Nutrition for Weight Modification

The modification of an athlete's weight may help optimize athletic performance and health (Tables 3 and 4). This program is best monitored by a health care provider with expertise in sports nutrition. The goals of this modification should be realistic and relate to the athlete's gender, sport, and medical, psychological, and weight history. Weight modifications should be implemented in the off season (15). Other factors to consider for weight gain or loss include the following:

- Physical maturity of the athlete
- Gain of lean mass versus loss of fat mass
- The current body weight and composition
- An evaluation of current diet and activity habits (e.g., analysis of a 3-d food record and physical activity level) to establish energy intake and energy expenditure.
- Frequency of monitoring an athlete's progress
    - Assess body weight/composition initially within 1–2 wk of intervention to regular intervals thereafter
- Periodic food records to monitor the athlete's diet are useful
- Progress during weight modification should ideally be monitored by tracking changes in body composition rather than body weight

Principles of Weight Gain

- When energy intake exceeds energy expenditure (positive energy balance), weight gain will occur.

TABLE 4. Food substitutions to reduce calories.

Instead of This	Try This	Calories Saved
1 cup of 2% milk (120)	1 cup skim milk (80)	40
Tuna packed in oil (170)	Tuna packed in water (100)	70
Fast food breakfast sandwich (300)	English muffin (150)	150
Fast food double hamburger (560)	Grilled chicken sandwich (400)	160
Caesar salad (520)	House salad (300)	220
Fast food fried chicken (400)	Grilled chicken breast (170)	230
6-inch meatball sub (540)	6-inch Turkey sub (280)	260
16 oz caramel blended coffee (430)	16 oz nonfat latte (160)	270
Taco salad (790)	Cheese quesadilla (490)	300
Extra large French fries (610)	Small French fries (210)	400
Fast food shake (900)	Small vanilla cone (150)	750

- Athletes who desire to gain weight should adjust their energy intake to increase lean muscle mass, not body fat.
- Athletes who desire to gain weight should consume protein at the upper range of recommended protein level (Table 1).
- To gain lean muscle mass, an athlete must take in an additional 500–1000 kcal·d^{-1} along with participating in an appropriate strength training program. Either of these tasks done separately will not cause a gain in lean muscle mass. Weight gain in excess of 2–3 lb·wk^{-1} is not all lean muscle mass.
- Emphasize strength training rather than aerobic exercise to stimulate muscle growth.
- Proper hydration should always be maintained.
- Avoid skipping meals to optimize timing and distribution of energy intake.

Caution

- Large increases in body fat may have adverse effects on the immune system and may increase risk factors for chronic disease.
- Athletes attempting to increase their body or muscle mass often use supplements purported to enhance weight gain. The only proven safe and effective means to increase muscle size and strength for long-term athletic performance is increased muscular work combined with recommended energy and protein intake.

Principles of Weight Loss

- When energy expenditure exceeds energy intake (negative energy balance), weight loss will occur.
- Athletes who desire to lose weight should adjust their energy intake to maintain muscle mass and decrease body fat.
- Increases in energy expenditure and moderate decreases in energy intake may help preserve fat-free mass and muscle strength while dieting.
- Weight loss should be gradual at approximately 0.5–2.0 lb·wk^{-1}, which equals a net negative energy balance of 250–1000 calories per day.
- Female athletes should not consume less than 1200–1400 calories per day; male athletes should not consume less than 1500–1700 calories per day. An athlete cannot maintain adequate micronutrient levels with these restrictive amounts of energy intake.
- Athletes should remain hydrated during weight loss.
- Avoid skipping meals to avoid compensatory overeating.
- Aerobic exercise is preferred to achieve negative energy balance, whereas resistance training may help to preserve muscle mass.

Caution

- Athletes, particularly those in lean-body sports, may experience pressure to achieve low body weights or body compositions that are unrealistic. The pressure to meet these goals can lead to disordered eating and eating disorders.
    - Negative energy balance can lead to weight loss and disruption of endocrine function (11).
    - These conditions add a unique challenge to any health care professional guiding them through the weight loss process.
- Weight loss may impair performance due to factors including a reduction in energy stores, impairment of immune function, alterations in mood, changes in enzyme activity, and structural alterations in muscle.
- Rapid or excessive weight loss can result in adverse health effects, including cognitive dysfunction, compromised cardiac function, and inability to maintain body temperature.
- To lessen the risk of injury, athletes should be properly fueled and hydrated before training sessions or competition.
- Avoid fad diets, low-calorie diets, and weight-loss drugs.
- Weight management recommendations should be made by health care provider with expertise in sports nutrition.

It is essential the team physician understands the following:

- Change in energy balance is key to weight modification
- Weight modification goals can be met through changes in diet and exercise alone
- The adverse health effects of excessive energy restriction and excessive energy intake

It is desirable the team physician does the following:

- Identify the appropriate weight modification goals and methods
- Counsel athletes on the importance and types of fluids and fuels for weight modification
- Coordinate the athletic care network for an athlete's weight modification, including referring to and consulting with a sports dietitian
- Recognize warning signs of negative energy balance (e.g., fatigue, poor training, frequent injury or illness, disordered eating, and endocrine dysfunction).
- Be aware of possible negative consequences of micronutrient deficiencies due to severe negative energy balance.
- Dispel myths related to fad diets, low-calorie diets, and weight-loss drugs.

Preexercise Nutrition

Exercise refers to targeted training or competition, potentially with sport-specific requirements. Preexercise is defined as 4 h or less before the exercise session. General nutrition and in-season requirements for fluids and fuels

apply before this time. Adequate nutrition before exercise has been shown to improve performance, as compared to a fasting state (10). The preexercise fuel and fluids should be composed primarily of CHO to maintain BG during exercise, which leads to a sparing of muscle and liver glycogen, and moderate in protein and low in fiber and fat to minimize gastrointestinal distress (1).

Preexercise meals should be individualized, and differences need to be recognized. Optimal timing is not always practical, based on scheduling or individual preferences. Athletes should experiment with fluid and fuel choices and the timing of consumption while training before using the strategies during competition.

The timing of fluid and fuel intake is important when considering pre-exercise nutrition.

- Fluids
  - At least 4 h before exercise, drink 12–20 oz (350–600 mL) of water or sports drink (6%–8% CHO [14–19 g per 8 oz], Table 5). This will optimize hydration and allow adequate time for excretion of any excess fluid.

May take some fluid up to the point of exercise.

- Fuels
  - CHO: 3–4 g CHO per kilogram body weight 3–4 h before competition; can be solid
  - CHO: 1 g CHO per kilogram body weight 1 h or less before competition; should be liquid

Caution

- Recognize the amount of CHO in the fluid. Concentrations >6%–8% CHO will decrease the absorption of fluid.
- The CHO concentration in many "energy drinks" is >8%.
- Sufficient calories are needed so that athlete is not hungry during exercise, but not so large as to leave undigested food in the stomach.

TABLE 5. Food examples and timing of preevent meals.

At Least 4 h before Exercise, Drink 12–20 oz of Sports Drink (6%–8% CHO, 14–19 g CHO, and 110–165 mg sodium per 8 oz) or Water	
Three to four hours before competition or training athletes could consume	• A turkey sandwich, wheat crackers, granola bar, and fruit • Pasta with meat or tomato sauce, salad, piece of fruit • Rice bowl with steamed vegetables and chicken or beef, fruit • Yogurt, fruit and granola cereal, French toast/pancakes with syrup and eggs, yogurt, glass of orange juice
One hour or less before competition or exercise	• Sports drink • Energy bars • Toast • Apple sauce • Crackers • Cereal with skim milk • Banana (27 g CHO)

- Avoid preexercise intake that is high in fat and fiber as this can cause gastrointestinal distress before and during exercise.

Nutrition during Exercise

During extended exercise, energy stores in the body are depleted, thirst sensation may be dulled, and the rate of gastric emptying may be reduced. Therefore, athletes need to consume both fluids and fuel for optimal performance. As glycogen stores in the body are being depleted, muscles rely more heavily on blood glucose for fuel, especially after 2–4 h of continuous exercise. In addition, adequate fluid and electrolyte replacement is necessary for proper cardiovascular function, thermoregulation, optimal performance, and recovery and may help prevent muscle cramping and electrolyte imbalance. An individualized plan is necessary to prevent overhydration, dehydration, and/or electrolyte imbalances.

- Fluid replacement should begin early during an exercise program and continue during activity.
- For exercise lasting less than 1 h, water or sport drink is sufficient.
- Consumption of sports drinks is recommended for exercise lasting 1 h or longer.
- CHO consumption is especially important when exercising after an overnight fast or when liver glycogen is decreased.
- Consumption of 30–60 g CHO per hour has been shown to extend endurance performance for longer events (3).
  - Consumption of 6–12 oz of sports drink every 15–30 min during exercise can extend exercise capacity of athletes who participate in prolonged or intermittent sports.
  - Fluid replacement with water alone may lead to hyponatremia. Athletes should avoid drinking too much water and only drink as much fluid as they have lost during exercise. Consuming beverages with at least 100 mg of sodium per 8 oz will help prevent hyponatremia.
- Fluid and electrolyte losses will vary depending on the sport, the individual, and the environmental conditions. The athlete should attempt to anticipate the losses as a guide to fluid intake during exercise.
- Potassium is important for fluid and electrolyte balance. A diet rich in a variety of fresh fruits, nuts, seeds dairy foods, lean meats, and whole grains is usually considered adequate for maintaining normal potassium status among athletes

Caution

- Athletes should not begin exercise in an energy-depleted or dehydrated state.

TABLE 6. Glycemic index foods.

Low Glycemic Index Foods/Beverages (<55)	High Glycemic Index Foods/Beverages(>70)
Skim milk	Sports drinks
Yogurt	Potatoes
Pineapple	White bread
Banana	White rice
Kidney beans	Cornflakes
Sweet potatoes	Honey

- Both protein and potassium consumption during exercise is unnecessary for performance.
- CHO in solid form can also be consumed during exercise, but digestion is slower compared to liquid and gel forms. It is easier to consume solid carbohydrates in certain sports such as cycling, whereas athletes in other sports such as running and swimming may find it easier to consume carbohydrates in liquid form.
- Fluid in hyperhydrated forms (e.g., glycerol) does not improve performance or hydration and is not recommended.

Nutrition for Postexercise Recovery

After exercise, there may be deficiencies in fuels (primarily muscle and liver glycogen) and fluids (water and electrolytes). There may also be muscle damage, requiring protein for repair. The postexercise dietary goals are to provide adequate CHO, fluids, and electrolytes to replace muscle glycogen, aid recovery, and restore hydration. Protein consumption after exercise will provide amino acids for building and repair of muscle tissue.

Restoration of these deficiencies is a requirement for optimal performance in the next exercise event. The method by which this restoration occurs is influenced by the timing of the next competition. This is particularly critical for athletes who have multiple, same-day exercise (e.g., tournaments, two-a-days) or next-day exercise.

The window for optimal postexercise recovery is 6 h after the cessation of that exercise. Most glycogen resynthesis begins within the first 30 min.

- Intake of 1.0–1.5 g CHO per kilogram within 30 min after exercise increased glycogen storage and decreased recovery time (muscle strength) compared to ingestion two hours after exercise (8).
- CHO with a high glycemic index (e.g., simple CHO) result in an increase in the rate of resynthesis compared to CHO with a low glycemic index (e.g., complex CHO) (2) (see Table 6).
- Adding 10–20 g of protein to a postexercise recovery snack will not enhance muscle glycogen stores, but it will support muscle repair and growth. It is important to include both carbohydrates and protein in a recovery regimen. Adding 10–20 g of protein postexercise will help start protein synthesis (9).

To continue recovery beyond the 30-min window, an athlete should eat a 1.0- to 1.5-g CHO per kilogram and 10–20 g of protein approximately 2 h postexercise. See Table 7.

In conjunction with the need for glycogen replacement, fluid replacement is necessary to optimize recovery.

- Volume of replacement should be 1.5 times the amount of fluid lost. A simple guideline of consuming 16–24 oz of fluid for every pound lost during exercise can help athletes replace fluids quickly postexercise.
- Thirst is not a good indicator of fluid status: 1.5-L loss is required before thirst is perceived.
- Addition of electrolytes speeds the rate of recovery; individual fluid balance may be restored approximately three times faster with sports drink as compared to water. Consuming rehydration beverages and salty foods as subsequent meals/snacks will help replace fluid and electrolyte losses.
- Water plus food is a good replacement strategy, provided that food can be consumed. Food has a higher electrolyte concentration than electrolyte drinks.
- There is significant variance in individual sweat rates and electrolyte loss due to environmental conditions, inadequate acclimatization, or individual variances.
- If high sweat rates or electrolyte losses are present (e.g., "salty sweaters"), additional sodium replacement may be necessary.
- Replacement should stop approximately 0.5–1 h before the next competition to allow homeostasis.

Cautions

- All athletes need to restore energy, but some athletes may not need to practice acute recovery nutrition if their next exercise bout is not for several days.
- Athletes often begin exercise in an energy- and fluid-depleted state.
- Athletes should avoid consuming high amounts of protein at the expense of CHO.
- There is no benefit to IV fluid replacement over oral fluid consumption unless the athlete cannot drink the same volume.

It is essential the team physician

- Recognize the importance of fluid and fuel plans for pre-, during and postexercise

TABLE 7. Recovery meals.

For example a 150-lb athlete would need to consume an initial 68 g of CHO in a recovery snack and approximately 10–20 g of protein in a recovery snack within 30 min after exercise. This could include	• A sports drink or recovery drink and a medium sized whole grain bagel with 2 tablespoons peanut butter • 12 oz chocolate milk and a large banana
Two-hour recovery meal can consist of	• Two cups of pasta with tomato sauce and 2–3 oz of chicken, fish or meat • A few hours later, the athlete would eat another small snack comprised of: two cups of whole grain cereal and one cup of low-fat milk. • One piece of fruit with one cup of yogurt

- Understand timing and composition of fuel and fluid replacement is important preexercise, during, and postexercise
- Understand individual variances exist among athletes.

It is desirable the team physician

- Coordinate preexercise, during, and postexercise fluid and fuel plans with the athletic care network.
- Counsel the athlete on preexercise, during, and postexercise fluid and fuel plans.
- Target athletes at increased risk for deficiencies in fuel and especially fluids and those who are heavy sweaters who lose large amounts of sodium.
- Understand weight measurement as a guide to fluid status.

Supplementation

Supplements are outside the scope of this paper.

- Athletes can meet 100% of their dietary needs from a well-balanced nutrition plan that addresses performance, hydration, recovery, and health. In athletes with certain medical conditions (e.g., iron, calcium, and vitamin D deficiency), supplementation may be beneficial.
- Although all manufacturers are required by the Food and Drug Administration to analyze the identity, purity, and strength of all their product's ingredients, they are not required to demonstrate the safety and efficacy of their products.
- Contamination of dietary supplements with banned substances remains a concern (16).

Sports medicine professionals should consider the following factors in evaluating supplements:

- Validity of the claims relative to evidence-based science of nutrition and exercise
- Potential adverse health effects

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