Fluid Dynamics

The ever-changing variety of sports drinks and recovery drinks can be

By Michelle Rockwell

Michelle Rockwell, MS, RD, is the former Coordinator of Sports Nutrition at the University of Florida and now serves as a nutrition consultant for several sports teams and athletes from U.S. Soccer, Major League Baseball, and the World Tennis Association. She can be reached at: michellerock1@aol.com.


When many of today’s top coaches and athletic trainers were in college, deciding what athletes would drink was easy—there really was no choice at all. Drinking anything during practice was often seen as a sign of weakness, and if any liquid was available during games, it was water.

Now, athletic trainers can choose from a dizzying array of sports drinks and recovery drinks in a seemingly endless variety of types and flavors. Athletes are bombarded with advertisements touting one drink over another and may be more influenced by flashy marketing than by hard science.

In this article we’ll look at what’s in sports drinks and recovery drinks and help you pick the best ones for your athletes. In most cases this means taking a closer look at the back label than the front, since you’ll be searching for the right mix of ingredients in the right amounts to meet your athletes’ needs.

The primary reason for using a sports or recovery drink can usually be classified into one or more of four categories: improving hydration, enhancing performance, optimizing recovery, and adding weight or lean mass. There can be a great deal of overlap between these goals—proper hydration improves performance, carbohydrates help improve performance and speed recovery, and protein can aid in recovery and weight gain. The key is having your goals drive the choice of beverage.

When weighing your options, keep in mind that even the most well-formulated drink has no value if athletes won’t drink it. Fortunately, the wide variety of flavors available means you should be able to find one to fit any athlete’s palate. However, taste preferences often change with intense activity, so it is critical that athletes train with the beverages they plan to use when competing.

Also, athletes respond to and tolerate beverages in different ways. So be prepared to tailor your offerings to individual needs.

INSIDE SPORTS DRINKS

Sports drinks are commonly used before, during, and after practices and competitions to help athletes stay properly hydrated. This can improve performance by reducing fatigue while protecting against dehydration and heat-related injury. The most basic source of hydration is water, but sports drinks offer additional ingredients that aid in hydration while also providing other benefits.

Each drink uses a different mix of ingredients, many of which are examined below. First, decide what you want to get from a sport drink, then find the one with the ingredients that best fit your athletes’ goals.

Carbohydrates: One of the biggest advantages sports drinks have over water is carbohydrates. Research has repeatedly shown that carbohydrates consumed before and during exercise can improve performance in endurance activity lasting more than an hour or in stop-and-go sports that have intermittent periods of high-intensity exercise.

Athletes involved in purely anaerobic sports, strength training, or low-intensity exercise for less than an hour can usually use plain water to hydrate, as long as they drink enough. Although sports drinks are not very high in calories,
they can add up in athletes who don’t burn them off through activity.

When exercising more than one hour, to ensure the right level of carbohydrates, athletes are encouraged to consume about 30 grams of carbohydrates one to two hours prior to exercise, preferably in liquid form. This is about the amount found in a 16-ounce bottle of most sports drinks. Once they start their activity, athletes should consume 30 to 60 grams of carbohydrates per hour. Since sports drinks should be between six and eight percent carbohydrate—or about 15 grams of carbohydrate per eight-ounce serving—this will typically equal 16 to 32 ounces of a sports drink.

Sports drinks with more than eight percent carbohydrate should be avoided because the increased carbs can interfere with fluid absorption and cause gastric upset. Those with less than six percent carbohydrate do not optimize energy delivery to muscle.

You also want to look for drinks that use a combination of different sugars, such as sucrose, fructose, and glucose. When used alone, fructose and other single sugars can cause gastric distress, including bloating and diarrhea.

Specifically designed to promote rapid fluid and carbohydrate absorption, classic sports drinks have a high glycemic index, which means they provide immediate energy during exercise. Some manufacturers use non-traditional carbohydrate sources, such as rice or maltodextrin, to create drinks with a lower glycemic index aimed at endurance athletes. These manufacturers claim that the slower rise in blood sugar provided by lower glycemic index sources better meets the demands of endurance and ultra-endurance exercise.

Research with athletes in actual exercise situations has not confirmed these claims. Furthermore, there are not complete data about how well athletes tolerate these more complex carbohydrate sources. As long as athletes begin exercise with ample carbohydrate stores and take in sports drinks at consistent intervals during exercise, energy will remain available throughout the activity.

Sodium: Sports drinks almost always include electrolytes to help replace those lost through sweat, mainly sodium. Most classic sports drinks have between 70 and 120 mg of sodium per eight-ounce serving, which matches typical sodium sweat loss. Sodium also promotes optimal hydration by making the body like a “sponge” to hold onto water; triggering the thirst mechanism that stimulates further drinking; and, for some athletes, improving the taste, which encourages consumption.

Some sports drinks designed specifically for endurance athletes contain higher levels of sodium, typically 200 to 300 mg per eight ounces, since sodium losses via sweat can be more extreme in endurance activities. These drinks are appropriate for athletes: exercising or competing for more than two hours; exercising in extreme heat; who have high sweat sodium rates (indicated by a salty film on their face or jersey after working out); or who have muscle cramping known to be related to sodium imbalance. Athletes not in these categories should stick with standard sports drinks since consuming more sodium than is lost through sweat can cause dehydration and muscle cramping.

Protein: Adding protein to sports drinks is an increasingly popular trend. The theory is that added protein will help stimulate insulin secretion, thereby enhancing carbohydrate uptake and utilization, which would theoretically slow fatigue in endurance exercise. Manufacturers of sports drinks containing protein claim they can also minimize post-exercise muscle damage.

The research into using protein this way is mixed. Several studies have not supported claims of decreased fatigue and muscle damage, and some that showed a performance benefit have been criticized for their design. Hopefully, more data will be available in the near future, as this is certainly an area of interest to many athletic trainers.

Proponents of protein-containing sports drinks recommend a 4:1 ratio of carbohydrates to protein. This, for example, would mean 16 grams of carbohydrates for every four grams of protein. That works out to two grams of protein per eight-ounce serving.

Athletic trainers should consider three potential issues before using protein-containing sports drinks. First, protein slows gastric emptying, which could mean bloating, gas, diarrhea, or similar discomfort during exercise. Second, it can
also interfere with fluid absorption, a main reason for using sports beverages. Third, adding protein to sports drinks alters the taste. Some athletes find the taste very chalky and unpalatable during exercise.

Since the jury is still out on whether sports drinks with protein may enhance performance, athletes should avoid using these drinks if gastric issues or taste interferes with beverage consumption. The risk of decreasing hydration far outweighs the potential performance-enhancing benefits. Plus, drinks with protein may run afoul of NCAA supplement-distribution rules depending on their exact make-up or protein level.

Amino acids: There is some research showing that branched-chain amino acids and other individual amino acids (glutamine and leucine, for example) consumed on a daily basis, although not necessarily while exercising, can delay fatigue in endurance exercise. Athletes who hear about this potential link may want to use sports drinks with added amino acids for this reason. However, these drinks typically contain a much lower quantity of amino acids than the level used in research and are unlikely to have the same effect. Plus, the addition of amino acids might make it impermissible for schools to provide these beverages to their athletes under NCAA supplement-distribution rules.

Magnesium, Calcium, and Potassium: Found in many sports drinks, these minerals are lost in sweat, but generally in minimal amounts. Some sports medical professionals have linked deficiencies of these elements to muscle cramping, but the links have not been supported by research. While athletes can get small amounts of magnesium, calcium, and potassium from sports drinks, the primary source should be their regular diet—through fruits, juices, vegetables, nuts, milk or other dairy, and fortified foods such as cereals.

Other vitamins and minerals: More and more sports drinks are adding B vitamins, which play a role in energy usage, and antioxidants (Vitamin C, Vitamin E, and selenium), which may help combat muscle damage. However, there is no evidence to suggest that consuming these during exercise benefits performance or hydration. Rather than looking for these in a sports drink, ensure that athletes’ overall diets meet vitamin and mineral needs, or supplement with a basic multivitamin.

Caffeine: Although caffeine has recently been added to some sports drinks, these should not be confused with “energy drinks,” which usually contain herbs and other stimulants. Several studies have shown that 200-300 mg of caffeine (equivalent to two cups of coffee) consumed prior to exercise may improve performance. Note that one serving of these caffeine-containing drinks commonly contains less than 50 mg of caffeine. Thus, athletes would have to drink a high volume of these fluids to experience any benefit.

Although recent research has refuted the belief that caffeine is a diuretic, we know it does contribute to increased urine output, and thus could impact hydration status. Any athlete who uses a sports drink with caffeine should enter training or competition especially well-hydrated and be sure to drink enough fluids throughout the activity. I would not recommend caffeine-containing sports drinks before, during, or after activity for any athlete exercising in extremely hot conditions.

It’s also important to consider that individuals have different responses to caffeine. Side effects can include headache, jitters, nervousness, a racing heartbeat, GI upset, and diarrhea. These side effects may be enhanced by adrenaline during competition times.

Note that caffeine at high concentration levels is banned by the NCAA and other sports-governing bodies. It is unlikely for an athlete to reach banned levels through caffeine-containing sports drinks, but other beverages, dietary supplements, and medications contain caffeine and additional stimulants. The combination of these products and caffeinated sports drinks could cause problematic caffeine levels.

INSIDE RECOVERY DRINKS
In years past, recovery drinks were largely an ad hoc product, with each school using its own brew of ingredients. An NFL strength and conditioning coach remembers his first graduate assistant position where one of his primary responsibilities was making recovery shakes for players to drink after weightlifting sessions, using a specific protein powder prescribed by the head strength coach. He tried an endless variety of ingredients, but the shakes tasted absolutely awful and players would do anything to avoid drinking them: Some even brought an extra pair of shoes to
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dump their shakes into.

Now, recovery drinks are a mainstream product. Their taste and texture are designed to appeal to athletes, not turn them away. And their contents go well beyond the protein mixes of days gone by. As a result, athletic trainers and strength coaches need to determine what they want from a recovery drink and find the one that best fits their needs.

Recovery drinks are generally designed for athletes to use after training or competing at an intense level for more than one hour. But they can also be used in other ways. Some use them when illness or injury precludes regular meals, and athletes who can’t tolerate solid food before a game use them as a pre-competition meal. Others take them between multiple events on the same day or as between-meal snacks to gain weight.

Be aware that NCAA rules limit the content of drinks that schools are allowed to supply to their athletes. Carbohydrate/electrolyte drinks may be provided, but the addition of protein, amino acids, or other substances may make it impermissible for a school to provide a drink, or in some cases, for an athlete to consume it.

Protein: The main ingredient in many recovery drinks is protein, which supports muscle growth, repair, and strength development. The protein can come from a wide variety of sources, including milk (casein and whey), soy, and eggs. Drinks containing milk products can cause gastric problems, especially for lactose-intolerant athletes. Look for drinks containing at least 10 grams of protein—from a source the athlete can tolerate—especially when the product is for use following anaerobic or strength exercise. Some drinks also include individual amino acids (e.g., glutamine or leucine) which are marketed as further enhancing recovery and muscle growth, but these effects have not been confirmed by research.

Carbohydrates: A mainstay of sports drinks, carbohydrates also have a role in recovery since they help replenish energy stores depleted during exercise. Carbohydrates should come from both high-glycemic and low-glycemic sources. The high-glycemic sources promote glycogen resynthesis, which can begin immediately when the right sugars are available, while lower-glycemic carbs can help restore energy over time. These drinks should have at least 40 grams of carbohydrates, and as much as 60 to 80 grams for endurance athletes.

Beverages vary in sugar content, but keep in mind that products made with milk contain milk sugar (lactose), which is a natural sugar and not an added sugar. Other products are sweetened with glucose, sucrose, fructose, and even high fructose corn syrup.

Vitamins and Minerals: Most recovery drinks contain substantial amounts of vitamins and minerals, with calcium and iron usually leading the way. Antioxidants such as Vitamins C and E are often used because of their potential role in limiting muscle soreness and supporting recovery. B-vitamins, zinc, and Vitamin A are included because they are critical components of energy utilization and muscle-building.

Drinks containing vitamins and minerals can boost overall daily intake in key areas where athletes are commonly deficient, such as calcium, iron, zinc, and antioxidants. However, there is no additional benefit from consuming these right after exercise.

Muscle-building ingredients: Some manufacturers include supplements such as creatine, DHEA, tribulus, carnitine, and vanadium, to market their product’s ability to promote muscle growth. Most recovery drinks contain minimal amounts of these ingredients, if any, and thus are likely below any effective dose level. Athletes should be reminded that products containing dietary supplements or herbs are not closely regulated and carry the risk of impurity and contamination.

Milk: Chocolate milk has recently been touted as a good recovery beverage for athletes. It is similar in calories, macronutrients, and micronutrients to many recovery beverages—eight ounces of reduced fat chocolate milk has 130 calories, eight grams of protein, 24 grams of carbohydrates, two grams of fat, and 300 milligrams of calcium. Chocolate milk is preferred over white milk since the high-glycemic sugar in the chocolate helps with immediate glycogen resynthesis. Of course, chocolate milk does contain lactose, which some athletes will be unable to tolerate, particularly if their GI system grows more sensitive with exercise.
Limited research is available on the effectiveness of chocolate milk in supporting muscle recovery. One study at Indiana University found that chocolate milk was similar to a sports drink in supporting athletes’ recovery between two exercise bouts. Further research on the usefulness of chocolate milk for exercise recovery will be beneficial.

Chocolate milk does have the advantage of being fairly inexpensive, familiar to athletes, and easy to purchase. Some athletes who are not comfortable using dietary supplements would be comfortable using a whole food like milk. And, like all traditional recovery beverages, it is useful for athletes whose appetite is suppressed following activity.

On the other hand, unlike sports and recovery drinks that can be stored at room temperature, milk is highly perishable and must remain refrigerated. I will never forget the look on an athletic trainer’s face when a swim coach and I decided we’d like to begin using chocolate milk as a recovery beverage for some members of the swim team. My thought, of course, was about the nutrition. Her thought was where to store and refrigerate enough containers of milk for 40 people to use for twice-daily workouts—more than 450 containers per week. What would she do if they weren’t all used up at the end of the week? How would she chill them on the pool deck?

We ultimately used a dining hall refrigerator in a storage closet under the pool to store individual-sized milk containers, which we re-ordered every five days. The containers were transferred poolside in coolers with lots of ice and restocked each hour.

In summary, sports drinks and recovery beverages can play an important role in athletes’ training, performance, and overall health. Take advantage of the opportunity to educate and guide athletes you work with toward their winning drink combination.

Sidebar:
Calorie Counters
Many weight-conscious athletes complain that sports drinks have “too many calories” or “too much carbs” and are reluctant to use them. It’s up to athletic trainers to promote good hydration even when faced with these complaints.
Tell athletes that carbohydrates consumed during exercise are used directly as fuel for performance. The analogy of gas fueling a car works well with some athletes.

Another recommendation for calorie-phobic athletes is to prioritize sports drink calories, since they can impact performance and safety so significantly. These athletes could reduce calories consumed in a meal or snack outside of exercise to allow for sports drink calories while remaining within their total calorie goals.

For example, 16 ounces of a typical sports drink (the minimum amount recommended for one hour of exercise) contains 120 calories. This is about the same as 1/3 muffin, 1/3 cup of rice, mayo on a sandwich, or one can of soda. A standard recovery drink has about the same number of calories as one peanut butter and jelly sandwich, one slice of thick-crust pepperoni pizza, three homemade chocolate chip cookies, or one small Caesar salad.

Calorie-conscious athletes may also make the mistake of choosing low-calorie or no-calorie fitness beverages, which have fewer sugars—and thus fewer calories and carbs—than most sports drinks. While these beverages do help with overall hydration when consumed in adequate amounts, they are not an appropriate substitute for sports drinks because they lack sufficient carbohydrates and, in many cases, electrolytes.

Fitness beverages can play a role in athletes’ diets when they are used to supplement or replace water intake. Athletes who don’t like water may hydrate better with a flavored beverage. Gymnasts, golfers, and baseball and softball players I have worked with enjoy drinking fitness beverages and notice benefits of improved hydration, since they drink more of these than they did water.

Calorie-conscious athletes should be warned against diluting their sports and recovery drinks. Diluting these drinks can lower the carbohydrate, electrolyte, and other nutrient content beneath the formulated levels designed to match sweat
loss and optimize fluid and overall nutrient absorption.

Sidebar:
Caught in the Crossfire
The topic of which beverages we should and shouldn’t be drinking received wide attention recently when a group of well-known researchers established the Beverage Guidance System published in the American Journal of Clinical Nutrition. America’s obesity epidemic was cited as the driving force behind the recommendations—it has been reported that up to 30 percent of our calories currently come from beverages. The researchers recommended getting only 10 to 14 percent of our calories from beverages, a decrease that would likely require a significant drop in consumption of sweetened beverages.

Specifically, they touted drinking more water. If someone desires a more varied beverage selection, he or she should select from tea and coffee first, followed by skim and low fat milk, and non-caloric drinks (like diet soda or flavored waters). Fruit juices, even 100 percent fruit juices, should be limited to less than eight ounces per day, while sodas and sports drinks should be used “sparingly except by endurance athletes because these beverages provide calories.”

While these guidelines have merit and offer benefits for much of the general population, I have two major concerns for athletes who may read or hear these recommendations. First, any message that recommends cutting back on beverage consumption can confuse athletes who are constantly hounded by sports medicine professionals preaching good hydration habits, following them around with water bottles, and making them check the color of their urine. Research has shown that many athletes start training sessions in sub-optimal hydration status, rarely drink enough to match fluid loss during exercise, and follow poor recovery nutrition and hydration practices.

With athlete safety our priority and the consequences of dehydration and heat illness so severe, we need to continue promoting adequate fluid consumption, even if that means sometimes drinking drastically more than the 98 ounces of fluid recommended in the guidelines. And the recommendation to use beverages with added sugar calories sparingly could be misleading for athletes who are looking to enhance performance or improve their recovery from exercise.