



Cramping in Summer Sports: The Sodium Solution

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The adult body contains 200 to 250 grams of salt (sodium chloride), which is about a half-pound and more than enough to fill a few saltshakers. But in August football, in five sets of summer tennis or in tropical triathlons, some athletes can lose 25 to 50 grams of salt in sweat. So athletes going hard can lose up to 10 to 25 percent of their total body salt! Massive salt loss like this – along with dehydration and muscle fatigue – leads to cramping.

Cramping starts as muscle twitching, often in the arms or legs, and can evolve into painful whole-body muscle cramps that can disable athletes: Picture a football player writhing on the field; a triathlete hobbling to the finish; or a tennis player forced to default.

Famous Crampers on the Court

Tennis player Andy Roddick cramped up against Michael Chang last year in the French Open. Chang, a former crammer himself, had this advice: “Get more minerals in your body.” **The vital mineral in cramping, however, is sodium because only minor amounts of potassium, calcium or magnesium are lost in sweat.** In other words, bananas and oranges don’t cure cramps. Replacing salt does.

Patrick Rafter defaulted twice with cramping. He underwent tests to find out why. As John McEnroe put it, “Rafter sweats twice as much as any other guy on the tour.” The tests showed that Rafter can sweat 10 liters in three hours, losing 25 grams of salt. Another tennis player, also known for cramping, lost 50 grams of salt in four hours!

Not All Cramps Are Alike

Not all cramps are alike and the causes of cramping are diverse and debated. For example, a writer’s cramp or calf cramps that wake you at night are not caused by salty sweating. Nor does salty sweating cause the cramp in an injured thigh muscle when you overuse it. Cramping that can hobble athletes with sickle trait when they run or patients with atherosclerosis when they walk, is caused by low blood flow and not low sodium.

Salt Loss: Ancient Mariners

Three lines of evidence implicate low sodium in causing heat cramps. First, history. Knowing that stokers on ocean liners mixed sea water with drinking water, a London doctor prevented cramps in industrial stokers using a saline drink. Adding salt in beer or in milk cut cramping in miners and men building the Hoover Dam. And deep in British coal mines in the 1920s, cramping was cut by “salt in water, about the composition of sweat.”

Seriously Sweating Sooners

The second line of evidence is from research on sodium loss in athletes, much of it by the Gatorade Sports Science Institute (GSSI). This shows that individual athletes, such as NFL players, who suffer heat cramping, are heavy and salty sweaters. In contrast, selected athletes – tennis players, runners, soccer players and football players - who don't lock up, don't lose as much sodium in sweat. An ongoing GSSI field study of Oklahoma Sooner football players suggests that crampers lose more sodium than position-matched non-crampers. **So growing research ties heat cramping to dehydration and sodium depletion.**

Proof in the Pudding

The third line of evidence is anecdotal proof in the pudding. At the University of Oklahoma, we have cut heat cramping among our athletes by urging them to consume more salt and drink sports drinks that contain sodium. We:

- Have them salt their food
- Tout healthful foods high in sodium
- Put pretzels in team meetings
- Debunk the mythical fixes like vinegar, mustard and pickle juice. An ounce of pickle juice is ineffective for preventing cramps. It is like an unhealthy liquid salt tablet; too much sodium and almost no fluid.

The Plain Water Problem

Plain water is the other extreme: It contains almost no sodium. A sports drink taste good, which promotes drinking and rehydration, and has some sodium to fend off cramping. At Oklahoma, athletes with a history of cramping get the right balance of sodium and fluid for their needs, rotating Gatorade and GatorLYTES (an electrolyte powder), with water only as a chaser. If a player does lock up, the cramps can be reversed in an hour or two by drinking sports drinks with added sodium, such as a package of GatorLYTES. If the athlete is vomiting and unable to drink fluids, we can reverse severe cramping in an hour or two with 2-3 liters of intravenous normal saline.

The ability to rapidly cure heat cramping by the addition of sodium either orally or through a saline IV tends to prove that heat cramping is caused by dehydration and sodium depletion.

The products listed below can replace electrolytes lost in sweat. Most athletes don't require any more sodium and potassium than provided by Gatorade. A few athletes, those prone to whole-body cramping, can benefit from ingesting fluids with higher sodium levels. However, pickle juice contains far too much sodium, too little water and should be avoided.

Table 1. The electrolyte and carbohydrate content of various fluids.

Product (per 8-oz serving)	Sodium (mg)	Potassium (mg)	Carbohydrate (g)	Carbohydrate (%)	Calories (kcal)
Gatorade	110	30	14	6	50
Gatorade plus GatorLYTES	460	201	14	6	50
Pedialyte	248	188	6	2.5	24
Rehydralyte	414	188	6	2.5	24
Vlasic Dill Pickle Juice	2938	198	NA	NA	NA