Muscle Cramps: Why and How to Prevent Them

The heat and humidity this summer has many of our clients suffering from muscle cramps. Looking at past research and theories on muscle cramps, we must conclude that the elusive question of what causes muscle cramps remains unanswered.

The three main causes cited for causing EAMC (Exercise Associated Muscle Cramps) are:

- Loss of serum electrolytes (sodium, potassium, magnesium, chloride, calcium) because of dehydration.
- Pre-mature muscle fatigue caused by performing exercise at a higher relative exercise intensity or duration, when compared with normal training.
- Inhibited range of motion as a result of tight muscles.

Muscle CrampsThe loss of serum electrolytes happens when you train and neglect to consume enough fluids. This dehydration occurs in all weather, training intensity, or terrains. However, it is most detrimental when you train in hot, humid conditions. It is detrimental because electrolytes are lost through sweat and perspiration. Electrolytes are a group of ions required by the body to stimulate multiple neurological reactions. The five primary electrolytes are sodium, potassium, chloride, magnesium and calcium. Sodium, potassium and chloride are the most important for muscle contraction.

Many people believe all muscle cramps can be explained by a lack of potassium, but most physiologists do not.
While there is no replicated scientific evidence to date, most scientists believe it is the depletion of sodium and chloride, that causes cramping because of the role they play in maintaining fluid balance in the body. How does depletion of sodium and chloride effect training? As an athlete exercises for an extended duration in hot weather, their core body temperature increases. This leads to dehydration. Blood pressure will decrease, and the heart rate rises. One of the ways the body tries to compensate for this is to release hormones that increase sodium permeability in the kidneys. This, in turn, increases the uptake of water into the kidney. These combined responses slow the decrease in blood pressure, and the body reserves water and sodium for necessary core body functions. When there is a higher percentage of water in and outside of cells than electrolytes, athletes experience hyponatremia. This disrupts the balance of electrolytes inside and outside of cells, causing a decrease in neural signals within the muscle, thus decreasing performance.

The only instance I found that may somewhat support the theory that sodium loss causes EAMC was a case report of an experienced triathlete during the course of the Western Australian Ironman Triathlon. The athlete’s sodium levels stayed relatively the same from before the start of the race to transition number two. However, from transition number two to the end of the race, the athlete lost 2% of his body weight due to fluid loss. “The athlete slowed during the run phase of the race after his core temperature rose to critically high levels. As he slowed and his core temperature increased, there was an unusually rapid reduction in blood sodium that preceded cramping, despite presenting with signs of dehydration.” (5)
Other studies have hypothesized a decreased serum sodium concentration would cause muscle cramping but have proved to be inconclusive (2, 4). Noakes et. al. studied Ironman South Africa athletes to analyze serum electrolyte levels, and even though the decrease in sodium concentrations was significant, the difference compared to a control group was within the normal clinical range of post-race serum sodium concentrations. They were unable to correlate decreased sodium concentration to an increase in exercise-associated muscle cramping. Instead, they concluded “the increased activity of cramping muscles post-race may reflect increased neuromuscular activity.” (2)

The second hypothesized cause of EAMC, is pre-mature muscle fatigue. “No mechanism explains how such imbalances in serum electrolytes result in localized muscle cramping. The “muscle fatigue” hypothesis suggests that EAMC is the result of an abnormality of neuromuscular control at the spinal level in response to fatiguing exercise. The development of premature muscle fatigue appears to explain the onset of EAMC.” (3) The diagnosis of EAMC is made clinically, and the most effective immediate management of EAMC is rest and passive stretching. The key to the prevention of EAMC is to reduce the risk of developing premature muscle fatigue. (6)

Hunter Allen, a USA cycling Level 1 coach, agrees that rest and stretching are the best way to prevent muscle cramps. If you exercise your muscles when they are already in a stretched (weakened) state, you will not gain fitness or strength. As you exercise without stretching, your muscles will become tight and they aren’t able to work in the range of motion necessary for
optimal muscle recruitment. If you add the extreme conditions and intensity of a race, the muscles may not be able to respond without cramping. He recommends massage and yoga to keep muscles open.

You can’t use a “one size fits all” approach to muscle cramping since the cause will vary person to person. A veteran Ironman-distance triathlete could complete in an extremely hot and humid Austin 70.3 and need 2L of IV at the finish, but never get muscle cramps. However, someone new to endurance racing could race a sprint triathlon in the same conditions and complain of calf cramps during the run.

The best prevention of exercise-associated muscle cramping would be:

Drink 16 ounces of an electrolyte drink such as nuun before your workout in hot conditions, and sip an electrolyte drink during workouts lasting 60 minutes or longer in hot conditions. To prevent bloating and discomfort, the electrolyte drink should be non-carbonated and have low concentrations of carbohydrate. Carbonation and high sugar content inhibits the digestion and absorption of the electrolytes and glucose. If you usually eat a low-sodium diet, speak with your doctor about adding salt to your meals on the days you work out for 60 minutes or longer in hot conditions. If your diet consists of packaged foods and eating out, you consume enough salt to compensate for loss during exercise and should not add it to your meals. Work with a Trismarter.com Sports Nutritionist to create a customized training nutrition plan. They will help you determine the amount of gels,
chomps, water, and electrolyte drink you should be consuming per workout.

Avoid pre-mature muscle fatigue by:

Scaling down your workouts during hot and humid conditions: Don’t force the pace of a run even if it was scheduled to be a sub-threshold workout. Your heart rate will naturally be higher as the mercury rises, so if it’s in the ‘endurance’ zone instead of the ‘recovery’ zone during your warm-up, back-off and adjust the workout even though you feel like your exertion level is low.

Staying loose: Befriend a foam roller and use it religiously, attend yoga class, or get a massage.

Avoiding weekend warrior syndrome: If you haven’t been riding your bike all summer and decide to head out on a four hour ride in 93’ temps with 90% humidity, you are setting yourself up for muscle fatigue and nail-biting muscle cramps.

What to do when you get a cramp? Once you get a cramp, you cannot make it disappear right away. This is why prevention is key. Most cramps are relieved through light stretching, massage, and hydration. During a race, walk through the aid stations, sip defizzed cola, and stretch the affected area. If you feel a stitch in your side during a run, try to slow your rate of breathing and consciously breathe deeper into your abdominal cavity or reach hands overhead to stretch the affected side. You can try to run through a stitch if you can manage the discomfort. Cramps in the quadriceps or calves should be slowly stretched and massaged as well, followed by suggested prevention tips above.

Sources: