Exercise Associated Muscle Cramping
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Whether you consider yourself a fitness freak or a couch potato, you've probably experienced the painful spasms known as *exercise associated muscle cramping*, or EAMC. These cramps usually happen while performing exercise to fatigue, such as the calf cramp that hits so many divers getting back in the water after some time off. They can also hit during the hours of recovery that follow, such as the charley horse that makes you pull over during your drive home from a hard workout.

EAMC most commonly occurs in muscles that span two joints. This includes the calves, hamstrings, and quadriceps. EAMC also occurs in the adductors (inner thigh) as well as muscles of the hand and wrist. This is thought to be due to their relatively large ranges of motion and resultant muscle fiber overlap when in a relaxed, shortened position.

EAMC does not require whole body fatigue, such as from running a marathon. Instead, any little muscle that is worked to fatigue will be susceptible to EAMC, such as the hand of someone writing a lengthy letter.

The Big Lie

Nearly everyone has heard at some point that the best way to prevent cramps is to stay hydrated and eat bananas. Unfortunately, this advice is based upon the extremely persistent myth that cramps are caused by dehydration and/or electrolyte imbalances. Exercise physiologists have known for decades that this strategy, while certainly an otherwise healthful habit, will do nothing to prevent EAMC. To understand where this myth came from and why it continues to be propagated by fitness novices and experts alike, we must look at the history of research on the topic.

"Miner Cramps"

The first studies of cramps looked at the condition in steamship workers and miners. The extreme heat present in these environments lead to a variety of health issues, including dehydration and electrolyte depletion due to sweating over the course of a 12-16 hour work day. Thus, research in the early 1900s focused on the correlation between these symptoms, going so far as to label EAMC officially as "heat cramps" or "miner cramps" (Brockbank 1929, Derrick 1934, Edsall 1908, McCance 1936, Oswald 1925, Talbot 1935). This was the birth of the dehydration and electrolyte theories of EAMC.

Between the mid 1930s and early 1970s, research continued to focus on the relationship between EAMC and other symptoms and illnesses associated with intense activity. Where the interpretation of these and earlier studies missed the mark is that none attempted to see if EAMC occurs as much in temperature neutral environments as in hot ones, as we now know it does. Also, they failed to look at EAMC occurring in people experiencing acute muscular fatigue without intense sweating, such as hand and wrist

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cramps in new musicians or typists. Thus, the only correlation between EAMC, dehydration, and electrolyte imbalance was in the fact that all three conditions were the result of physical work to muscular exhaustion.

Beginning in the mid 1980s, exercise physiologists and researchers began to reevaluate previous research to see if they truly identified a direct correlation between EAMC, dehydration and/or electrolyte levels (McGee 1990). Armed with a broader perspective, researchers looked for the common denominator between all of the situations in which EAMC commonly occurred.

Evidence began to accumulate showing EAMC was not directly correlated with dehydration, electrolyte levels, or environmental conditions of either extreme heat or cold (Maughan 1986, Miles & Clarkson 1994, Schwellnus et al 2004, Sulzer et al 2005). Rather, it seems to be most directly associated with extreme fatigue of a given muscle, not necessarily the fatigue of the entire body.

Hypokalemia

To confuse matters even further, there is indeed a link between low potassium and cramping. Clinical hypokalemia, generally classified as a blood potassium level below 3.5 mEq/l, can cause generalized skeletal muscle cramping. Present in less than 1% of people who aren't on medication (Lederer 2004), this condition is generally associated with one or more of the following conditions:

- people suffering from eating disorders or elderly who have trouble eating solid foods
- people with kidney disorders
- people taking medications that affect kidney function, such as diuretics
- people with AIDS

So, it is easy to see that someone who is suffering from cramps due to true hypokalemia will have a host of other symptoms that they are likely under medical treatment for. Additionally, the cramping associated with clinical hypokalemia usually only occurs at advanced stages of the condition and in muscles independent of activity level (Lederer 2004).

Unfortunately, this relatively rare condition and its symptoms often get clumped together with EAMC and cramping in specific muscles that *were* worked to fatigue. In truth, it is very unlikely that someone would find themselves with clinical hypokalemia while remaining in a position to work their muscles to fatigue.

Treatment of Cramps

When a cramp hits, the fastest way to stop it involves stretching the cramping muscle while contracting its antagonist, or opposite, muscle (Schwellnus 1997). For example, if you have a cramp in your hamstring, you should straighten your leg and contract your quadriceps.

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This lengthening of the muscle reduces the amount of overlap between the strands of the muscle fibers and limits the amount of force they can generate. The contraction of the antagonist also serves to send a signal of inhibition to the cramping muscle, instructing it to relax. Deep massage may or may not reduce the duration of the cramp, though it usually helps to relieve the associated pain.

Once the cramp releases, you should continue to stretch the affected muscle for 30-60 seconds. This will further inhibit the contraction of the muscle fibers, reducing the chance it will cramp again.

Prevention

If water and bananas isn't the answer to staving off EAMC, what is? Both clinical studies and practical experience agree- the best way to prevent EAMC is to delay the onset of the acute muscle fatigue that triggers them (Bentley 1996, Schwellnus 1999). This includes:

- incorporating exercises functionally similar to how you use your muscles into your fitness program, such as calf raises or kickboard laps to prevent finning-related calf cramps.
- stretching muscles prone to cramping to reduce their resistance to movement.
- being well-rested and well-fueled for the activities you pursue.
- avoiding strenuous exertion when performing activities you're not conditioned for.

Summary

While it is likely impossible for someone who is getting the most out of his or her body to avoid EAMC altogether, preparation through conditioning and stretching is the only proven way to reduce their occurrence. Though good hydration and a diet including electrolytes will have many benefits to your health, your propensity to cramping will remain unaffected by these strategies.

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