Sports Nutrition Myths That Deserve to Die but Live On

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Sports nutrition research and the practical applications of the research are ever changing and evolving. However, some myths remain widespread in the athletic community. Coaches, trainers, and athletes often cling to outdated information, which can harm performance and health. Three sports nutrition myths that are addressed in this article surround carbohydrate intake before exercise, treatment for muscle cramps, and quantity of dietary protein needed to stimulate muscle protein synthesis.

Each myth will be given historical context, and this article showcases newer research to dispel the myth. Moreover, for each myth, a researcher with expertise in the content area will provide the ''bottom line'' for practitioners for communicating to athletes. Nutr Today. 2017;52(2):57–61

INTRODUCTION

We have heard it before; science is evolutionary, not revolutionary. But what happens when writers, bloggers, and Internet stories stop evolving and get stuck in repeating outdated sports nutrition information to athletes? What happens is bad advice, unnecessary adherence to an outdated practice, and a threat to science credibility. I have seen this play out in many ways. One way is that a writer (I am hesitant to use the word journalist) is asked to submit a story on eating before exercise. The writer, who is not a nutritionist or sports scientist, trolls the Internet and finds articles, blogs, or Web sites that cite research from the 1970s indicating that carbohydrate eaten in the hour before exercise leads to a blood sugar surge followed by a crash, rendering the athlete incapable of quality training or competing. Therefore, athletes should avoid carbohydrates pre-exercise. The writer might even find a quote from a nutrition expert and capture it for the story; even though he/she never interviewed the expert in question. The story line that carbohydrate is bad for athletes before exercise gets repeated and is even backed up by experts. I know this to be true because I have seen myself quoted in stories (quotes that were decades old), even though I had never talked to the writer.

Another way this happens is the rise of the fitness blogger, well-meaning exercise and dieting enthusiasts who translate personal beliefs into advice for others. We know that anecdotal information is not evidence, but personal stories are powerful and give credence to a blogger's belief. A case in point is a recent article that touted the benefit of protein for muscle building, weight loss, satiety, controlling cravings, burning belly fat, and world peace (okay, just kidding about that last one). The underlying message of the article was "pile on the protein, the more the better." The author said that he eats 50 to 60 g of protein at every meal, with an additional 20 grams of protein between meals. That plan, he said, was his secret to a "ripped and shredded body." Therefore, he concluded that everyone should adopt a very high protein diet, and they would get the same results that he got.

Myths arise from quotes of outdated evidence, personal bias, and cherry picking data.

A third way that old information gets repeated is through cherry picking the data that support a personal bias. This method is not limited to bloggers and fitness writers. I recently listened to a lecture by a physician, known for touting the benefits of a low glycemic index diet, who told the audience that only lentils or other low glycemic index foods should be eaten before exercise to avoid a blood sugar crash, which would impair performance. The study cited was published 25 years ago.[1] Subsequent research has shown that although some athletes may benefit from a pre-exercise feeding with low glycemic index foods for most it does not confer a performance benefit.[2]

This article showcases 3 enduring sports nutrition stories in need of an update. In addition, a leading expert in the specific research area will provide insights and a key take away point. The myths are the following:

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1. "Do not consume carbohydrate in the hour before exercise." Leading exercise physiologist, researcher, and sports nutrition consultant, Dr Asker Jeukendrup, will lend his insights.
2. "Eating potassium-rich foods will alleviate muscle cramps." Hydration expert, sports nutrition and hydration consultant, and author, Dr Bob Murray, will provide insights into newer thinking about muscle cramping during exercise.
3. "There is no limit to how much protein an athlete should eat to enhance muscle mass," will be discussed by the leading protein nutrition researcher and university professor Dr Stuart Phillips.

CARBOHYDRATE AND PRE-EXERCISE CONFUSION

Carbohydrate is a versatile and necessary macronutrient for athletic performance. The reasons are many: carbohydrate stores in the body are limited, it is a key fuel for the brain and central nervous system, and it is a substrate for muscular work under both aerobic and anaerobic conditions.[2] The thinking about dietary carbohydrate requirements for athletes have shifted from a one-size-fits-all approach to tailoring needs to athlete's training and competition, to ensure that there is adequate carbohydrate availability to meet demands. Athletes are encouraged to consume carbohydrate at different times (pre-exercise, during exercise, and postexercise) depending on the intensity, duration, and need to maximize liver and muscle stores. For example, athletes involved in skill sports, such as baseball or golf, do not require high intakes of carbohydrate or special pre-event feeding intake strategies. On the other hand, athletes who train and compete for events that last several hours, such as distance cycling, tournament soccer matches, or triathlons, need to plan to eat before and during exercise, as well as during recovery periods, especially if they will be exercising on consecutive days.

Dietary carbohydrate requirements for athletes have shifted from a one-size-fits-all approach to tailoring needs to athlete's training and competition to ensure that there is adequate carbohydrate availability to meet demands.

The pre-event carbohydrate needs range from 1 to 4 g/kg of body weight (BW), depending on how close the feeding is to the exercise time. For example, consuming 4 g/kg BW 4 hours before exercise is suggested, whereas when closer to the event, a smaller amount of carbohydrate is recommended to allow time for digestion and absorption. In the mid-1970s, some researchers expressed concern that pre-exercise carbohydrate could have negative effects on exercise performance. The premise was that because pre-event carbohydrate stimulated insulin secretion other metabolic fates such as increasing glycogen breakdown and suppressing fat oxidation during exercise would lead to rebound hypoglycemia and impaired performance. Foster et al[3] gave cyclists 75 g glucose half an hour before cycling at high intensity. Exercise time was impaired by about 19%, and the authors suggested that athletes avoid carbohydrate in the hour before exercise. A review paper by Jeukendrup and Killer[4] found that since the Foster paper, other researchers have found either no effect on performance or an improvement of performance when carbohydrate is consumed in the hour before exercise.

The idea that low glycemic index carbohydrates are preferred before exercise is also a widely held belief. However, in the recent position paper on nutrition and athletic performance, using data from the Academy of Nutrition and Dietetics Evidence Analysis Library, this myth is dispelled. "In the majority of studies examined, neither glycemic index nor glycemic load affected endurance performance nor metabolic responses when conditions were matched for carbohydrate and energy."[2] Although the metabolic effect of consuming carbohydrate before exercise might be an elevated insulin level, it is important to separate this effect from a performance effect. Planning carbohydrate strategies for athletes should always be individualized because some athletes report symptoms of hypoglycemia during exercise when they consume carbohydrate before exercise.[5]

The Bottom Line

Leading sports nutrition researcher and consultant, Dr Asker Jeukendrup, sums it up this way. "For a long time, it was said to avoid carbohydrates in the hour before exercise. Studies do not support such advice, and most studies show no difference or an improvement in performance. However, in reality, it requires a little trial-and-error to find out what works best for an athlete. Some individuals are more prone to develop hypoglycemia when they have carbohydrate before exercise. However, interestingly, the presence or absence of hypoglycemia during the first minutes of exercise does not correlate with how people feel. Some feel great even though blood glucose is temporarily low, other show similar symptoms to hypoglycemia even though their blood glucose when measured is in the normal range. (electronic communication, Asker Jeukendrup, PhD, November 29, 2016)" For more information on this and many other sports nutrition topics, see Dr Jeukendrup's Web site at http://www.mysportscience.com/.

MUSCLE CRAMPS AND POTASSIUM

When talking to groups of athletes, I always ask 2 questions: "how many of you cramp during practice or a game?" and "what do you do when you cramp?" Inevitably, someone will say, "I eat a banana." Indeed, many athletes believe that cramps are caused by lack of potassium, and this myth is perpetuated by recreational and elite athletes alike. Dr Bob Murray, managing principal of Sports Science Insights and sports nutrition and hydration expert says, "Some people mistakenly believe that potassium loss is the cause of muscle cramps and suggest eating oranges and bananas to replace the potassium lost in sweat. However, potassium loss is not the culprit. It is true that potassium is lost in sweat, but the concentration of potassium in sweat is low; usually, less than 10 mmol/L is far less than that of sodium, 20 mmol/L to more than 100 mmol/L. In addition, the amount of potassium lost in even a large volume of sweat represents a small fraction of total body potassium content, whereas sweat sodium losses in a single 2-hour training session can approximate 20% of total body sodium content (electronic communication, Bob Murray, PhD, December 15, 2016)."

So, if potassium is not the culprit, what is? Despite the frequency in which cramps occur and the long history of exercise-associated muscle cramps (EAMC) in sports, the exact cause is still being elucidated. All of the following have been proposed as causative or contributing factors to EAMC: dehydration, electrolyte imbalance, fatigue, altered neuromuscular control, or a combination of any or all of these factors.[6] The dehydration-electrolyte imbalance has been the prevailing theory of EAMC.[7] Athletes are not very good at replacing the fluids that they lose during exercise, resulting in dehydration, which sensitizes select nerve endings by contracture of the interstitial spaces leading to muscle cramping. Exercise-associated muscle cramps is often seen in athletes exercising in hot, humid environments, so the term "heat cramps" has been used to describe these painful muscle contractions.[7,8] However, athletes exercising in cool temperatures and swimmers experience EAMC, so dehydration is not the sole cause of EAMC.

A leading theory for EAMC is the "altered neuromuscular control" hypothesis. Cramping is thought to be related to muscular fatigue. Predisposing factors to muscle fatigue include exercising in hot and humid weather, increasing exercise intensity and/or duration, and depletion of muscle energy stores.[8] This theory was popularized by Schwellnuss[8] and suggests that neuromuscular fatigue alters reflex control mechanisms.[8,9] Muscle fatigue encourages an imbalance of the excitatory drive from muscle spindles and the inhibitory drive originating from Golgi tendon organs within the muscle.[8,9] The result is a muscle cramp. There is good empirical data to support the theory, but it does not discount that dehydration and electrolyte imbalances play a role in the root cause of cramps in some athletes.[9] Indeed, not all cramps are the same, and different environmental factors or altered water and electrolyte balance can contribute to cramping.[10]

Another interesting avenue of research on cramping is the growing research on transient receptor potential (TRP) ion channels.[11] Channels in the nerves within the oral cavity sense different compounds and send messages to the brain via various TRP receptors. For years, athletes have tried pickle juice or mustard packets to alleviate a muscle cramp. The rapidity at which cramps were relieved meant that it could not be related to digestion, absorption, and distribution of the electrolytes in the pickle juice or spicy mustard. Further research showed that pickle juice triggered nerves in the mouth that signaled the spinal cord neurons with the result of reducing motor neuron activity to the cramping muscle.[12] Using the TRP receptors, a spicy or pungent food, like pickle juice or mustard, signal neurons in a complex cascade to lessen or halt a cramp. Most adults know that capsaicin, the compound that gives heat and spice to hot chili peppers, can activate specific TRP receptors to let your brain know that it is hot, sometimes painfully so.[11] (Murray[12] presented a thorough review of the emerging science of muscle cramping and TRP.)

Using this knowledge, some products are popping up with the aim of reducing EAMC by activating TRP channels. One company is calling the category neuromuscular performance supplements; the ingredients of their product are listed as lime juice, cinnamon, ginger, and capsaicin along with water, sugar, and salt, and stevia, with the claim of preventing muscle cramps by activating TRP channels. The evidence to support their claims is more theoretical and anecdotal than empirical, but some small studies are showing the promise of using a blend of herbs and spices to stop cramping. A recent abstract lends credence to the claims. In a randomized, double-blind, placebo-controlled crossover trial, 20 young subjects with a history of muscle cramping were studied in 2 experimental trials inducing calf muscle cramps. In 1 trial, the subjects were given a neuromuscular performance supplement 15 minutes before inducing calf cramps, and in the other trial, a control beverage was ingested. With the neuromuscular performance supplement, the TRP channel activation reduced the intensity and duration of the cramp, and the subjects reported less muscle soreness.[13]

A new category of dietary supplements being called neuromuscular performance supplements might be the answer to preventing or treating exercise-associated muscle cramps, but bigger and better studies are needed to make sure that effects are real.

The Bottom Line

Dr Murray's advice is "to stay well hydrated and fueled during training and competition to help reduce the risk of cramping. For those athletes prone to cramps, additional interventions such as consuming extra sodium or strong spices before and during exercise may be needed to prevent or treat cramping."

THERE IS NO LIMIT TO THE AMOUNT OF PROTEIN THAT ATHLETES SHOULD CONSUME

There is no doubt that athletes require more protein to promote an increase in lean muscle than the recommended dietary allowance of 0.8 g/kg BW.[2] Early recommendations for protein intake for athletes were viewed through the lens of sport type; with 1.2 to 1.4 g/kg BW of protein recommended for endurance athletes and 1.4 to 1.7 g/kg BW for strength athletes. Because researchers learned more about how protein stimulates muscle protein synthesis (MPS), guidelines have evolved to refine protein intake depending on the athlete's training status (ie, how well trained, either aerobically or strength-trained), the intensity and duration of the workout, the undertaking of a new training regimen, carbohydrate availability, and most importantly, energy availability.[2] Today, the recommended intake for athletes ranges from 1.2 to 2.0 g/kg BW a day. In addition to protein quantity, the variables of protein quality and timing are also important to MPS.[14] The dose of protein that maximally stimulates MPS at rest and after resistance exercise is about 10 g of essential amino acids or 0.25 to 0.3 g per protein or 15 to 25 g of protein.[15] It also seems that the branched–chain amino acid, leucine, is an important stimulus of MPS.[16] Thus, most researchers and sports nutritionists recommend that athletes consume around 20 g of high quality protein per meal, spread out every 3to 5 hours over multiple meals. That is not difficult to achieve in an athlete's diet when one considers that 3 oz of meat, fish, or poultry provides about 21 g of protein. Higher doses of 40 g of protein or more have not been shown to further increase MPS.[2]

There are situations when a higher intake of protein (>2.0 g/kg/d) is beneficial for athletes. Researchers have found that during periods of energy restriction a higher intake of protein helps to preserve muscle mass. Protein has several potential advantages over carbohydrate or fat as the macronutrient of prime importance. Protein has a greater thermic effect than either carbohydrate or fat; protein provides greater satiety and has the potential to preserve lean body mass (LBM) when energy is restricted.[17] In a short-term study (2 weeks), 20 healthy, resistance-trained men were fed their usual diet for 1 week with about 15% of calories from protein. The second week, the men were fed a hypocaloric diet (60% of usual intake) with either 1.0 or 2.3 g of protein. The group consuming the higher protein intake as part of an energy-restricted diet had greater preservation of lean mass while losing fat.[18] Athletes attempting to decrease body fat while preserving lean mass most likely will benefit from a well-planned hypocaloric diet with increased protein. However, there is no reason to believe that a very high protein intake of greater than 2.5 g/kg/d will afford more protection of lean mass or improve performance.[17]

Athletes who restrict calories for weight loss benefit from a higher intake of dietary protein to protect lean muscle mass.

A recent paper that is generating buzz with athletes suggests that 20 g of protein does not maximally stimulate MPS in all circumstances.[19] Athletes with high muscle mass or LBM frequently ask if they need more protein than someone with smaller LBM. Researchers wanted to answer that question by designing a study with healthy, resistance-trained young men. Two groups of 15 men, 1 group with 65 kg or less LBM and 1 group with 70 kg or more LBM, were assigned 20 or 40 g of whey protein after a bout of whole-body resistance exercise. A similar stimulus of MPS was observed during the recovery period in both groups, with greater MPS noted with the higher amount of protein. The researchers speculate that the whole-body resistance exercise used in this study was more intense than single-leg resistance exercise, which has been used in other studies. Thus, the authors conclude that the amount of muscle activated during exercise in the said study was greater than in that of in other studies. The authors also pointed out that LBM did not influence MPS, because both groups of subjects had similar MPS in response to the higher amount of protein. Where does that leave recommendations to athletes? I turned to protein researcher Stuart Phillips of McMaster University. "Stimulation of MPS is an important aspect of stimulating muscle growth. When we originally observed that 20 g of protein 'did the job'[15] to maximally stimulate MPS, we were studying trained young men following a heavy leg workout. MacNaughton et al[19] used a whole-body routine, and they showed that a 16% difference between 20 g and 40 g protein was significant. My take is that as per dose of protein goes from 20 g to 40 g you may squeeze out a little more MPS, but it's a case of diminishing returns (electronic communication, Stuart Phillips, PhD, January 2, 2017)."

The Bottom Line

Dr Phillips sums up the protein intake issue thusly, "You can eat and digest a lot of protein in 1 meal, but I think somewhere around 0.3 to 0.4 g protein/kg per meal tops out the MPS response. Also, based on unpublished work, we think you can press that MPS 'button' about 4 times per day with that meal. In my opinion, beyond that returns diminish sharply (personal communication)."

REFERENCES

1. Thomas DE, Brotherhood JR, Brand JC. Carbohydrate feeding before exercise: effect of glycemic index. *Int J Sports Med*. 1991;12(2):180–186.
2. Thomas DT, Erdman KA, Burke LM. Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: nutrition and athletic performance. *J Acad Nutr Diet*. 2016;116(3):501–528.
3. Foster C, Costill DL, Fink WJ. Effects of preexercise feedings on endurance performance. *Med Sci Sports*. 1979;11:1–5.
4. Jeukendrup AE, Killer SC. The myths surrounding pre-exercise carbohydrate feeding. *Ann Nutr Metab*. 2010;57(suppl 2):18–25.
5. Moseley L, Lancaster GI, Jeukendrup AE. Effects of timing of pre-exercise ingestion of carbohydrate on subsequent metabolism and cycling performance. *Eur J Appl Physiol*. 2003;88(4–5):453–458.
6. Casa DJ, DeMartini JK, Bergeron MF, et al. National Athletic Trainers' Association position statement: exertional heat illnesses. *J Ath Training*. 2015;50(9):986–1000.
7. Miller KC, Stone MS, Huxel KC, Edwards JE. Exercise-associated muscle cramps: causes, treatment, and prevention. *Sports Health*. 2010;2(4):279–283.
8. Schwellnus MP. Cause of exercise associated muscle cramps (EAMC)—altered neuromuscular control, dehydration, or electrolyte imbalance? *Br J Sports Med*. 2009;43(6):401–408.
9. Nelson NL, Churilla JR. A narrative review of exercise-associated muscle cramps: factors that contribute to neuromuscular fatigue and management implications. *Muscle Nerve*. 2016;54(2):177–185.
10. Kenney WL, Murray B. Three TRP channel agonists and one absentee antagonist. *Curr Sports Med Rep*. 2016;15(6):446.
11. Schumacher MA. Transient receptor potential channels in pain and inflammation: therapeutic opportunities. *Pain Pract*. 2010;10(3):185–200.
12. Murray B. How curiosity killed the cramp; emerging science on the cause and prevention of exercise-associated muscle cramps. *AMAA J*. 2016;29(3):5–7.
13. Craighead DH, Shank SW, Alexander LM, Kenney WL. Orally ingested transient receptor potential (TRP) channel activators attenuate the intensity-duration of voluntarily induced muscle cramps in humans. *FASEB J*. 2016;30(1 suppl):lb706–lb706.
14. Phillips SM, Chevalier S, Leidy HJ. Protein "requirements" beyond the RDA: implications for optimizing health. *Appl Physiol Nutr Metab*. 2016;41(5):565–572.
15. Moore DR, Robinson MJ, Fry JL, et al. Ingested protein dose response of muscle and albumin protein synthesis after resistance exercise in young men. *Am J Clin Nutr*. 2009;89(1):161–168.
16. Phillips SM, van Loon LJ. Dietary protein for athletes: from requirements to optimum intakes. *J Sports Sci*. 2011;29(suppl 1):S29–S38.
17. Phillips SM. A brief review of higher dietary protein diets in weight loss: a focus on athletes. *Sports Med*. 2014;44(suppl 2):S149–S153.
18. Mettler S, Mitchell N, Tipton KD. Increased protein intake reduces lean body mass loss during weight loss in athletes. *Med Sci Sports Exerc*. 2010;42(2):326–337.
19. MacNaughton LS, Wardle SL, Witard OC, et al. The response of muscle protein synthesis following whole-body resistance exercise is greater following 40 g than 20 g of ingested whey protein [published online ahead of print August 2016]. *Physiol Rep*. 2016;4(15).

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