

Athletes & Acid

Understanding Sports Induced Acidosis



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Athletes and Acid:

Why aging, elite, and high performance athletes need to understand and avoid excess acid build up in their muscles, a condition called Sport Induced Acidosis

by Robert Burns, PhD

Elite and high performance sport athletes continually push at the boundaries of physics, trying to compress time into ever-smaller increments or beat gravity at its own game. In the process, they often redefine what is “humanly possible,” not only for themselves but, in some cases, for all of us.

As every athlete knows, in the sports world a millisecond or the slightest internal or external physical advantage can mean the difference between victory and defeat, a repeat performance or a new world record or personal best. And, unfortunately, sometimes it is a world where athletes destroy their careers, health or reputations trying to dope their way to new physical feats.

Life in the balance

Currently, athletes competing in elite, high level, individual and team sports are breaking performance barriers at a record pace. There are a number of reasons for this: advancements in training, athletic equipment, sports medicine and physical therapy, as well as a deeper understanding among coaches and athletes of human body chemistry and the role nutrition and body chemistry plays in athletic performance. For the purpose of this paper, we will focus on one particular—and often overlooked—physiological and nutritional aspect of maintaining health and athletic performance: control of sports induced acidosis through acid-base balance.

Athletes who are committed to legal, healthful ways of increasing performance, reducing fatigue, and compressing recovery time need to understand acid balance and the negative impact of too much acid. High performance and elite sport athletes should be particularly concerned with maintaining a healthy acid level, as they regularly place themselves under physical and dietary stresses that can lead to imbalances, most commonly lactic acid which indicates excess hydrogen ion (acid) buildup. Whatever your level of athletic intensity, a healthy acid balance can mean the difference between greater athletic achievement or being brought up short by muscle “burn” or cramping.

A pH primer ~ or ~ what every athlete needs to know about acid balance

Proper pH balance is a key component of good health and it is absolutely essential to athletic performance. pH is measured on a 14-point scale, with 7 being neutral. The lower the pH value, the higher the acidity; the higher the pH value, the more alkaline. pH values vary throughout systems in the human body. So, as you might imagine, stomach acid has a very low pH value, ranging from 1.0 to 3.0 while digesting food. Pancreatic excretions are very high in pH value, ranging from 8.0 to 8.3. The pH value of arterial blood in a healthy human is balanced around the middle of the 14-point scale at a narrow range of 7.35 to 7.45, or just slightly alkaline.

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As the body metabolizes fuel (i.e. food), acid wastes are created. To sustain a healthy blood pH balance, acid wastes must be removed from the body or neutralized. The body has numerous ways to flush acid waste out of the system: the lungs vent carbon dioxide; our kidneys filter blood and excrete acids through urine (urine pH value can be as low as 4.5); skin sweats acids out of the system. In addition to its various acid-flushing functions, the human body also has built-in chemical buffers that help to neutralize pH imbalances, including calcium, phosphorus, bicarbonate, hemoglobin, and phosphate cycles in the blood. When, because of diet, intense exercise, and/or aging, we exceed the body's ability to flush out or neutralize acid wastes, acid buildup—*sports induced acidosis*—occurs.

Crossing the threshold, managing the “burn”

Most serious athletes are familiar with the phenomenon known as “muscle burn.” Muscle burn is largely the result of lactic acid which indicates hydrogen ion buildup in the system and is one effect of excess acid in the blood and tissue. Acid concentration increases when an athlete exceeds what is called the “lactate threshold,” the point at which the body can no longer flush or neutralize acid wastes as fast as they are being produced. When an athlete crosses the lactate threshold for a sustained time, acid accumulates in the muscles and can lead to cramping, severely compromising their performance. Contrary to popular belief, lactic acid is not, in and of itself, the cause of acidosis. However, elevated levels of lactic acid in the system are an indicator of excess acidic hydrogen ion buildup in the muscles and blood.

Exercise is not the only contributing factor to acidosis. Aging and diet also play key roles. As we age, our systems that rid the body of acid waste don't work as efficiently. Furthermore, the western world's diet, with its overemphasis on animal protein, fats, processed sugar and flour, is likely a contributing factor in acidosis. Because elite and high performance athletes often burn through exponentially more calories than the average person does in a day (a 175-pound athlete can burn approximately 6,000-8,000 calories in the course of a 60-mile bike race alone), they should be particularly concerned with acid balance and dietary health. Also, the athlete's often-accelerated intake of protein and carbohydrates can produce surplus acid from their metabolic wastes.

Prevention is the best medicine

So, how can athletes protect themselves from acid imbalance? A healthy diet is the best place to start. Cutting back on acid-producing foods and beverages such as animal protein, coffee, soft drinks, and wine, can help. But remember: just because a food is chemically acidic doesn't automatically mean it's an acid *producing* food. (So, for example, citrus fruits actually have an alkalizing effect on the body, as do most acidic fruits and vegetables.) To maintain a healthy acid balance, many natural medicine practitioners recommend a diet comprised of anywhere from a 60/40 to as much as an 80/20 ratio in favor of alkalizing foods over acid-producing foods. However, that's not always easy to achieve—especially for people who don't want to pay obsessive attention to their diet. And, as we discussed earlier, even with the best diet, human beings naturally become more acidic as we age and our metabolic processes slow.

Supplemental solutions?

Can alkalizing supplements help maintain a healthy acid balance and bolster the body's natural chemical buffers? Can they get past the stomach barrier to selectively get rid of excess acid? Can they help athletes—especially older athletes—improve their performance by raising their lactate threshold? These are questions that can only be decisively answered by extensive clinical studies. We know that calcium, magnesium and potassium carbonates and hydroxides can help combat low-grade acidosis, but simple carbonate forms of minerals are not alkaline enough to be effective on most organic acids. However, there have been some very interesting test results using a compound comprised of potassium hydroxide, magnesium hydroxide and calcium carbonate that slowly releases its buffer activity for both organic and inorganic acids.

Two pilot tests conducted by the Seattle-based supplement company Tamer Laboratories found that subjects who used a food grade, alkaline mineral compound (called Alka-Myte®) for five days experienced an average decline in urinary acidity of 53 percent. Another Tamer Laboratories pilot test conducted at Seattle Performance Medicine showed that this acid-buffering compound significantly reduced muscle burn, increased time to fatigue, lowered lactate levels in the blood, and increased muscle strength and recovery in cyclists who participated in the test pilot. In addition, a blind placebo study was conducted on Nordic skiers by Dr Dan Heil at Montana State University. After 24 elite Nordic skiers used either Alka-Myte or placebo for 7 days at a dose of 1 tablet per 50 pounds of body weight, the following significant changes were noted in their upper body ergometer performance: 1. increased power output; 2. reduced cardio-respiratory stress with lower heart rate, respiratory rate and energy expenditure (lower sub-maximal VO_2) and 3. reduced blood lactate levels.

In the meantime, what we do know is that acid balance and acid buffering are crucial to human health and slowing the aging process. This is an area that is garnishing more and more attention from practitioners of traditional and holistic medicine as well as athletes and coaches. By addressing ways to lower acid levels with slow release acid reducing compounds, we may be able to buffer or slow the negative effects that acidosis has on athletes, as well the many disparate maladies that share acidosis as a common thread.

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