Practical Considerations for Bicarbonate Loading and Sports Performance

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‘Bicarbonate loading’ provides an ergogenic strategy for sports which involve high rates of anaerobic glycolysis and are limited by the fatigue associated with a progressive increase in intracellular acidity. Consumption of sodium bicarbonate before exercise – typically 300 mg/kg body mass or about 20 g for a 70-kg athlete – can temporarily increase blood bicarbonate concentrations and provide extra capacity to manage the hydrogen ions that efflux from the muscle. A meaningful increase in blood buffering capacity should extend the time that high-intensity exercise can be sustained before fatigue occurs. Targeted sports include events involving sustained high-intensity exercise of 1–7 min duration, such as rowing, and middle distance swimming and running events. However, sports involving 30–60 min of sustained exercise just below the so-called anaerobic threshold may benefit from bicarbonate loading if it supports the athlete for periods in which the pace is increased; for example, surges during the event or the final sprint to the end. Similarly, the repeated-sprint performance typical of team and racquet sports, and even combative sports, may also benefit from improved buffering.

The available literature shows reasonable but not unanimous support for the benefits of bicarbonate loading for each of these sporting scenarios. A meta-analysis of 38 studies of sodium bicarbonate supplementation recently tried to quantify its effect on performance [1, 2]. It found that the typical bicarbonate loading dose achieved a possibly moderate performance enhancement of 1.7% (90% confidence limit ± 2.0%) in a single 1-min sprint in male athletes. This effect was increased by ~0.5% for each increase of 100 mg/kg body mass in the dose or by the addition of 5 extra sprints. Factors that reduced the effect by a similar amount were a 10-fold increase in the test duration and being female. There was a small correlation between performance and the pre-exercise increase in blood bicarbonate.
Although the common household/cooking product, bicarb soda is a cheap and widely available form of bicarbonate, many athletes find this to be unpalatably salty. Alternative bicarbonate preparations include the pharmaceutical alkalizer powders, capsules and tablets developed to address symptoms of urinary tract infections. The major side effect of bicarbonate supplementation is gastrointestinal distress including nausea, stomach pain, diarrhea and vomiting. Many athletes who could potentially benefit from enhanced buffering capacity fail to bicarb load in competitive settings due to fear or personal experience of such gut upsets. A systematic investigation found that the best protocol to optimize blood alkalosis and reduce the occurrence of gastrointestinal symptoms was to spread out the consumption of bicarbonate capsules over the 120–150 min before the start of exercise and, if practical, at the same time as consuming a carbohydrate-rich meal and some fluid.

Athletes should practice with such strategies to fine-tune a successful protocol for their sport. This should take into account their individual tolerance, but also practical issues such as the need to accommodate a warm-up or repeated events (e.g. heats, semis, finals) on the same or successive days. More studies are needed to examine the benefits of bicarbonate loading on sports-specific protocols, its interaction with other supplements, and the potential effects of chronic application of bicarbonate loading to enhance training adaptations to interval training.

References