Bicarbonate Loading Counterpoint: Summary

HYPOTHESIS
Our hypothesis is that Bicarbonate loading does not improve anaerobic sports performance. The opposing hypothesis is that Bicarbonate loading does improve anaerobic sports performance.

NORMAL NON-CLINICAL USE
In normal non-clinical settings Bicarbonate is used to treat low pH in the stomach and esophagus. Using effervescent Sodium Bicarbonate (NaHCO₃), in conjunction with antacids, gives a significant increase to intra-oesophageal pH. Effervescent NaHCO₃ was the only substance that showed reliable increases in intragastric pH (6). Chewable and swallowable antacids did not show significant increase in intragastric pH (6).

CLINICAL USE
Bicarbonate is used to treat low arterial pH of a patient in a severely acidotic state. This is found in patients with diabetic ketoacidosis (4).

MECHANISM OF ACTION
During high intensity exercise, there is an excessive generation of H⁺ ions from lactate dissociation, (2) causing an accumulation of H⁺ ions which is linked to decreases in work rate and performance. (2) This is due to impairment of myofilament interactions through reduced Ca²⁺ release from the Sarcoplasmic Reticulum and its subsequent binding (1). Bicarbonate is reported to buffer pH and increase H⁺ ion efflux from the muscle by increasing the concentration gradient across the sarcolemma, which enhances the co-transport of H⁺ and Lactate from the myoplasm (2).

CLINICAL DOSAGE
Seeing as Bicarbonate is not a nutrient there is no Recommended Dietary Allowance (RDA). However, ingestion of 0.3 g kg⁻¹ body weight of NaHCO₃ was found to cause significant gastrointestinal distress. This can be considered the upper tolerable limit (3). Additionally, this level NaHCO₃ ingestion leads to Na⁺ intake that is well above the tolerable upper limit of 2300 mg/day (3). There is a clinical dosage for use in emergency ketoacidosis. In this setting a patient receives 133.0meq of bicarbonate when arterial pH is between 6.90 and 6.99, 89.2meq of bicarbonate when arterial pH is between 7.00 and 7.09, and finally they receive 44.6meq of bicarbonate when arterial pH is between 7.10 and 7.14 (4). The patient receives dosage every 30 minutes. This process is repeated every 2 hours until arterial pH reaches 7.15 (4).

COUNTERPOINT EVIDENCE
In 2010, Price and Simons studied the effects of Bicarbonate supplementation on eight trained healthy men (5). The participants ingested either 0.3 g kg\(^{-1}\) body weight of NaHCO\(_3\) or a placebo of Sodium Chloride one hour before their trial. The intermittent protocol of the experiment called for twenty 24 second treadmill sprints at 100% \(\text{v-VO}_2\text{max}\). One minute after, they performed a run to exhaustion at 120% \(\text{v-VO}_2\text{max}\) (5). The results of the run to exhaustion found no significant differences (P>0.05) between the NaHCO\(_3\) and NaCl treatments (5). In addition, 4 of the 8 subjects reported gastrointestinal discomfort following ingestion of Bicarbonate. The study concluded that ingestion of Bicarbonate does not significantly affect performance (5).

A study by Zabala et al. studied the effects of Bicarbonate ingestion on performance in Wingate anaerobic tests. Ten elite BMX cyclists participated in this study (7). The participants each ingested 0.3 g kg\(^{-1}\) body weight of NaHCO\(_3\), or placebo of NaCl, 90 minutes before the experiment. The experiment consisted of 3 trials of the Wingate test with 15 minutes of passive recovery given between trials (7). The study found no significant differences (P>0.05) in peak power or Time to peak power between experimental and control groups. The study concluded that bicarbonate ingestion has no effect on performance (7).

**POINT EVIDENCE**

A study performed by Zajac et al. investigated the effect of Bicarbonate on trained youth male swimmers. These athletes consumed 300mg kg\(^{-1}\) body weight of NaHCO\(_3\), or a placebo. The solution was ingested over 15 minutes, 90 minutes prior to the start of the trial (8). Participants then performed two sets of 4x50m freestyle sprints with a one minute rest between each sprint. The two sets were performed 72 hours apart (8). This study produced a significant difference in the first sprint between the experimental and control data. The results also showed that there were elevated pH and blood Bicarbonate levels (8).

**REFUTING STATEMENTS**

In the paper by Zajac et al. they only found a significant difference in the first sprint. There were no significant differences found in any of the other three trials (8). Also, there was no clear statement of limitations regarding performance results. Finally, the data presented in regards to blood lactate was incomplete and was the only variable not represented by a figure.

**CONCLUSION**

Ingestion of bicarbonate before exercise does not improve anaerobic sports performance, and therefore is not an effective ergogenic aid.
REFERENCES


