NaHCO₃ | Sodium Bicarbonate and its role in cramping

Rachel Painter, ATC
Hyper or prolonged contraction of muscle

Painful

Blood and Muscle pH Balance/Buffering

Fatigue

Dehydration

Motor neuron excitability
Motor Neuron Excitability

Anxiety

Bentley 1996
Muscle Shortening

Increased stiffness and resistance to lengthening

Trigger Points

http://doylene.files.wordpress.com/2008/12/fig409backmusclestrp.jpg
Fatigue
Genetics:
- Ratio of muscle fiber types
- Alkalotic/Acidotic tendencies
- Hydration, Sweat Rate, and Metabolism
Terrain Types:
- Natural
- Artificial
Cramp Types

“Uh oh... Cramp!”
HEAT

- Salt Loss
- Fluid Loss
- Muscle Fatigue

Eicher 2007
Salty Sweating

Genetics

Eichner 2007
http://www.wikiwak.com/image/AmericanFootballTraining.jpg
Remedies??

[Image of Gatorade bottles and bananas]

Stofan, 2005

http://www.coxhardware.com/Products/product_images/gatorade.jpg
Exercise Induced Cramping

- Cramping secondary
- Fatigue

Ergogenic Aid
Can we prove exercise or heat?

Bentley 2006, Sostaric 2006
Sodium Bicarbonate

\[
\text{Na}^+ \quad \text{O} \quad \text{C} \quad \text{O} \quad \text{H}
\]
<table>
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<tr>
<th>ATP-PCr</th>
<th>ATP-PCr+LA</th>
<th>LA + O2 system</th>
<th>O2 system</th>
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<tr>
<td>Shot Put</td>
<td>220-400 yd sprint</td>
<td>880 yd dash</td>
<td>Soccer, Lacrosse (not goalies)</td>
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<tr>
<td>100 yd. Sprint</td>
<td>Halfbacks, Fullbacks</td>
<td>Gymnastics events</td>
<td>Cross-country skiing</td>
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<tr>
<td>Base Stealing</td>
<td>Speed Skating</td>
<td>Boxing (3 min rounds)</td>
<td>Marathon</td>
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<tr>
<td>Golf, Tennis Swings</td>
<td>100 yd swim</td>
<td>Wrestling (2 min periods)</td>
<td>Jogging</td>
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</table>

Adapted from Gambetta (2007), pp 125
If $A=B$ and $B=C$, Does $A=C$?
Studies (as usual...some say yes and some say no...)

www.greyhoundraces.com.au

Cleary et al 2007
Randy Eichner 2007

Lyle Kesl 1998
Michael Price 2008
Verbitsky 1997

![Graph showing normalized knee torque over recovery time with different conditions.](image)

- **B**: Load(\(\dot{V}O_2\text{max}\)) + 17%
- **C**: B + NaHCO₃

The graph illustrates the effect of recovery time on normalized knee torque with conditions B and C, showing statistical significance marked by asterisks (*) at specific time points.
Figure 2—Exercise time to fatigue across trials. *Indicates different from ACD trial ($P < 0.05$).
got cramps?
“Utilizing sodium bicarbonate as a means of preventing muscle cramping in collegiate football athletes”
2010-2011 Oregon Football Athletes – Fall Camp
Protocol: University of Oregon Fall Camp (August 9\textsuperscript{th}-August 26\textsuperscript{th}, 2010)

• Athletes did not change their hydration protocol during fall camp from year to year
• Weights were taken daily and were directly correlated to their solution ratio
• 8 ounces of \textit{Riptide Rush} flavored “G” were measured in the cups.
• A weighted scale was used to measure the weight in ounces of Alka Seltzer tabs for each subject; this was then compared to the approximate number of tabs also calculated
• The solution was made hours before consumption to remove ‘fizzling’ properties
• Athletes consumed their drinks in labeled \textit{Muscle Milk} cups 30 minutes before activity.
Known Side Effects:

Upset Stomach

My hamster died.
<table>
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<tr>
<th>Subject</th>
<th>Date</th>
<th>Weight(lbs)</th>
<th>Weight Loss</th>
<th>gNaHCO3/tab</th>
<th>gNaHCO3/kg</th>
<th>Weight gNaHCO3/subject</th>
<th># of tabs/subject</th>
<th>g other substance</th>
<th>Total g</th>
<th>Total oz</th>
<th>Consume d with Exposure</th>
<th>Did not consume with exposure</th>
<th>Cramp</th>
<th>Practice</th>
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Average Tab Amount Per Subject

Subject

Number of Tabs

Average Tab Amount
<table>
<thead>
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<th>Subject</th>
<th>Average Weight (lbs)</th>
<th>Tab Amounts</th>
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Exposure and Cramping Incidence

- Consumed and exposed: 87%
- Did not consume and exposed: 9%
- Cramped: 4%
Cramping Tendencies

- **Cramp with Consumption**: 67%
- **Cramp without Consumption**: 33%

*Note: 2 of the 3 subjects that cramped with consumption cramped after the time limit of alkalotic effect.*
Subjective Data

• 11 out of 12 Subjects Returned Surveys
• 10/11 Felt they cramped less when compared to last year (one found no difference)
• 10/11 Found the solution not difficult to consume (one found the solution difficult to consume)
• 11/11 who returned surveys believe that the solution helped them to cramp less
• 10/11 would use this protocol again if available (one would not due to nausea side effects)
Memorable Quotes

• “I loved it!”
• “Some how make it taste better.”
• “Make it possible to use when MO center has the heat turned on for practice.”
• “I thought it worked really well during fall camp. Last year I remember having more trouble keeping on top of all the stuff I needed to do to prevent cramping.”
• “Tasted good at any temperature.”
• “The syrup like texture made it difficult to get down and keep down in the high stress atmosphere surrounding games.”
Big Picture Ideas

• Alka-Seltzer can be used as a means of cramp attenuation in athletes with a history of muscle cramping.
• Muscle cramping is a complex phenomena which may or may not have anything to do with fluid loss
• Alka-seltzer should be used as a prevention protocol and should follow a specific gram to body weight ratio
• Athletes respond well to this treatment
• It is an easy and attainable product to work with.
Goals From Here

• Develop a usable and adaptable protocol
• Create an easy to use Tab to Weight ratio range that clinicians can replicate quickly
• Encourage the appropriate use of Alka-Seltzer as a part of the prevention domain
• Educate athletes who have a history of cramping about this prevention protocol
References

References


