Compare the bioavailability of two different-sized of magnesium supplements

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Bioavailability of Magnesium from Magnesium Salts with Different Particle Sizes

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Conflict of Interest

- This research is funded by New Capstone Inc., the manufacturer of ReMag
What is magnesium?

- Magnesium (Mg) is an essential nutrient for the human body
  - *Important for more than 300 enzyme systems*\(^1\)
  - *Vitamin D and calcium*\(^1,2\)

However, 50% of the US population has inadequate dietary magnesium intake\(^3\)
Magnesium intestinal absorption

Passive transport

Active transport

Current magnesium supplements

■ Advantage
  - *Increase the dietary magnesium intake*

■ Disadvantage
  - *Side effect: diarrhea*\(^4\), especially in a high dose (350 mg)
Hypothesis

- **Smaller particle size (picometer)** may increase the bioavailability (absorption) of magnesium and reduce the diarrhea side effect compared to the normal particle size.
Objectives

■ Compare the bioavailability of two magnesium supplements with different particle sizes in a healthy population

■ Evaluate the use of ionized Mg (iMg) as a biomarker for magnesium status in a healthy population
  - Few studies used iMg, but iMg is the active form of Mg
Methods: Study design

- Single-blind crossover randomized controlled trial
Methods: Study design

■ Each session lasts 24 hrs
■ Washout is at least 1 week
■ During each session, following supplements will be randomly given:
  - A placebo
  - Mg citrate (300 mg, normal-sized)
  - Mg chloride (300 mg, pico-sized)
ReMag
(“Picometer”, “Liquified”)
(Mg chloride)

Natural Vitality Calm
(“Normal-sized”, “Powdered”)
(Mg citrate)


http://naturalvitality.com/natural-calm/
Methods: Mg measurement

- Blood iMg
  - NOVA 8
Methods: Mg measurement

- Urine total magnesium
- Serum magnesium concentration
  - Atomic absorption spectrophotometry (AAS)
Methods: data collection

Intervention

Breakfast

Lunch

Evening Snack

-15 mins  0  0.5 hr  1 hr  2 hrs  3 hrs  4 hrs  6 hrs  8 hrs  21 hrs  24 hrs

http://www.clker.com/clipart-blood-drop-5.html
Preliminary data analysis

- **24-hour total area under curve (AUC)** is used to assess the bioavailability (**blood iMg**)

- **3 Matched pairs t tests** are used (**blood iMg**)

<table>
<thead>
<tr>
<th>N</th>
<th>Mg chloride (pico)</th>
<th>vs</th>
<th>Mg citrate (normal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Mg chloride (pico)</td>
<td>vs</td>
<td>Placebo</td>
</tr>
<tr>
<td>6</td>
<td>Mg citrate (normal)</td>
<td>vs</td>
<td>Placebo</td>
</tr>
</tbody>
</table>
Results: Overview of blood iMg (Average ± SD)
Results: Overview of Serum Mg concentration (Average ± SD)
Results: Overview of Urine total Mg (Average ± SD)
Results: AUC blood iMg

<table>
<thead>
<tr>
<th>Matched Pairs t tests</th>
<th>Mean</th>
<th>SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mg chloride (pico) - Mg citrate (normal)</td>
<td>-0.06</td>
<td>1.65</td>
<td>0.465</td>
</tr>
<tr>
<td>Mg chloride (pico) – Placebo</td>
<td>1.31</td>
<td>1.25</td>
<td>0.040*</td>
</tr>
<tr>
<td>Mg citrate (normal) - Placebo</td>
<td>1.10</td>
<td>1.63</td>
<td>0.081</td>
</tr>
</tbody>
</table>

*, significant difference (p < 0.05)
Conclusions

- There is no difference of bioavailability between pico-sized and normal-sized magnesium supplements.

- There is an increase in blood iMg concentrations indicating an absorption response for Mg chloride (pico-sized).

- There is a tendency an increase in blood iMg concentrations indicating an absorption response for Mg citrate (normal-sized).
Future plans

■ Particle size analysis of both magnesium supplements (Purdue nanotechnology lab)

■ Chemical analysis of chloride ion in ReMag (AgNO₃ reaction)

https://www.purdue.edu/discoverypark/birck/research/index.php
References:


