Effects of Magnesium Supplementation on Muscle Soreness and Performance

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Thesis
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Introduction

• Magnesium (Mg) as an ergogenic aid
  • Specific catalyst for more than 300 enzymatic reactions

• Common mineral deficiency

• Recommended Dietary Allowance (RDA)
  • Men 19-30 years: 400mg/day
  • Women 19-30 years: 310mg/day

• Athletes tend to be more deficient due to excess sweat losses

• How is Mg assessed?

Table 1: Recommended Dietary Allowances (RDAs) for Magnesium [1]

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
<th>Female</th>
<th>Pregnancy</th>
<th>Lactation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth to 6 months</td>
<td>30 mg*</td>
<td>30 mg*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7–12 months</td>
<td>75 mg*</td>
<td>75 mg*</td>
<td></td>
<td></td>
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<tr>
<td>1–3 years</td>
<td>80 mg</td>
<td>80 mg</td>
<td></td>
<td></td>
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<tr>
<td>4–8 years</td>
<td>130 mg</td>
<td>130 mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9–13 years</td>
<td>240 mg</td>
<td>240 mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14–18 years</td>
<td>410 mg</td>
<td>360 mg</td>
<td>400 mg</td>
<td>360 mg</td>
</tr>
<tr>
<td>19–30 years</td>
<td>400 mg</td>
<td>310 mg</td>
<td>350 mg</td>
<td>310 mg</td>
</tr>
<tr>
<td>31–50 years</td>
<td>420 mg</td>
<td>320 mg</td>
<td>360 mg</td>
<td>320 mg</td>
</tr>
<tr>
<td>51+ years</td>
<td>420 mg</td>
<td>320 mg</td>
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</tr>
</tbody>
</table>

*Adequate Intake (AI)
• Equivocal results for magnesium supplementation and performance

• Terblanche et al, 1992, determined Mg does not improve performance for marathon runners

• Moshli et al, 2012, concluded Mg supplementation had no impact on hand grip and knee strength for inactive older females

• Research is lacking on the effects of Mg supplementation on performance in a deficient population
Methods

• 24 recreationally active college-aged students recruited
  • $n = 22$

• Inclusion criteria:
  • Recreationally active
  • Bench press at least 1 x week for the past 6 months

• Exclusion criteria:
  • All other supplement or medication use

• Recruitment: North Alabama- campus and CrossFit
  • IRB- approved
  • Written, informed consent obtained
  • Research grant approved

• 7-day food and training diary baseline measurements
• Anthropometric measurements
Methods Cont.

**Exercise Protocol**

Soreness-
- Estimate 1 RM using CSCS 4\(^{th}\) Edition
  - 1 warm -10 reps
  - Choose a weight they can lift between 6-8 times
- Eccentric bench press soreness protocol (85% of their 1RM)
  - Hollander et al, 2003, 4 x 12 reps @ 80 1-RM
  - Howatson et al, 2007 3 x 15 reps @ 100% Eccentric RM- elbow flexors
  - Meneghel et al, 2014, 4x 15 reps @ 1RM
- Pilot work
  - 4 participants- 5 sets of 10 eccentric bench press- SUCCESS

**Performance Protocol**
- 3 sets to failure at 65%, 75%, 85% of previously determined 1RM
• **Soreness Ratings**
  • Delayed Onset of Muscle Soreness (DOMS)
  • Likert scale
  • Meneghel et al, 2014

0 1 2 3 4 5 6

• 0 = no soreness
• 1= dull feeling of soreness
• 2= light, continuous soreness
• 3= more than light soreness
• 4= annoying soreness
• 5= severe soreness
• 6= intolerable soreness
Rate of Perceived Exertion (RPE)

Fig. A.5  Adult OMNI-resistance exercise RPE scale, male (Robertson 2004)
Statistical Analyses

• Paired t test pre vs post within Mg and Pla
  • 65%, 75%, and 85% reps to failure
  • Total Volume (TV)
• 2 (group) x 2(time point) ANOVA
• 2 (trial) x 5 (time point) repeated measures ANOVA
• 2 (group) x 3(time point) ANOVA (Delta value)
• Post hoc tests
Table 1 Descriptive characteristics for participants ($n = 22$)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>21.5</td>
<td>1.53</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>173.6</td>
<td>9.1</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>84.0</td>
<td>22.6</td>
</tr>
<tr>
<td>Body Fat (%)</td>
<td>26.2</td>
<td>8.1</td>
</tr>
<tr>
<td>Estimated VO$_2$ max (ml/kg/mm)</td>
<td>43.1</td>
<td>5.1</td>
</tr>
<tr>
<td>(Male, Female)</td>
<td>37.1</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Values are means and standard deviations

Table 2 7-Day Food and Training Recall Analysis

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mg Intake (mg/day)</td>
<td>209.1</td>
<td>114.6</td>
</tr>
<tr>
<td>Mg RDA (%)</td>
<td>52.2</td>
<td>28.6</td>
</tr>
</tbody>
</table>

Values are means and standard deviations
Performance Results

<table>
<thead>
<tr>
<th>Table 3: Performance measures of Pre vs Post for Magnesium and Placebo</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>------------------</td>
</tr>
<tr>
<td>65% RTF</td>
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<tr>
<td></td>
</tr>
<tr>
<td>75% RTF</td>
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<tr>
<td></td>
</tr>
<tr>
<td>85% RTF</td>
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<tr>
<td></td>
</tr>
<tr>
<td>TV</td>
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</tbody>
</table>

RTF = Reps to failure
TV = Total Volume
Note: ⁺ p = 0.08, Pre vs Post Performance Trials
Results- Session RPE Eccentric Trials

- No sig main effect for trial
- No significant main effect for group
- Significant trial x group interaction (p = 0.008)
Eccentric Trial Acute RPE Results

- Significant main effect for trial ($p = 0.01$)
- Significant main effect for time point ($p = 0.002$)
- No significant trial x time point interaction ($p = 0.713$)

* significance at $p < 0.05$
Soreness Delta

- No significant main effect for time point (24 vs 36 vs 48) (p = 0.551)
- Significant main effect for group (p = 0.036)
- No significant interaction (p = 0.995)

* significant at p < 0.01
Conclusion

• 350mg/day of Mg supplementation significantly reduces muscle soreness in deficient, recreationally active, individuals

• Mg supplementation approached significance for 65%, and 75% reps to failure in bench press
References


18. Lukaski, H., Prevention and treatment of magnesium deficiency in athletes


23. Russ Lenth Piface Statistical Power Analysis https://homepage.divms.uiowa.edu/~rlenth/Power


27. University of Houston’s Non-exercise VO2 max estimation
