SCOTTSDALE MAGNESIUM STUDY:
Scottsdale Magnesium Study: Absorption, Cellular Uptake and Clinical Effectiveness of a Timed-Release Magnesium Supplement in a Standard Adult Clinical Population

Key Points
A recent study published in the *Journal of the American College of Nutrition (JACN)* evaluated the absorption, cellular uptake and clinical effectiveness of MagSRT™ in a standard adult population.\(^1\) The authors reported that:

- MagSRT™ was well-tolerated by most individuals, with 91% of participants completing the 30-day trial. Individuals who continued the trial for 90 days, reported no side effects.
- Overall symptomatology, evaluated using a magnesium status questionnaire, improved 28% over 30 days and 63% over 90 days.
- Red blood cell (RBC) magnesium increased 6% and 30% over 30 and 90 days, respectively.
- 96% of all trial participants had baseline magnesium status within lab normal ranges; however, 79% and 89% had suboptimal serum and RBC magnesium status at baseline, respectively.

Study Objective
The objective of the study was to evaluate the efficacy of MagSRT™ in a real-world cross section of patients with clinically normal magnesium status. Primary clinical outcomes included:

1. Assessment of magnesium absorption by measuring changes in serum magnesium levels at four and eight hours after initial supplementation;
2. Examination of cellular uptake using RBC magnesium values after 30 and 90 days of supplementation; and
3. Evaluation of patient symptomatology shifts using a magnesium status questionnaire after 30 and 90 days of supplementation.

A secondary objective was to evaluate the percentage of recruited patients with suboptimal, versus normal, magnesium status based on serum, RBC, and questionnaire results. Data from the 1999 - 2000 National Health and Examination Survey (NHANES) indicate that at least 68% of Americans consume less than the RDA for magnesium.\(^2\) However, normal lab ranges are determined based on values from 95% of the population, most of whom are not consuming enough magnesium.

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Approach

Ninety-one adults participated in a placebo-controlled study at two clinics; 53 individuals received MagSRT™, containing 500 mg dimagnesium malate and Vitamins B6, B12 and folate, with remaining individuals receiving a placebo. Participants were asked to take 2 tablets twice a day with meals. Baseline serum magnesium, RBC magnesium and magnesium status questionnaire scores were collected before trial initiation. To evaluate magnesium absorption, serum magnesium was measured 4 and 8 hours after participants ingested 2 supplemental tablets (250 mg magnesium, half of the recommended dose) or 2 placebo tablets. After 30 days, RBC magnesium was evaluated and participants completed the magnesium status questionnaire. Twenty-four MagSRT™ participants continued the trial for 90 days; RBC magnesium and questionnaire scores were again evaluated after 90 days.

Results

Figure 1 summarizes the baseline characteristics of the trial participants. There were no significant differences in location, age, gender, body weight, BMI or magnesium status between MagSRT™ and placebo participants.

Magnesium Absorption

Serum magnesium increased 22% four hours after taking two tablets of MagSRT™, then decreased 5% after an additional four hours (Figure 2). The initial increase in serum magnesium suggests that magnesium was absorbed through the small intestine into the bloodstream.
The slight decrease at 8 hours may have captured the body in the process of regulating serum magnesium concentration, either by incorporating it into cells or releasing it into the urine. Serum magnesium did not increase in those taking the placebo.

The laxative effects of magnesium are greatly diminished when magnesium is well absorbed. Ninety-one percent of trial participants completed the 30-day trial and 75% reported no side effects. Of those individuals who continued the trial for 90 days, none reported side effects.

**Uptake of Magnesium into Red Blood Cells**

RBC magnesium levels increased 6% and 30% over 30 and 90 days, respectively, in the MagSRT™ group. Both increases are statistically significant (p <0.001). RBC magnesium levels increased 2% in the placebo group after 30 days. Although significant (p = 0.035), it is unlikely that this increase is clinically relevant. RBC magnesium values as a function of time are summarized in Figure 3.

Red blood cell magnesium is a better measure of magnesium stores than serum magnesium and values exceeding 6.0 mg/dL are considered optimal.³

**Symptom Reduction**

Participants in the MagSRT™ group reported a 28% improvement in questionnaire symptoms after 30 days, with 19 participants (40%) having scores less than the threshold value of 30. Placebo subjects reported a 6% improvement in symptoms, with one participant (3%) scoring less than the cutoff value of 30. Symptom scores for the 24 MagSRT™ participants who continued with the trial decreased a total of 63% over 90 days. Ultimately, all 24 (100%) of the 90-day MagSRT™ participants achieved a score less than the questionnaire threshold value of 30. Figure 4 summarizes reported symptoms (as questionnaire scores) as a function of trial day for both the MagSRT™ and placebo groups.

Symptoms showing significant improvement after 30 days of MagSRT™ supplementation included (ranked from smallest to largest p value): memory, carbohydrate/chocolate cravings, sexual energy, blood pressure, fatigue, concentration, asthma/wheezing, anxiety,
and gagging/choking from esophageal spasms. These results suggest that MagSRT™ may provide a safe, highly effective clinical tool for addressing these particular symptoms. However, because the supplement contains significant amounts of methyl folate, B12 and B6 in addition to magnesium, we cannot conclude that magnesium alone is responsible for the improvement in symptomatology. A future trial evaluating the effect of dimagnesium malate alone on the magnesium status questionnaire scores is necessary to further validate the magnesium status questionnaire used in this study.

**Magnesium Status**

There is no recent published data on magnesium status among Americans; therefore, evaluating baseline magnesium status and the impact of magnesium supplementation on status was a secondary objective of this study. Figure 5 summarizes the change in serum and RBC magnesium status after supplementing with MagSRT™ for 30 days.

The normal range for serum magnesium is between 1.6 and 2.3 mg/dL; however, optimal serum magnesium status is expected at values ≥ 2.0 mg/dL. At baseline, 17% of MagSRT™ participants had serum magnesium values ≥ 2.0 mg/dL, indicating that 83% had suboptimal serum magnesium status. Eight hours after ingesting 250 mg of dimagnesium malate, 42% of MagSRT™ participants had serum magnesium values ≥ 2.0 mg/dL.

The normal range for RBC magnesium is between 4.2 and 6.8 mg/dL. There is some debate around optimal intracellular magnesium levels. One source suggests that an optimal RBC magnesium would be ≥ 6.0 mg/dL. At baseline, 9% of MagSRT™ participants had RBC magnesium values of 6 or greater, indicating that 91% had low RBC magnesium status. After 30 days, 16% in the MagSRT™ trial had a RBC magnesium value ≥ 6 mg/dL. Of those who continued the MagSRT™ trial for 90 days, 48% reached optimal magnesium status.
According to these ranges for both serum and RBC magnesium, roughly 80 - 90% of this trial population may have had suboptimal magnesium status at baseline. These findings correlate well with the results from the magnesium status survey, which indicated that 100% of participants had a score ≥ 30 at baseline, suggesting low magnesium status.

**Conclusion**

A standard adult clinical population presented with both qualitative and quantitative evidence of compromised magnesium status at the beginning of the trial. Supplementation with MagSRT™ for at least 30 days significantly improved magnesium status symptoms and increased RBC magnesium with minimal gastrointestinal symptoms.

**References**