Mg citrate found more bioavailable than other Mg preparations in a randomised, double-blind study.

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Introduction: In industrialised countries chronic latent magnesium deficiency has been determined over the recent years. Based on epidemiological data chronic suboptimal dietary magnesium intakes implicate the development of cardiovascular diseases, osteoporosis and asthma. Efficacy of any magnesium supplementation strongly depends on the bioavailability of its form that however has not been sufficiently investigated for numerous magnesium preparations so far. The different bioavailability of the magnesium compounds used may explain the conflicting clinical findings of former magnesium intervention studies. In the present randomised, double-blind, placebo-controlled study the relative bioavailability of three magnesium preparations Mg amino-acid chelate (Mg AAC), Mg citrate and Mg oxide were compared.

Method: 46 healthy volunteers were randomly assigned to three parallel treatment groups (Mg AAC, Mg citrate and Mg oxide providing 300 mg of elemental Mg/day each) and placebo. Subjects had daily magnesium intakes from food equal to the Reference Nutrient Intake (RNI) ± 20%. The duration of the study was 60 days and volunteers were required to provide a 24 h urine collection, saliva samples and fasting blood samples at baseline (day 1), 24 h after the first magnesium supplementation (acute supplementation at day 3) and at the end of 60 days (chronic supplementation at day 61). Magnesium content of all samples was determined by atomic absorption spectrophotometry. All statistical analysis were carried out using analysis of covariance (ANCOVA).

Results: With the organic forms of Mg (amino-acid chelate and citrate) there was a significant increase in urinary Mg excretion compared to Mg oxide and placebo after 60 days (Fig 1). Only Mg citrate significantly increased plasma Mg concentrations both after acute and chronic supplementation (Fig 2). No significant differences in red blood cell Mg concentration among the three treatment groups were detected either with acute or chronic supplementation. With acute supplementation there was no significant effect between the groups on salivary Mg concentration, but after 60 days in the group treated with Mg citrate salivary magnesium concentration significantly increased (Fig 3).

![Fig. 1: Mean (± SEM) urinary Mg excretion (mg Mg/day). Significant difference of the three treatment groups compared to placebo at various stages (n=46, *p=0.033).](image-url)
Conclusion: Urinary magnesium excretion is a major determinant of the body’s magnesium status and provides significant information about the bioavailability of magnesium salts. The increase of plasma magnesium concentration is clinically relevant. Daily magnesium urinary output data show a higher absorbability of the organic magnesium preparations Mg citrate and Mg amino-acid chelate after 60 days of supplementation than Mg oxide or placebo. This effect can be explained by the better solubility of organic magnesium compounds. The lack of increase of renal magnesium excretion with magnesium oxide may be caused by osmotic effects increasing stool volume and intestinal motility and thereby decreasing the full extent of absorption.

Effectiveness of oral magnesium supplementation is considerably determined by its ability to increase plasma magnesium concentration. But only Mg citrate significantly increased plasma magnesium concentration both at days 3 and 61. Also salivary Mg concentration was higher in the Mg citrate group compared to baseline.

In the present study Mg citrate was found to be the most bioavailable preparation resulting in the greatest serum magnesium concentration both after acute and chronic supplementation. Mg citrate is therefore useful for the therapy of magnesium deficiency with symptoms of neuromuscular impairment, calf cramps etc. Both short- and long-term substitution of this well tolerated magnesium salt is effective to increase plasma magnesium concentration.