

# WHICH FORM OF MAGNESIUM?

When choosing a magnesium supplement one consideration is the particular type of magnesium. High-quality chelated magnesium is bound to another molecule, such as citric acid in the case of magnesium citrate. These secondary molecules, or 'ligands' as they are called, may have important biological effects beyond the magnesium itself that can help guide the selection of a suitable magnesium formulation. So, although all are a good source of magnesium, different types may be better suited to different uses.

Type	Ligand	Key Uses	Discussion
<b>Magnesium (glycinate)</b>	Glycine	Stress Sleep Boost glutathione	Glycine functions as an inhibitory neurotransmitter in the central nervous system via the glycine receptor. <sup>1</sup> Glycine is also a N-methyl-D-aspartate (NMDA) receptor agonist and may be useful in mood and behavioral disorders. <sup>2,3</sup> Clinical studies suggest a non-drowsy, sleep-enhancing effect. <sup>4</sup> Glycine is a precursor to glutathione and supplementation increases glutathione synthesis. <sup>5</sup>
<b>Magnesium (citrate)</b> <b>Magnesium (citrate/ malate)</b> <b>Magnesium Powder</b>	Citric acid Malate	Low energy Fatigue Muscle pain Fibromyalgia	Citric acid and malate are Krebs-cycle intermediates and may improve mitochondrial functional and cellular energy production. <sup>6,7</sup> Clinical studies suggest benefit of magnesium citrate and/ or malate supplementation for fibromyalgia. <sup>8,9</sup>

**Amounts of glycine, citric acid, and malate per serving:** Magnesium (glycinate) provides 751 mg glycine per capsule. Magnesium (citrate) provides 545 mg citric acid per capsule. Magnesium (citrate/ malate) provides 490 mg citric acid and 170 mg malate per capsule. Magnesium Powder provides 1400 mg citric acid per scoop.

<sup>1</sup> Rajendra S, et al. The glycine receptor. *Pharmacol Ther.* 1997;73:121-146

<sup>2</sup> Javitt DC, et al. Adjunctive high-dose glycine in the treatment of schizophrenia. *Int J Neuropsychopharmacol.* 2001 Dec;4(4):385-91.

<sup>3</sup> Cleveland WL, et al. High-dose glycine treatment of refractory obsessive-compulsive disorder and body dysmorphic disorder in a 5-year period. *Neural Plast.* 2009;2009:768398.

<sup>4</sup> Bannai M, et al. New therapeutic strategy for amino acid medicine: glycine improves the quality of sleep. *J Pharmacol Sci.* 2012;118(2):145-8.

<sup>5</sup> McCarty MF, et al. Dietary Glycine Is Rate-Limiting for Glutathione Synthesis and May Have Broad Potential for Health Protection. *Ochsner J.* 2018 Spring;18(1):81-87.

<sup>6</sup> Sugino T, et al. Effects of Citric Acid and L-Carnitine on Physical Fatigue. *J Clin Biochem Nutr.* 2007 Nov;41(3):224-30. doi: 10.3164/jcbn.2007032.

<sup>7</sup> Wu JL, et al. Effects of L-malate on mitochondrial oxidoreductases in liver of aged rats. *Physiol Res.* 2011;60(2):329-36.

<sup>8</sup> Russell IJ, et al. Treatment of fibromyalgia syndrome with Super Malic: a randomized, double blind, placebo controlled, crossover pilot study. *J Rheumatol.* 1995 May;22(5):953-8.

<sup>9</sup> Bagis S, et al. Is magnesium citrate treatment effective on pain, clinical parameters and functional status in patients with fibromyalgia? *Rheumatol Int.* 2013 Jan;33(1):167-72.