

How Buffering By Magnesium Bisglycinate Chelate
Improves Magnesium Oxide Absorption

Advantages of Magnesium Bisglycinate Chelate Buffered

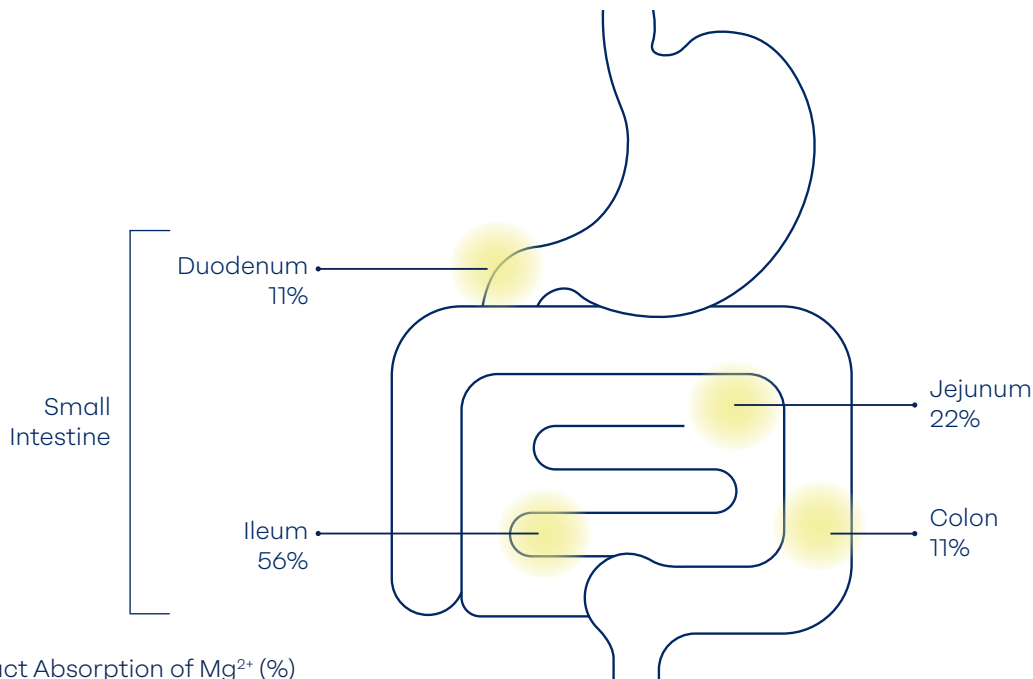
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Advantages of Magnesium Bisglycinate Chelate Buffered

The normal adult dietary intake of magnesium is between 300mg to 360mg/day (12.5-15.0 mmol/day). Magnesium is the 11th most common mineral in the human body, governs the activity of over 350 enzyme systems, and plays a key role in over 80% of metabolic functions; yet it remains one of the most poorly understood and underappreciated minerals in human nutrition.¹

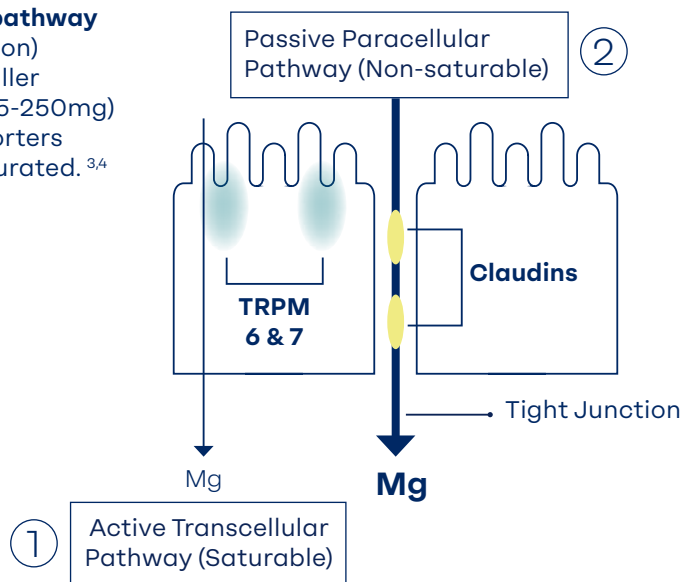
Magnesium Absorption

Magnesium can be absorbed along the entire length of the gastrointestinal tract, although different segments of the small bowel and the colon contribute unequally to overall absorption.²



Two Transport Systems

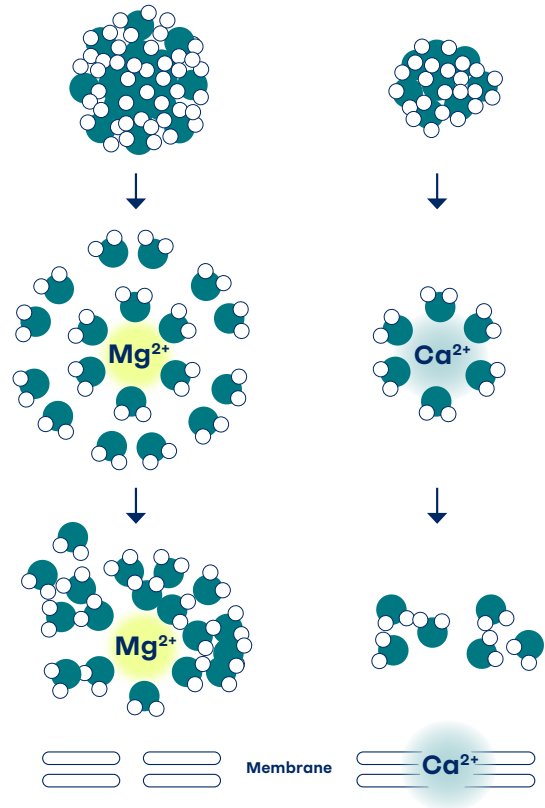
1. Active Transcellular pathway (distal intestine and colon) can transport only smaller magnesium loads (< 125-250mg) because active transporters TRPM 6&7 become saturated.^{3,4}



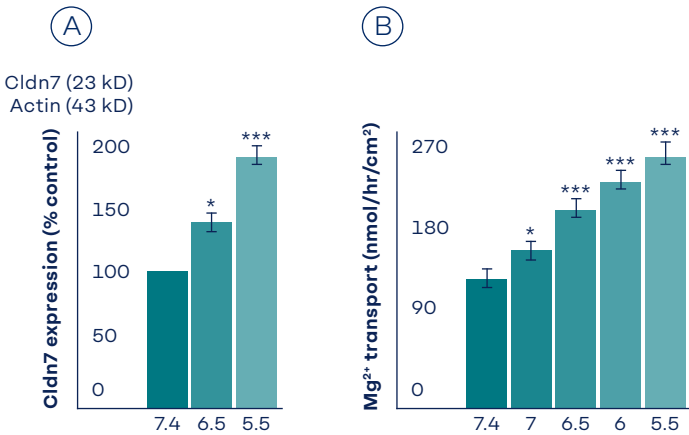
2. Passive Paracellular (non-saturable) pathway is responsible for 80-90% of magnesium uptake in the intestinal tract. Driven by solvent drag and electrochemical gradient for higher magnesium loads (>250mg) it needs tight junction proteins (Claudins) to strip magnesium of its hydration shell to facilitate passive transport.

Hydration Shell

Magnesium binds water tighter than calcium and is hard to dehydrate. Its radius is ~400 times larger than its dehydrated radius, and this difference is much more prominent than for calcium (~25-fold)¹. This simple fact explains many of magnesium's peculiarities. For instance, it is almost impossible for magnesium to pass through narrow channels in biological membranes that can be readily traversed by calcium because magnesium, unlike calcium, cannot be easily stripped of its hydration shell. Further, for magnesium to be taken up by the enterocytes in the GI tract, the ion has to be in the soluble form, and in order to permeate the GI epithelium, magnesium must partially or completely be stripped of its hydration shell. This work is done by the **transcellular** transporters within the enterocytes and the **paracellular** Claudins.⁵



Source: Adapted from Jähnen-Dechent et al; M. Clin Kidney J. 2012;5;i13-i14



Source: Adapted from Thongon, N. et al, World J Gastroenterol 2011;17(12):1574-83

Influence of pH

The solubility of minerals is an essential factor for their absorption in the GI tract and pH plays a key role in maintaining solubility. As the pH rises through the length of the small intestine, the bioavailability of magnesium decreases.⁶ Paracellular magnesium transporters are shown to be switched on by a luminal pH of between 5.5 and 6.5 (Fig A) and this correlates with an increase in magnesium transport (Fig B) in a dose response manner.⁵

Magnesium Oxide

Magnesium oxide is a potent alkalizing agent that is used in the pharmaceutical industry to improve bioavailability of alkaline compounds such as HTCZ. In a rat model, it has been found to raise the luminal pH in the rat intestine to 8.5 and increase absorption of HCTZ up to 3-fold when compared to HCTZ without

magnesium oxide.⁷ Therefore, driving up the pH in the vicinity of the absorption site could be contributing to magnesium oxide's poor bioavailability and is more likely to occur at doses in excess of 250mg which require paracellular absorption; but at high pHs, the tight junction transporters are inhibited.

Magnesium Bisglycinate Chelate Buffered

The low bioavailability of Mg oxide can be improved by reducing the pH at the absorptive surface of the intestine, thereby enhancing passive uptake via the paracellular pathway by stimulating Claudin upregulation. The glycine in Magnesium Bisglycinate Chelate is a powerful buffer that slows the rate of increase of small intestinal luminal pH. Hence a combination of both these magnesium sources offers distinct advantages. Magnesium Bisglycinate Chelate Buffered delivers 18mg of elemental Mg/100mg of the product. Per 100mg of the product, it contributes 8.9mg of magnesium that is chelated with 55mg glycine—enough to improve solubility and buffer the remaining Mg as oxide to optimize paracellular transport. Significantly more than half the product by weight is magnesium bisglycinate chelate – hence the name **Magnesium Bisglycinate Chelate Buffered**.

Magnesium Bisglycinate Chelate in this Formulation

1. The two glycine molecules of the chelate occupy the reactive sites of magnesium, reducing complexing with phytates and other inhibitory substances that reduce absorption.
2. Glycine occupation of these sites may reduce hydration of the molecule which could reduce the frequently encountered problem of laxation (as typical magnesium salts are known for).
3. Glycine improves the solubility of the whole compound, which improves bioavailability.⁸
4. A portion of chelated magnesium may be absorbed via the amino acid active transport pathway.
5. Buffering effect of glycine on the chelated magnesium will enhance its absorption through the saturable active transcellular transport pathway by making the compound more soluble.
6. Glycine helps lower luminal pH (5.5-6.5) that optimizes paracellular Claudin transport.

Mg Oxide in this Formulation

If the load of Mg oxide is limited, kept soluble, and then buffered to reduce its alkalizing effect on small intestinal lumen, then bioavailability can be enhanced, side effects reduced, and Mg oxide can deliver one of its most attractive characteristics – its high elemental content – without sacrificing tolerability or bioavailability.

Magnesium Bisglycinate

Chelate Buffered: Rediscovered

The formulation hasn't changed, but science and technology have. Albion's scientific quest to constantly explore new ways to understand and improve bioavailability and tolerability of its organic minerals has recently revealed additional benefits of the buffering effect of glycine chelate that have now been applied to Magnesium Bisglycinate Chelate Buffered and offers prescribers and consumers a tried and tested, bioavailable, tolerable, and formulatable magnesium that is in step with current research and knowledge.



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