

# “Think Your Calcium’s got the *Right Stuff*?”

## Introducing CAL>MAG>D

*Far too many supplement manufacturers jump on the vitamin/mineral highway all too quickly, throw together a multi-mineral product, and hope that a captive audience buys their product due to a costly marketing scheme. Some might even put some interesting pseudoscientific claims on their label to try to sell their product. Just keep in mind; there’s a difference between “real” science and “marketing” science... a BIG difference.*

---

### “What’s the difference?”

We’ve all heard the stories about those septic tanks being cleaned out only to find the remains of undigested vitamin tablets at the bottom of the tank. Some have lost confidence in tablets, even supplements for that matter asking the question; “Is this stuff really even working if it’s not even going where it’s supposed to go?” This is a valid question that brings up a good point, *just because something goes into your mouth doesn’t mean it’s going to end up where it’s supposed to.*

### Bioavailability

Bioavailability is the degree at which a drug, nutrient, or other substance is absorbed or becomes available at the site of physiological activity after administration. So, the question to ask now is; “How does a vitamin or mineral get to where it’s supposed to go?” Fortunately, researchers at Viva Vitamins have unlocked that mystery and incorporated the science behind it into the designing of their minerals.

### Chelation

Chelation is when one or more metallic ions form a non-covalent ligand with an anionic molecule or coordination system. What this means is when one or more negatively charged molecules loosely holds hand with a positively charged element on the periodic table. How this is beneficial to the bioavailability of a mineral is to think of the chelating agent as acting as a chaperone. The best way to get a child to school is to have the child escorted by a chaperone. Otherwise, the child will most likely get lost or get distracted by something else along the way. In like manner, a naked ion will get lost along the gastrointestinal tract by binding to something else that will either cause it to pass up its site of absorption or drop it off at some

random site in the gut depending on pH or in the presence of other binding competitors. Although the exact mechanism of ion-chaperone transport is unclear, the most accepted postulation is that it is done via passive transport mechanisms (Wapnir and Stiel, 1986). Whereas the charged mineral has to undergo more rigorous bio regulation for absorption in the alimentary canal via coupled uptake mechanisms (Ferraris and Diamond, 1989), most likely by Na<sup>+</sup> or Ca<sup>2+</sup> gradient-driven ionophores.

### Choosing the best Chelating Agent

The question now is, what would be the best chaperone to use to take these minerals to where they’re supposed to go? Intuition would tell us that the best chaperone would be a species that our bodies recognize as beneficial. One such group of chelating agents are various intermediates of the Krebs Cycle (aka. TCA cycle). One turn of the Krebs Cycle converts one mole of Acetyl Coenzyme A into three moles of a powerhouse energy duo (NADH and FADH) and one mole of ATP. This fascinating biochemical process that our bodies use to convert food into energy yields certain intermediates along the way. These intermediates include oxaloacetate, citrate, isocitrate, succinate, malate, fumarate, and α-keto glutarate. Interestingly, these intermediates can ferry off and do some neat things on their own. In this manner, they too are of some biological importance. It is for this reason, that the body recognizes these intermediates and initiates a warm welcome for them when they’re introduced into the body from food. The same goes for certain amino acids. It is suggested that the human alimentary canal is surprisingly set up for the transport of not only mineral-bound Krebs Cycle intermediates, but also mineral-chelated amino acids – namely Histidine

within the brush border epithelium of the gut (Glover and Wood, 2008). This may explain why more and more research is demonstrating a marked increase in the luminal transversion of chelated minerals than their naked ionic counterparts.

### So, What's Being Chelated?

#### CALCIUM:

Calcium is an essential mineral for cardiac sustenance and plays a direct regulatory role in the Krebs cycle. Within the mitochondria, calcium acts as the on-off switch to several dehydrogenase enzymes involved in Krebs cycle reactions. Research indicates that calcium can increase the rate of Krebs cycle reactions in heart mitochondria. An increase in calcium can drive reactions toward completion, leading to a net increase in energy production (Wan B et. al., 1989). Calcium is also responsible for the sliding filament reaction in myocardial contraction, which is what drives the contraction-relaxation cycle of the pumping heart (Schaffer et. al., 1985). Besides calcium's critical importance in heart muscle physiology, supplemental calcium has demonstrated its required presence for the suppression of bone loss (Ruud G. L. de Sévaux, et. al., 2002).

#### MAGNESIUM:

Magnesium is essential to all living organisms, being required for DNA and RNA synthesis, among other things. Magnesium also acts as a cofactor by certain ATP-utilizing enzymes. Magnesium also plays a pivotal role along with calcium in the myocardial relaxation-contraction process (Michailova et. al., 2004). It is therefore no surprise that clinical research has shown that magnesium promotes healthy heart rhythms (Pansin P et. al., 2002). Further, research has demonstrated magnesium's beneficial role in relaxation and lowering blood pressure (Jee SH et. al., 2002).

#### VITAMIN D:

To make the bioavailability of calcium possible, this is where vitamin D comes in to play. 1,25-dihydroxcholecalciferol (the vitamin D hormone) stimulates the synthesis of epithelial calcium channels, plasma membrane calcium pumps, and induces the formation of calbindins (R. H. Wasserman, 2004). What this means is that vitamin D is

basically setting up all major routes of transport to make calcium bioavailable. So, make sure to take supplemental vitamin D if your diet is poor in it or you don't get adequate sunlight throughout the day.

---

### References:

- R. H. Wasserman, *Vitamin D and the Dual Processes of Intestinal Calcium Absorption*, J. Nutr. 134:3137-3139, November 2004.
- Ruud G. L. de Sévaux, Andries J. Hoitsma, Frans H. M. Corstens and Jack F. M. Wetzels *Treatment with Vitamin D and Calcium Reduces Bone Loss after Renal Transplantation: A Randomized Study*. J Am Soc Nephrol 13:1608-1614, 2002
- Wapnir R. A., Stiel L. *Zinc intestinal absorption in rats: specificity of amino acids as ligands*. J. Nutr. 1986; 116:2171-2179.
- Ferraris R. P., Diamond J. M. *Special regulation of intestinal nutrient transporters by their dietary substrates*. Annu. Rev. Physiol. 1989; 51:125-137.
- Glover CN, Wood CM, *Histidine absorption across apical surfaces of freshwater rainbow trout intestine: mechanistic characterization and the influence of copper*. *J Membr Biol*. 2008 Jan;221(2):87-95. Epub 2008 Jan 23.
- Wan B, LaNoue KF, Cheung JY, Scaduto RC Jr. *Regulation of citric acid cycle by calcium*. *J Biol Chem*. 1989 Aug 15;264(23):13430-9.
- Schaffer SW, Tan BH. *Effect of calcium depletion and calcium paradox on myocardial energy metabolism*. *Can J Physiol Pharmacol*. 1985 Nov;63(11):1384-91.
- Michailova AP, Belik ME, McCulloch AD. *Effects of magnesium on cardiac excitation-contraction coupling*. *J Am Coll Nutr*. 2004 Oct;23(5):514S-517S.
- Pansin P, Wathanavaha A, Tosukhowong P, et al. *Magnesium and zinc status in survivors of sudden unexplained death syndrome in northeast Thailand*. *Southeast Asian J Trop Med Public Health*. 2002;1:172-9.
- Ruud G. L. de Sévaux, Andries J. Hoitsma, Frans H. M. Corstens and Jack F. M. Wetzels *Treatment with Vitamin D and Calcium Reduces Bone Loss after Renal Transplantation: A Randomized Study*. J Am Soc Nephrol 13:1608-1614, 2002
- Jee SH, Miller ER 3rd, Guallar E, et al. *The effect of magnesium supplementation on blood pressure: a meta-analysis of randomized clinical trials*. *Am J Hypertens*. 2002;15:691-6.

