

# THE AFIB REPORT

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## Magnesium Absorption and Assimilation

By Jackie Burgess RDH (ret)

### SUMMARY

Optimizing intracellular magnesium is first step in maintaining normal sinus rhythm. The form of magnesium is important to replete those stores. The true amino acid chelated form of magnesium glycinate offers the benefit of fast and complete absorption without interference and without the adverse effects of bowel intolerance. Other forms may take longer or may not work at all if they can't reach the target cells.

In addition to the form of magnesium, other interferences can influence the ability to absorb and assimilate this essential mineral/electrolyte. Afibbers who claim magnesium doesn't help control arrhythmia may have absorption/assimilation issues.

### INTRODUCTION

We know most afibbers are deficient in magnesium (Mg) and also that most respond favorably to magnesium supplementation; therefore, in our advice protocol(1) for new afibbers, we typically recommend starting with the Essential Trio which includes magnesium glycinate, potassium and taurine. Potassium is the key rhythm stabilizer, but can't function without adequate magnesium. Periodically, someone posts that magnesium supplementation had no effect on improving their afib. This prompted me to examine why that might be. What influences might bring about a negative result?

First, it's not a given or a guarantee that just because we consume something, be it a nutrient-dense food or a supplement, that it fully reaches the target destination and provides the intended benefit. Two steps in the digestive process are relevant to this discussion: absorption and assimilation; Absorption of nutrients into blood and Assimilation of nutrients from blood into cells. Specific for this post is magnesium, but it applies to other minerals and nutrients as well.

The Essential Trio is oral supplementation. Transdermal delivery – ie, topical or through the skin (dermis) offers a highly efficient delivery of magnesium and has been reported as helping afibbers who've used the topical Magnesium Chloride Oil. [Intramuscular injections of magnesium sulfate are also highly effective.] The drawback with the oil is that it's not as convenient as using capsules. However, transdermal delivery of magnesium is an option that should not be overlooked if someone is not finding afib (AF) resolution with oral supplements. Epsom salts (magnesium sulfate) baths or foot soaks are another transdermal delivery option that people report as working well.

Oral supplementation with a true magnesium glycinate amino acid chelate offers the best of both

worlds in that it is a “nutritionally functional mineral chelate” meaning all components of the mineral compound have nutritional value to the body or 100% nutritional density. In this case, the glycine ligand (component) also provides numerous benefits which are noted at the end of this report.

The following discussion focuses only on oral supplementation and lists potential areas of interference in both absorption and assimilation that may influence an unsuccessful result for afibbers. The list offers a wide variety of potential reasons. Scan to gather in the full scope and complexity of the absorption/assimilation process. As a provisional, a possible reason for non-success may be that an afibber is already optimal in intracellular (IC) magnesium... always possible, but not likely. They may be optimal in magnesium but very low in potassium and high in sodium. In that case, using just magnesium without improving the other electrolyte balances would be an obvious reason for limited success with magnesium. Otherwise, there are numerous other influences to consider that affect absorption.

***Disclaimer***

*As always, recommendations to use magnesium and/or potassium supplementation assumes the individual has healthy, normal kidney function and no impairment or dysfunction. If not, then these supplements must be used under medical supervision.*

Note that I am relying heavily on research provided by the leader in chelated minerals, Albion Advanced Nutrition – also known as The Mineral People™ as they have patented the amino acid mineral chelate process. Founded in 1956, Albion has over 150 patents including international registration along with over 300 articles and 10 books on chelation which seems unique in the supplement industry. Some critics say these studies are not impartial but in the absence of other studies of similar extent, the science they present based on their patent work and approval provides us with a basic understanding of why chelates are important, how they work and how to recognize pseudo or imposter chelates. I have no affiliation or financial association with Albion Minerals or any other supplement company, for that matter.

Note that the advantages of a true chelate apply to all minerals; not just magnesium. Various other minerals have been shown to have greatly improved benefits when combined with the proper ligand in a true chelated process.

My comments are included in [ ] brackets with my initial.  
(Jackie)

**FACTORS INFLUENCING ABSORPTION (2, 3)**

1. Form of magnesium

(Mineral salt forms, imitation chelates versus true chelates)

2. Health of the gut wall or intestinal transfer area

(Mg transfer or intestinal absorption can be decreased, impaired or blocked by inflammation, irritable bowel syndrome (IBS), intestinal mucosal diseases such as celiac, Crohn's, pancreatic insufficiency, blocked intestinal villi, Candida albicans overgrowth, inflammatory reactions due to gluten/gliadin/casein proteins, vitamin D deficiency; and frequently, formation of insoluble magnesium soaps in the stool due to complexing of magnesium with unabsorbed fats,... and obviously, in the case of surgical bowel resection).

[It should be noted that many of these factors often go undetected for long periods of time until a manifestation of Mg deficiency surfaces as a symptom of the prevalent condition at hand. Even then, magnesium deficiency (MgD) is often not recognized as suspect as an underlying factor or addressed by many physicians. J.]

3. Outer cell membrane status (cell envelope or phospholipids layer) affecting Mg receptor sites (When the cell envelope becomes stiff, hard, crimped and damaged from saturated and trans fat accumulations, that rigid membrane affects receptor site function and prevent nutrients from access or entry inside cells....frequently seen in insulin resistant and diabetic patients who have dysglycemia because they don't have enough magnesium to manage glucose efficiently). If the nutrient can't get in, it can't work.

#### 4. Dosing schedule

(The protocol to dose "low and slow" may be ignored. Impatience typically produces failure, diarrhea and is counterproductive to achieving results.)

#### 5. Wasters and/or high utilizers of magnesium

(Some genetic issues or errors in metabolism cause Mg wasting; includes selected inheritable disorders - Bartter's and Gitelman's or congenital renal magnesium wasting; primary and secondary aldosteronism; high Mg requirements (diabetics) and heavy exercisers with high activity levels, and gene flaws specific to AF. Exercise can increase the metabolic demand for certain minerals – magnesium and zinc most prevalent. Urinary Mg loss can increase by up to 30% following a session of strenuous exercise. Exercise when magnesium deficient can be dangerous. Stress-induced MgD includes exercise and free radical generation.)

#### 6. Interferences from food, drugs, alcohol, hormones, other supplements

(Frequent consumption of alcohol, coffee, food components ie, phytates, phosphorous, fiber, saturated fats, tannins, polyphenols can block or decrease mineral absorption. Antacids, anti-inflammatories, antibiotics, diuretics, or hormone replacement can cause considerable depletion of magnesium. Digoxin, Amiodarone and Betapace (sotalol) are known depleters of Mg.(4) High-dose calcium supplements compete as do calcium-containing antacids like Tums; consuming large quantities of caffeine and alcohol can deplete magnesium – ie, diuretic effect.)

#### 7. Hypokalemia

(Low potassium levels can increase urinary magnesium excretion)

#### 8. Taurine insufficiency – renal wasting

(Taurine spares magnesium globally – Mg wasting can result from taurine insufficiency.) (Genova Diagnostics)

#### 9. Magnesium can be lost from both the kidneys and intestine.

(A large factor is "volume diarrhea" but would also include laxative abuse and alcoholism.)

#### 10. Body size.

(Depending on the size of the individual, the larger the magnesium pool in the body, the lower the magnesium absorption, regardless of the source)

[So with this brief review, it's easy to appreciate how an individual subjected to one or more these influencing factors may try magnesium supplements but not have satisfactory results because they may be totally unaware of an underlying condition(s) influencing absorption, assimilation, or causing excess utilization or wasting. J]

### **WHICH FORM OF MAGNESIUM AND WHY?**

Which form offers the best chance for optimal absorption?

The short answer is one that doesn't break down in the digestive process and can be absorbed quickly and easily across the gut wall into the blood stream. This would be identified as a "true amino acid chelate which is made by the Albion patented process." Other forms of magnesium can and do reach the target cells, but in varying amounts and not as easily or quickly. So for the purpose of this discussion, and after various other interferences that may influence absorption and assimilation are acknowledged, it makes sense to use an effective product and not guess or waste money experimenting with other forms, especially if magnesium seems not to help reverse

the AF tendency.

We need to clarify exactly what constitutes a true amino acid chelate. Not all labeled chelates are true chelates and this can affect absorption and, ultimately, the typically-predictable, positive results. This directive needs to be very specific. Products may claim to be chelates but, in fact, some are not true chelates and if the label says just magnesium glycinate, it doesn't mean it's a true chelate. So, what's a consumer to do? The following explanations should help every afibber understand why true chelates are different and become an important issue in terms of supplementation success.

The take-home message is to start with only an amino acid chelated magnesium glycinate that is identified as being manufactured by the Albion patented process as identified in a following section. Other forms and brands will probably work to some degree but the true amino acid Albion chelate is the only type that offers the best chance to provide optimal delivery of magnesium with the least interference.

### **DISCUSSION -- ABSORPTION**

Bioavailability means how readily and easily it is absorbed across the gut lumen or intestinal wall and ultimately becomes available for biological activity in your cells and tissues. Another important factor for consideration is when using higher doses (therapeutic) amounts, what might be the side effects of elevated amounts of the ligand itself; i.e., citrate in the case of Mg citrate or chloride, in the case of Mg chloride. (Hyperchloremia is an electrolyte imbalance and is indicated by a high level of chloride in the blood. The normal adult value for chloride is 97-107 mEq/L. Inability of the kidneys to process or regulate excess chloride may be an important factor in some individuals.)

An understanding of nutrient metabolism is helpful. Nutrient molecules are bound together with other molecules and these are called ligands; ie, chloride, citrate, glycinate...in some forms of magnesium. True chelated bonds are strong. Non-chelated bonds are typically loose and break apart easily. Very simplistically, water, food and various beverages consumed pass to the stomach where they are mixed with digestive enzymes and stomach acid. Along with the food comes chemical additives, preservatives, pesticide residues and impurities and chemicals in water. Various molecules arrive in one form, are dissociated or broken apart and are free to combine with other molecules where they can become an entirely different compound. In the stomach, everything becomes a chemical soup (chyme). Eventually, everything passes out of the stomach to the small intestine, (duodenum, jejunum and ileum), the major sites of absorption where competition begins for access into the blood (and ultimately inside cells). Each component must have a carrier protein to facilitate crossing the intestinal lumen at the sites of absorption. Competition is high for carrier proteins. Various food components such as phytates, lignans, fats, tannins, phosphorous, polyphenols and fiber will prevent, block or bind to elements and can either prevent or limit varying amounts absorbed into the blood where nutrients and other chemical compounds access entry into cells. Proteins may be in short supply as carriers. Many nutrients do manage to get through but not always nearly as much as one might think or in forms that are not useful so the amount consumed may not actually be absorbed.

In the case of non-chelated compounds and/or pseudo chelated compounds, when they break apart in the stomach and finally reach the absorption sites in the in gut wall, they have the same competition for carrier proteins etc. However, the true amino acid chelate form quickly flows through the gut wall – intact, because it already has the protein carrier in the chelated amino acid form and needs no further chemical reaction. The glycine amino acid chelate is a very small amino acid molecule so it flows through quickly and easily.

Many veteran afibbers experimenting with magnesium supplementation have successfully combined a variety of forms... the topical magnesium chloride oil, magnesium citrate used in laxatives, magnesium gluconate, magnesium bicarbonate as in the Waller Water, older forms like Slo Mag (Mg chloride plus calcium), Epsom Salts soaks (magnesium sulfate)...and newer forms

including malic acid; and this is, of course, fine, as the only goal we seek is to achieve and sustain normal sinus rhythm (NSR). What works for one person, may not work at all for another. Since the true Albion chelated form offers the best chance of reaching the target cells intact, it makes sense to try that form first.

A 2007 research paper "Intestinal Inflammation caused by Magnesium Deficiency" indicates significant functional changes in the small intestine and in remote organs as well as increased sensitivity to oxidative stress. From testimonials offered on the BB, we know well how intestinal disturbances cause various conditions leading to afib and the subclinical inflammation factor is well known with vagus nerve irritation as well.(5)

Some reports indicate magnesium citrate is highly bioavailable, but it's also known this form does not stay in tissues for long. It's used in the citric acid cycle or Krebs's cycle and is typically shunted out of the body quickly. It also has the laxation effect.

When compared to magnesium citrate, magnesium bisglycinate is half as reactive (hypoacidity) when taken on an empty stomach (600 mg Mg/day) and more bioavailable based on classic symptoms of hypomagnesemia.

According to the National Institutes of Health, the form of magnesium is just as important as how much magnesium you're getting. Cheaper forms, such as Oxide and Chloride, are poorly absorbed and quickly excreted from your body.

### **CHELATES.**

The word, chelate - Etymology: Gk, chele, claw (pronounced: key late) v, to form a bond, thus creating a ring-like complex. An example is the interaction of a metal ion and two or more polar groups of a single molecule. (In loose terms: "bound to") [So you could imagine a magnesium molecule being 'grabbed' by a claw which binds the mineral to the amino acid in this case – glycine.]

Protein molecules are composed of chains of amino acids strung together. Amino acids are not the only "chelators" available, but they are ideal for minerals. The body is very efficient at absorbing individual amino acids, and Albion has identified the amino acid glycine as the preferred molecule for creating organic chelated minerals. Glycine is readily identified and absorbed across the intestinal wall, and Albion's glycinate chelates are actually small enough to transport right into the cells themselves!

### **PSEUDO CHELATES**

It's not enough to label a product a chelate and likewise, it's not enough to mix powders like magnesium oxide and glycine powder with some hydrolyzed soy protein and call it an amino acid chelate. Yet, that's what a lot of supplement makers do and label their product as magnesium glycinate chelate... or they'll chelate with other ingredients. This causes problems – like the protein molecule is too large for absorption or inability to form a tight chelate that withstands dissociation, use a very unabsorbable oxide form, and worse: the magnesium deficiency continues and the afibber says magnesium doesn't help them. (because very little if any actually reached interior of cells). Some supplement companies make a so-called chelated magnesium which is only partially chelated and contains some percentage of ionized, unbound or inorganic magnesium. Ionized magnesium is what is most likely to cause the bowel intolerance symptoms like diarrhea or very soft stools which then makes magnesium deficiency worse. Many molecules of ligands in imposter chelates are not small enough to facilitate absorption. Albion minerals are over ten times better absorbed than other standard preparations. Moreover, they are resistant to antinutritious substances, do not weaken the action of vitamins and pose a smaller risk of overdosing

## **TECHNICAL DETAILS - THE AUTHENTIC CHELATES (excerpt from Albion website)**

Manufacturing a properly chelated mineral for high-efficiency absorption is an intricate process. There are variations in chelates based on ligand choices and then there is the choice of manufacturing process. Various industry processes have different product outcomes.

A. Spray drying of a liquid formulation. This is the process used by Albion; it is an expensive process, requiring large sophisticated equipment and yields a highly controlled precise product. Variation in this process can be monitored and controlled. Product is 'flash dried' at a specific moment in the reaction process yielding a "fully reacted" end product with a guaranteed mineral content range.

B. Air drying of a slurry formulation. This process is common as it is cheap but yields a variable result. As the slurry air dries, the reaction process may be complete or not.

C. Dry mixing/blending of ligand and mineral. The result of this process is unreacted, unchelated material. Both the agent and mineral are dry blended in a machine resembling a cement mixer. Manufacturer claims the final chelation process will occur in the digestive process naturally.

D. A combination of the above. Some manufacturers will combine method C with B to bring the mineral content up to levels the manufacturer is claiming. The end result here is some level of chelation, possibly, with high levels of inorganic mineral (unreacted mineral) present.

## **AUTHENTIC CHELATE DEFINITION**

The National Nutritional Food Association (NNFA) created a definition of what an Amino Acid Chelate is in 1996; currently, Albion chelates are the only known chelates to meet the NNFA definition:

*Metal Amino Acid Chelate is the product resulting from the reaction of a metal ion from a soluble metal salt with amino acids with a mole ratio of one mole of metal to one to three (preferably two) moles of amino acids to form coordinate covalent bonds. The average molecular weight of the hydrolyzed amino acids must be about 150 AMU (Atomic Mass Units) and the resulting chelate must not exceed 800 AMU. The minimum elemental metal content must be declared. It will be declared as a METAL amino acid chelate: e.g. Copper amino acid chelate.*

-Adapted by the NNFA Board of Directors, July 1996

## **IDENTIFYING ALBION PATENTED PRODUCTS**

Two key label ID's to check.... Gold Medallion® and TRAACS®

Albion's Human Nutrition Division offers a Gold Medallion® status to those Albion customers whose products have been recognized for their mineral excellence. These companies can use the Gold Medallion label on products and literature to assure the consumer is assured that the product contains quality mineral ingredients based on scientific research. These are found on their website <http://www.albionminerals.com/human-nutrition/consumer-products/gold-medallion-retailers> along with another category <http://www.albionminerals.com/human-nutrition/consumer-products/gold-medallion-retailers/many> These companies, although not Gold Medallion customers, use Albion in many of their formulas. You may contact these companies directly to inquire about their range of products that include Albion minerals  
Go to the Albion website for extensive details on the chelation process.

Albion products use the labeling designation of TRAACS® which stands for The Real Amino Acid Chelate System to identify their human nutrition line of organic mineral products. The TRAACS® brand name assures the buyer they are getting reacted mineral amino acid chelates long with precisely controlled ingredient specification with FT-IR fingerprinting that both identifies and quantifies the degree of chelation. The FT-IR wave reading is the molecular 'track' that only TRAACS® branded products have been scientifically shown to follow.

This includes:

ISO 9001:2008 certified, \*cGMP certified, \* Kosher

- \* Hypoallergenic
- \* Vegetarian friendly
- \* Nutritionally functional
- \* Ultimate glycine:mineral molar ratio
- \* BSE-free
- \* Pharmaceutically pure
- \* Chemically validated (FTIR finger printed)
- \* Clinically researched

The Gold Medallion retailers include:

Bluebonnet  
Designs for Health  
Life Zone  
Metagenics  
Olymp Laboratories (Poland)  
Optimal Nutrients  
Solgar  
Swanson  
Trophic (Canada)

Doctor's Best...[I inquired specifically about the typical brands we recommend to afibbers. Doctor's Best is definitely one of the best and we can be sure it meets the true magnesium chelate specifications. Solgar, Bluebonnet and Swanson are on the list as well. J]

**[CLICK HERE for Albion Products at Best Price](#)**

**<http://www.afibbers.org/vitamins/vitamin12.htm>**

Apparently, printing patent numbers on bottle labels is not sufficient to ensure that the product inside meets the criteria, unless they have actually entered a licensing agreement with Albion.

This brings up KAL and Carlson's brands we often see being used..

The KAL magnesium glycinate product does not indicate it's chelated and the labeling indicates it will be subject to stomach dissociation "Rapid Solv Disintegration within 30 Min. (USP XXII)"

Carlson's no longer uses Albion's material. When they did, it was the buffered form. Their label now reads: This time-release formula is prepared to disintegrate over a period of up to 1 hour.

Kirkman is an Albion customer, but is not on the Albion's list, since they have not signed a licensing agreement with them.

Does this mean you should not use these products? No.

It means that you should be aware that if your intention is to use the true amino acid product which offers the best bioavailability and results, you aren't getting it with products not found on the foregoing list. Other forms of magnesium will definitely work to some degree but may cause bowel intolerance and electrolyte wasting which could affect your success results. And remember that in elevated dosing with magnesium, the ligand needs to be ' nutritionally functional' and not cause imbalances.

Reading between the lines, it's one thing to advertise on the label that you use Albion process; quite another that the truth in labeling will be enforced, policed or litigated for infringement.

### **GLYCINE BENEFITS (source: Albion Labs)**

Additionally, glycine offers some nutritional benefits as well. Glycine has important metabolic functions in the body, and research supports its use as a safe nutritionally functioning chelating agent. Glycine is used to form collagen, a key protein in cartilage and connective tissue and helps to preserve muscle mass. It is an essential component in the synthesis of creatine, which helps prevent liver damage due to alcohol abuse, and prevents ulcer-formation. Glycine also plays important roles in the central nervous system (CNS), the immune system, energy production, and the maintenance of a healthy prostate

There are more reports that could be listed about glycine protecting against other chemically induced damage from things like chlorpromazine, cisplatin and other hepato or nephro toxic agents, but the point is well made. Glycine is a good thing. From our standpoint (Albion Labs), glycine is an excellent choice for an amino acid chelate ligand for more than one reason. It is the smallest amino acid and thus, forms mineral chelates of the smallest possible molecular weight (greatest absorption potential). The stability constant that glycine possesses is excellent, as well. It allows for the chelate to remain intact throughout the pH range of the gastrointestinal tract, but it is not too strong - allowing for the efficient release of the minerals to the biological tissues in need of them. Glycine (and other amino acids) is also a useful nutrient to the body. (Source Albion Human Nutrition).

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4. Dietary glycine was found to be a safe and effective treatment to reduce the nephrotoxicity of cyclosporines. [Thurman RG, et al, Transplantation, 63 (11):1661-7 1997 Jun 15].
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**The End**

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Intestinal Inflammation Caused by Magnesium Deficiency Alters Basal and Oxidative Stress-Induced Intestinal

The mineral's roles in the clinical applications cited above are quite well established. Beyond commonly recognized clinical applications, researchers have demonstrated magnesium deficiency can cause subclinical inflammation in the small intestine producing significant functional changes there and in remote organs, as well as increased sensitivity to oxidative stress.

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