

Effective Calcium Supplementation: Not As Easy As Advertised!!

A current television commercial states that a particular brand of antacid not only relieves upset stomach, but also delivers something else that a body needs: Calcium!! On the surface, this product seems to be a good value for the consumer. The advertising campaign for this antacid has been successful, but this success may have come at the expense of the consumer's health. The active ingredient in this antacid/calcium supplement is calcium carbonate. It is the most commonly used source in calcium supplements in the market today because it is inexpensive and has a high calcium content. With the recommended dietary intake of calcium being 1000 mg, it is much easier to sell the consumer needed products in a single dose of a couple of tablets. This is an easy solution.... But is it effective? What determines effective calcium supplementation?

Effective calcium supplementation should include a source of calcium that:

- **Is safe**
- **Is bioavailable**
- **Is retained in tissues**
- **Has correct dosage**
- **Is balanced with other nutrients**

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Tolerance and Safety Are Crucial

Obviously, all the above factors are important to effective calcium supplementation. Safety is listed first for a practical reason. Effective calcium supplementation is not a program that one undertakes for only a month, or even a year. Effective calcium supplementation is a lifestyle commitment. If a calcium supplement exhibits poor tolerance or lack of safety, how can one be expected to use it throughout life?

Safety

All non-chelated calcium salts may cause constipation, but in the elderly, certain salts, including calcium carbonate, have been shown to cause diarrhea. Other side effects of calcium salts include flatulence, nausea, and bloating. Calcium chloride may produce more gastrointestinal irritation than other forms of calcium, and yet the hydrochloric acid in the stomach enters into a chemical reaction with all soluble forms of calcium salts to create calcium chloride. Calcium carbonate, the source of the antacid mentioned above, is known to cause rapid and potent neutralization of gastric acid, but it is not recommended for prolonged use, due to potential for systemic side effects. Calcium carbonate is associated with acid rebound. It induces gastric secretion that is markedly increased by food. It has been shown to induce gastric hypersecretion for three to five and one half hours after ingestion. This

acid rebound is most likely due to local effect on gastrin producing cells by ionized calcium. In the stomach, calcium carbonate (CaCO₃) neutralizes acid by undergoing the following reaction:



(The acid neutralization reaction which occurs in the stomach and creates calcium chloride)

All non-chelated salt forms of calcium are converted to calcium chloride in this fashion, and as pointed out above, the resulting calcium chloride produces severe gastric irritation. Therefore, all salt forms of calcium will produce some gastric irritation. The acid neutralization reaction shown previously forms the basis for calcium carbonate's effectiveness as an antacid.

This same chemical reaction is also the key to calcium carbonate's ability to cause a greater danger than acid rebound. Continued use of calcium carbonate has been associated with milk-alkali syndrome. The milk-alkali syndrome presents with three problems: hypercalcemia, metabolic alkalosis, and renal failure. Different forms of this syndrome have been described in medical literature. In addition to the acute form of milk-alkali (calcium carbonate) ingested. As stated, milk-alkali syndrome may result in kidney damage. This alkalosis develops from calcium carbonate due to a net loss of H+

(hydrogen ion) in the stomach that is no longer balanced by the binding of HCO₃ (bicarbonate ion) in the upper small intestine by unabsorbed Ca⁺⁺ (calcium ion). This leads to a small amount of bicarbonate being absorbed systemically, resulting in metabolic alkalosis. The risk of milk-alkali syndrome with calcium carbonate is increased by high dosage, prolonged use, or the concomitant use of sodium bicarbonate and/or homogenized milk and vitamin D.

Hulisz, D., *Calcium Supplementation, US Pharmacist*, December, 1995, P.14-22.

Handbook of Nonprescription Drugs, 9th Edition, 1990, American Pharmaceutical Association, p.257.

Milk-Alkali Syndrome Associated With Calcium Carbonate Consumption

Researchers reported that increased consumption of calcium carbonate for prevention and treatment of osteoporosis may be

causing the problem of milk-alkali syndrome to become prominent once again. In a hospital study, from 1990 to 1993, 16% of admissions for hypercalcemia were from milk-alkali syndrome. In 1993, this figure increased to 38%. This study showed that there was only one instance of milk-alkali in the five years prior to 1990. The researchers documented seven different cases where calcium carbonate products were the cause of the observed increased incidence of milk-alkali syndrome.

Beall, D., and Scofield, R.H., *Medicine* 74, 2, 1995, p.89-97.

The Milk-Alkali Syndrome, A Reversible Form Of Renal Failure

Clinicians report that they are seeing a rise in milk-alkali syndrome, which had become rare with the advent of modern ulcer therapy. These scientists reviewed several cases of milk-alkali syndrome, which

presented symptoms of irritability, nausea, headache, vertigo, weariness, hypercalcemia, metabolic alkalosis, and renal failure. All of the cases were attributable to the popular use of calcium carbonate as an antacid or as a calcium supplement.

Abreo, K., *et al.*, *Arch Intern Med* 153, April 1993, p 1005-1011.

Heaney, R., *Absorbability of Calcium Sources. The Limited Role of Solubility, Calcif Tiss Int.*, 1990, 46:300-304.

For the milk-alkali syndrome to occur, the calcium salt must go into solution in the stomach and be ionically available. Professor Heaney at Creighton University demonstrated that Albion's patented Calcium Chelazome[®] was very soluble in gastric juices, and also had the greatest degree of absorption compared to other forms of calcium (See Figure below). However, Albion's amino acid chelates have been shown to remain intact in the digestive system and are absorbed as intact chelates. Thus, it is unlikely that daily, prolonged supplementation of Calcium Chelazome[®] would cause milk-alkali syndrome.

Dosage: An Often Overlooked Factor

Having a calcium form that is highly bioavailable and well retained is essential to effective calcium supplementation. Another factor that is extremely important, but frequently overlooked, revolves around the dosage size of the calcium supplement. Most people want a supplement that supplies all the daily calcium requirements in a single dose. Studies by some of the leading researchers in the field of calcium nutrition have clearly shown that calcium is best absorbed in smaller divided doses. In fact, the data shows that as the quantity of the individual dose of calcium increases,

the percentage of absorbed calcium goes down dramatically, regardless of the calcium form.

To illustrate, a study was performed to determine the dose dependency of calcium absorption in an attempt to derive an optimum dose schedule. In one part of the study, calcium absorption was measured from three different calcium doses (0.5, 1.0 and 2.0 g) from calcium citrate and calcium carbonate. The increment of urinary calcium post-load, reflective of intestinal calcium absorption, rose dramatically from 0 to 0.5 g loads with only slight increases from 0.5 to

2.0 g. The researchers concluded that both forms of calcium display dose dependency for calcium absorption, with calcium from the citrate being better absorbed at all dosages than calcium from carbonate. Keep in mind that Heaney showed that Albion's calcium amino acid chelate was absorbed approximately 1.83 times better than calcium citrate and calcium carbonate.

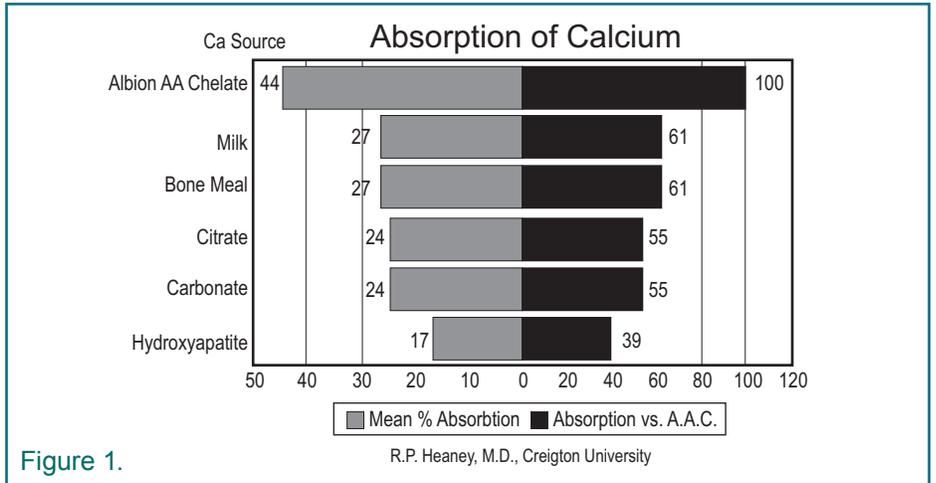
Harvey, J.S., *et al.*, *Journal of Bone and Mineral Research*, Vol. 3, 1988, p.253-258.

Heaney, *op cit.*

(Continue)

In Dr. Heaney, et al.'s study, Absorbability of Calcium Sources: The Limited Role of Solubility, (Calcif Tissue Int, 1990, 46: 300-304), seven different forms of calcium were evaluated. The results of this study are summarized in Figure 1.

As can be seen, Albion's patented calcium amino acid chelate (Chelazome®) was the highest in percent absorption. Its bioavailability was even higher than the calcium in milk.



Influence Of Calcium Load On Absorption Fraction

True calcium absorption was studied as a function of the size of the ingested load in healthy women, under meal conditions and at loads ranging from 15 to 500 mg calcium. The absorption rate was inversely related to the quantity of calcium ingested. At the lowest dose, the absorption averaged 64% and at the highest, 28.6%. In addition, the researchers showed results which permitted reasonably precise calculation of the absorptive effects of differing calcium ingestion strategies. Using the parameters found in the study, the researchers predict the following calcium absorption efficiencies:

- 500 mg in one daily dose** **29% absorption efficiency**
- 500 mg in two daily doses** **36% absorption efficiency**
- 500 mg in three daily doses** **40% absorption efficiency**
- 2000 mg in one daily dose** **14% absorption efficiency**

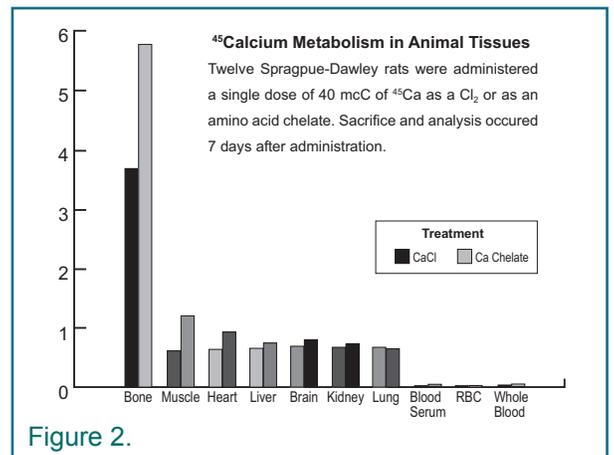
A single 200 mg dose of calcium would yield 50% less absorbed calcium than an equal amount of calcium given in four equal doses.

The tendency is for most supplement companies to offer large amounts of calcium per tablet/capsule in dosage forms that permit a required daily intake in a single swallow. This may be an easy way to sell calcium supplements, but it may not be in the consumer's best interest. Based on absorption efficiency research, it would appear that the most effective calcium supplementation program would consist of smaller divided doses, as apposed to larger single doses. More per dose is not necessarily better.

Heaney, R.P., et al., *J of Bone and Mineral Research*, 5:11, 1990, p. 1135-1137.

Tissue Retention - Another Key

A key to effective calcium supplementation is the ability of the calcium to be retained once it is absorbed. The data summarized in the figure below was constructed from data gathered by Professor D. Graff at Weber State University.



In this study, Professor Graff administered equal amounts of radio labeled calcium from chloride (which is the inorganic form of calcium formed in the stomach from calcium salts) and Albion's amino acid chelate. Seven days later, the absorbed calcium which was retained in the animals' bodies was measured. The animals retained 54.4% more calcium from Albion's calcium amino acid chelate found its way to the bone tissue than from the calcium carbonate.

Ashmead, H.D., Graff, D.J., and Ashmead, H.H., *Intestinal Absorption of Metal, Ions, and Chelates* (Springfield, IL, Charles C. Thomas) 228, 1985.

Calcium Alone - Not Most Effective

Giving large amounts of a single nutrient may not be the most effective course for nutritional therapy. Nutritionists know that the body's nutritional biochemistry relies on a balance of all needed nutrients. In the case of calcium and the fight against osteoporosis, high doses of calcium have not been found to be particularly effective. Other cofactors must be included to give the effective calcium supplementation program.

The effects of calcium supplementation (as calcium citrate malate, 1000 mg elemental calcium/day) with and without the addition of trace minerals (zinc 15 mg/day, manganese 5 mg/day, and copper 2.5 mg/day) on spinal bone loss was evaluated in healthy postmenopausal women in a two year, double blinded, placebo controlled trial. Bone loss relative to base line value continued in the placebo group. The group

receiving calcium alone showed some slowing of the bone loss process, while the group receiving calcium plus trace minerals had its bone loss arrested.

Spinal Bone Loss in Post-menopausal Women Supplemented with Calcium and Trace Minerals. Straise, L., et al., J of Nutrition 124(7): 1060-64, July, 1994.

Effective Calcium Supplementation Summary

In summary, an effective calcium supplementation program must take into account the following factors:

- Safety
- Bioavailability
- Tissue retention
- Proper dosage
- Balance of other nutrients

Developing a proper dosage and a balanced nutritional approach to

calcium supplementation is up to the formulators. For a source of calcium that is safe, and highly absorbable, as well as readily retained by the targeted tissues, Albion's patented calcium amino acid chelate (Chelazome®) is obviously the best choice. Albion's calcium amino acid chelate has demonstrated long and short term safety. It is not ionized in the gastrointestinal system, and so it is free from the problems of

acid rebound and gastric irritation common with calcium salts. There is little need to worry about milk-alkali syndrome with Albion's calcium amino acid chelate. Human and animal research has shown it to be the best absorbed calcium with proven target tissue retention.

**THE MOST EFFECTIVE CALCIUM SUPPLEMENT IS
ABLION'S CALCIUM AMINO ACID CHELATE!!**

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