ALBION®
HUMAN NUTRITION

RESEARCH NOTES

A COMPILATION OF VITAL RESEARCH UPDATES ON HUMAN NUTRITION

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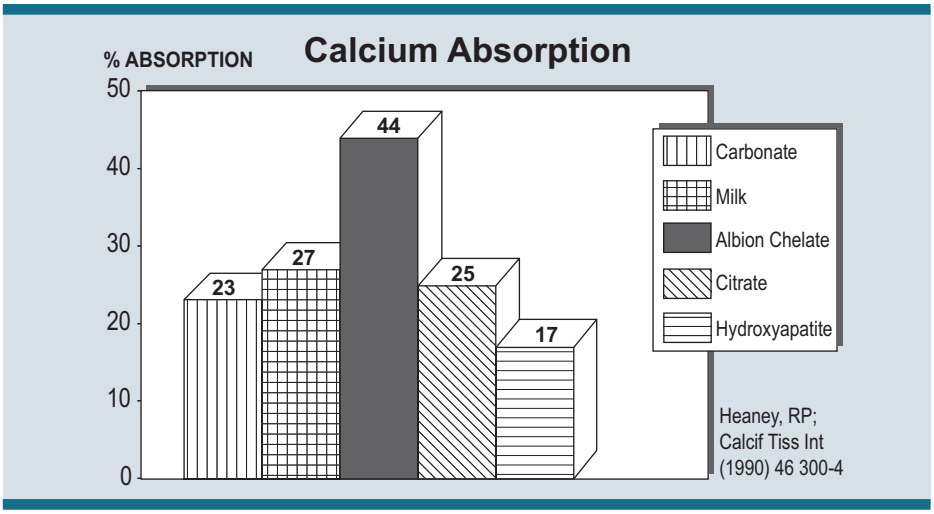
Calcium Absorption Conflict

With the renewed interest in osteoporosis, concerns with calcium absorption have become popular. The importance of bioavailability is obvious. If consuming a calcium supplement will have little effect on the body's calcium balance, there is no reason to ingest it. Many studies have indicated that taking a calcium supplement with a meal will increase absorption. However, a few contradictory studies have found there was no meal enhancement of calcium absorption.



Calcium from calcium carbonate is most often absorbed in the low 20% range. Several reports have found calcium citrate to have higher absorption potential than calcium carbonate. Calcium citrate malate may increase calcium uptake only 5% more than the calcium citrate. Other studies have shown that the differences in absorption of calcium citrate versus calcium carbonate were only significant when taken on an empty stomach.

A problem with calcium carbonate supplementation is absorption variations between subjects. Several studies have shown that certain individuals absorb calcium from calcium carbonate at very low levels (less than 10%). While a good antacid, calcium carbonate is not generally recommended as a nutritional source of calcium, since one cannot predict who will have difficulty absorbing that calcium. Calcium phosphate or calcium hydroxyapatites have consistently demonstrated the poorest uptake of calcium (only about 10-15%).

The calcium source delivering greatest absorption of all of the calcium sources tested in a human clinical study is Albion's patented Calcium Chelazome®. Calcium Chelazome® averaged 44% absorption of the dose (and this was without the benefit of meal enhancement). No other calcium form, including milk, has as high a rate of absorption.

Certain calcium supplements that are not chelated, or are improperly chelated, have been shown to interfere with the absorption of some other minerals, particularly with iron. Studies have indicated that taking non-chelate calcium supplements with meals makes it more difficult for women to meet their daily iron requirement. This negative effect has been seen with all ionizable forms of calcium – carbonates, citrates, phosphates, etc. Unlike these sources of calcium, patented calcium amino acid chelates from Albion do not ionize in the gut, thus eliminating the potential to interfere with iron absorption.

Ashmead, HD, "The effects of supplementary calcium amino acid chelate on mineral levels in hair, blood, saliva, and urine," Publication Pending.

Absorption of Calcium in Women Co-administered Oral Glucose

Some studies have suggested that glucose may enhance calcium absorption. A study was conducted to test the effects of different amounts of glucose (0, 56, 222, and 444 mmol) with calcium chloride (already of solution). When the calcium solution was administered with 0 to 222 mmol of glucose, there was a linear increase in calcium absorption. No further increase occurred with the addition of 444 mmol of glucose. Forty nine percent more calcium (as chloride) was absorbed with 22 mmol of glucose as compared to absorption without the addition of the carbohydrate.

Knowles, JB, et al., Am J Clin Nutr 1988; 48: 1471-4.

Absorbability of Calcium Sources The Limited Role of Solubility

Professor Robert Heaney investigated the absorption of seven different forms of calcium in normal adult women under loading dose conditions. The relationship between the calcium sources' solubility and absorbability was found to be weak, except in the case of Albion's Calcium Chelazome®, Table 1 shows the results.

In this study, Calcium Chelazome® from Albion Laboratories demonstrated a dramatically superior bioavailability in the group of women who took the calcium supplements on an empty stomach. Calcium Chelazome® was not tested with meals since absorption was so great even without meals.

Calcium Chelazome® was absorbed at a rate that was:

- 82% greater than calcium citrate
- 87% greater than calcium carbonate (even with meals)
- 165% greater than calcium as hydroxyapatite

Heaney, RP, et al., Calcif Tissue Int (1990) 46:300-304.

Table 1. Absorbability of chemically defined calcium sources

No.	Source	Approx. solubility (mM/liter)	N	Fractional absorption with meal	N	Fractional absorption without meal
1	Calcium oxalate	0.04	39	0.102 ± 0.040		
2	Hydroxyapatite	0.08			21	0.166 ± 0.090
3	Calcium carbonate	0.14	10	0.296 ± 0.054	43	0.235 ± 0.123
4	Tricalcium phosphate	0.97	10	0.252 ± 0.130		
5	Calcium citrate	7.30			7	0.242 ± 0.049
6	Calcium citrate malate	80.00	20	0.363 ± 0.076		
7	**Albion® Calcium Chelazome®**	**1500.00**			13	0.440 ± 0.104

Calcium Absorption: Effect of Meal and Glucose Polymer

Various meal components, such as glucose and lysine, have demonstrated enhanced intestinal calcium absorption under experimental conditions. Researchers have tried to also evaluate the effect of a glucose polymer on the absorption of calcium. Calcium carbonate was supplemented in conjunction with a glucose polymer. In analyzing the data from the study, the researchers found no significant enhancement in the absorption of calcium, as a carbonate, when it was administered with a meal or with a glucose polymer.

Sheikh, MS, et al., Am J Clin Nutr 1988; 48: 312-5.

Intestinal Absorption of Calcium Supplements in Solution

The solubility of a calcium supplement may play a role in its absorption. Thus, liquid forms of calcium may result in greater absorption. To test this theory, two calcium salts, as liquids, were taken on an empty stomach. It was found that 18.2% of the calcium, as a citrate, was absorbed compared to only 7.6% of the calcium, as a phosphate. Researchers noted that the citrate increased renal loss of calcium, whereas the phosphate decreased renal loss.

Schuette, SA and Knowles, JB: Am J Clin Nutr 1988; 47:884-8.

Dietary L-Lysine and Calcium Metabolism in Humans

Studies in animals have indicated that dietary supplements containing certain amino acids, particularly l-lysine, can enhance calcium absorption. Researchers examining the potential benefits of this amino acid on calcium utilization in humans administered a calcium loading dose along with or without 400 mg of l-lysine. All subjects receiving the calcium with or without the amino acid showed increased serum calcium. There was, however, an increase in urinary calcium excretion in those individuals who did not receive the l-lysine. They exhibited a blunted calciuric response to the calcium load. The lysine helped the body retain the absorbed calcium.

In a second study, 45 osteoporotic patients were tested for baseline intestinal calcium absorption and then given 800 mg/day for three days of either l-lysine, l-valine, or l-tryptophan. One day after administration of the amino acids, intestinal calcium absorption was reassessed. The l-lysine treated group showed a significantly higher intestinal absorption of calcium compared to the other amino acids.

The researchers concluded that l-lysine supplementation increased calcium absorption and decreased the urinary loss of calcium. They theorized that l-lysine supplementation could be a promising adjunct to the prophylaxis and treatment of osteoporosis.

Civitelli, R., et al., Nutrition, Vol 8 No. 6, Nov/Dec 92, pp. 400-405.

Calcium Absorbability from Milk Products, and Imitation Milk, and Calcium Carbonate

As a recognized source of calcium, milk products have been extensively examined. In one study, the researchers found that calcium from various dairy products was absorbed equally well. Fractional absorption from these sources ranged from 22.4% to 26.7%. The calcium from the dairy products was absorbed at least as well as the calcium from calcium carbonate. The mean absorption value of the six sources (22.0%), and it had the greatest variance. Two subjects absorbed less than 10% of the calcium from calcium carbonate, although these two averaged 21% and 24% absorption of calcium from the other five sources. Some people who absorb calcium well from food sources are not able to make good use of the calcium from calcium carbonate supplements.

In conjunction with the absorption of calcium from milk, Creighton University Professor, Robert P. Heaney, compared it absorption to Albion's Calcium Chelazome®. He reported that Calcium Chelazome® was absorbed 63% better than the calcium in milk.

Recker, R, et al., Am J Clin Nutr 1988; 47:93-95.
Heaney, RP, "Calcif. Tissue Int" 1990, 46:300.

Effects of Meals on Calcium Absorption

Besides dietary amino acids, certain other studies have suggested that calcium absorption may be enhanced when calcium is ingested with a variety of meals. Published research has shown that the meals improve calcium absorption by possibly causing more gastric acid secretion (lower pH in the small intestine) and slower stomach emptying time – allowing better dispersal and dissolution of the calcium as well as enhanced exposure to mucosal cell absorption sites. Even the solubilized calciums in milk and in calcium citrate malate (in citrus beverages) had greater absorptions when co-ingested with a meal (10-30% more).

The researchers noted that the co-ingestion of a meal with a calcium source not only enhanced absorption, but reduced between-subject variance. Based on their results, they recommended that people take calcium supplements with meals.

Heaney, RP, et al., Am J Clin Nutr 1989; 49; 372-376.

Albion Offers a Unique Blend of Calcium Forms in One Product

In reported studies, it has been observed that Albion's patented Calcium Chelazome® has shown an absorption rate of about 44% (taken on an empty stomach), and calcium citrate malate showed absorption rate of about 36% (taken with a meal, but not tested on an empty stomach).

In light of this, Albion Laboratories has developed a calcium source called Calcium Citrimal. Calcium Citrimal provides 20% elemental calcium, derived from Albion's patented (nutritionally functional chelate) Calcium Chelazome®, along with calcium citrate and malic acid.

Calcium Citrimal and Calcium Chelazome® are two great concepts in calcium supplementation for those wishing to maximize their calcium absorption with proven sources.

Albion Human Nutrition

100 Maple Park Blvd., Suite 110
St. Clair Shores, Michigan 48081 USA
[P] 586•774•9055 | [TF] 800•222•0733
[F] 586•774•8838
[e] info@AlbionMinerals.com