

# ALBION®

## RESEARCH NOTES

A COMPILATION OF VITAL RESEARCH UPDATES ON HUMAN NUTRITION

July, 2001

Volume 10, No 2

### LOOKING FOR THAT PATENTED INGREDIENT THAT IS BACKED BY RESEARCH?

You know . . . the one that will give your  
new product a marketing edge

**A**lbion Laboratories knows that the best products are built with the best ingredients, and the best ingredients need to be backed by scientific documentation - RESEARCH! Patented ingredients, backed by research are needed to make products that can be marketed with confidence. Every year Albion's three nutrition divisions (Human, Animal and Plant) put together research budgets for each discipline. Over the years, the amount of money invested in nutrition science research by Albion has grown, as has the amount of mineral nutrition knowledge that has come out of that research, knowledge that has led to products which have been used to directly or indirectly improve the nutrition and health of many people in many nations. In this issue of Albion Research Notes, we will share the findings of some recently completed and published research that Albion has funded. It is our hope that the findings of these scientific studies will help give ideas that will further help the health of many more people throughout the world.

#### EFFECTIVENESS OF TREATMENT OF IRON-DEFICIENCY ANEMIA IN INFANTS AND YOUNG CHILDREN WITH FERROUS BISGLYCINATE CHELATE

Study by: Dr. Oscar Pineda, Dr. HD Ashmead  
Latin American Center for Nutrition and Metabolic Studies, Antigua, Guatemala

Nutrition 2001 May;17(5):381-4  
(ISSN: 0899-9007)

Forty infants, six to 36 months old, with iron-deficiency anemia (Hemoglobin <11 g/dL) were matched and assigned to two groups. One group received FeSO<sub>4</sub> and the other received ferrous bisglycinate chelate (Ferrochel®) at a dose of 5 mg of Fe daily per kilogram of body weight for 28 days. Both groups had significant hemoglobin increases (P < 0.001), but only the group treated with ferrous bisglycinate chelate had significant increases (P < 0.005) in plasma ferritin. Apparent iron bioavailabilities were calculated at 26.7% for FeSO<sub>4</sub> and 90.9% for ferrous bisglycinate chelate. Regression analysis indicated that absorption of both sources of iron were similarly regulated by the body according to changes in hemoglobin. We concluded that ferrous bisglycinate chelate is the iron of choice for the treatment of infants with iron-deficiency anemia because of its high bioavailability and good regulation.

COMMENT: This study had the obvious mentioned finding that iron from Ferrochel® had an apparent bioavailability of 90.9%, as compared to 26.7% for iron from ferrous sulfate. This translates into a relative absorption rate of iron from Ferrochel® that is 3.4 times that of iron from ferrous sulfate. The additional finding that the absorption of iron from Ferrochel is regulated by the body according to changes in

hemoglobin is evidence of the safety feature of this iron form. This study further supports the findings of an earlier study (Pineda O, et al, J. Appl. Nutr. Vol 46, Numbers 1 & 2, 1994) that found the iron from Ferrochel to be absorbed at an efficiency rate that was almost four times that of iron from ferrous sulfate in the treatment of anemic adolescents.

#### IRON ABSORPTION FROM FERROUS BISGLYCINATE AND FERRIC TRISGLYCINATE IN WHOLE MAIZE IS REGULATED BY IRON STATUS

Study by: AC Bovell-Benjamin, FE Viteri, LH Allen  
University of California, Department of Nutrition, Davis, California USA  
Am J Clin Nutr 2000 Jun;71(6):1563-9  
(ISSN: 0002-9165)

BACKGROUND: There is a need to determine whether iron absorption from iron amino acid chelates is protected from inhibition by dietary phytate and regulated normally by iron status.

OBJECTIVE: The objective of this study was to compare iron absorption from ferrous sulfate, ferrous bisglycinate (Ferrochel®), and ferric trisglycinate in whole-maize meal; to determine whether iron from ferrous bisglycinate and ferrous sulfate exchanges in the intestinal pool; and to assess iron absorption from ferrous bisglycinate and ferric trisglyci-

nate over a range of iron statuses.

**DESIGN:** In study 1A, 10 iron-sufficient men consumed ferrous sulfate-fortified whole-maize meal porridge equilibrated with  $^{59}\text{Fe}$ -sulfate on day 1 and  $^{55}\text{Fe}$ -bisglycinate on day two. In study 1 B, these volunteers consumed ferrous sulfate-fortified porridge equilibrated with  $(^{59}\text{Fe})$ -sulfate and  $^{55}\text{Fe}$ -bisglycinate simultaneously. In studies 2A and 2B, iron absorption from 3 mg Fe as  $^{59}\text{Fe}$ -ascorbate,  $^{55}\text{Fe}$ -bisglycinate, or  $^{59}\text{Fe}$ -trisglycinate in water and in porridge was compared in 23 subjects with a range of iron statuses. Iron absorption was determined from blood radioactivity on day 16.

**RESULTS:** In study 1A, geometric mean iron absorption from ferrous bisglycinate was 6.0% (range: 2.6-13.6%), four times higher than that from ferrous sulfate 1.7%; range: (1.0-3.3%);  $P < 0.057$ . In study 1 B, absorption from neither source was different from that in study 1A. In studies 2A and 2B, absorption from all sources was strongly inversely related to serum ferritin.

**CONCLUSION:** In whole-maize meal, iron from ferrous bisglycinate is better absorbed than is iron from ferrous sulfate and does not exchange with iron from maize or ferrous sulfate in the intestinal pool. Absorption of iron from bisglycinate and trisglycinate is regulated normally by iron status.

**COMMENT:** This research found that iron from Ferrochel had a far greater relative bioavailability, in comparison to iron from ferrous sulfate, when administered along with a whole maize meal. The whole maize meal contains dietary phytate (a known inhibitor of iron absorption), and the iron from Ferrochel was absorbed at a rate that was four times higher than that of the iron from ferrous sulfate in the presence of this iron absorption inhibitor. The fact that the iron from Ferrochel does not exchange with the iron from maize or from ferrous sulfate is further evidence of the stability of the chelate molecule formed in Albion's patented process. The finding that iron from bisglycinate (Ferrochel) and trisglycinate (Albion's Taste-Free

Iron) is regulated by iron status gives further credence to the safety associated with the iron amino acid chelates.

#### **IRON BIOAVAILABILITY IN HUMANS FROM BREAKFASTS ENRICHED WITH IRON BISGLYCINE CHELATE, PHYTATES AND POLYPHENOLS**

Study by: Layrisse M; Garcia-Casal MN; Solano L; Baron MA; Arguello F; Llovera D; Ramirez J; Leets I; Tropper E  
Centro de Medicina Experimental, Laboratorio de Fisiopatología, Instituto Venezolano de Investigaciones Científicas (IVIC) Universidad Central de Venezuela, Caracas J Nutr 2000 Sep;130 (9):2195-9 (ISSN: 0022-3166)

This study was conducted to determine the bioavailability of iron amino acid chelate (Ferrochel) added to fortify breads prepared from either precooked corn flour or white wheat flour + cheese and margarine compared with the same basal breakfast enriched with either ferrous sulfate or iron-EDTA. The inhibitory effect of phytate and polyphenols on iron absorption from Ferrochel was also tested. A total of 74 subjects were studied in five experiments. Iron absorption from Ferrochel was about twice the absorption from ferrous sulfate ( $P < 0.05$ ). When ferrous sulfate and Ferrochel were administered together or in different meals, absorption from Ferrochel was about twice the absorption from ferrous sulfate ( $P < 0.05$ ). Polyphenols present in coffee and tea inhibited iron absorption in a dose-dependent manner. American-type coffee did not modify iron absorption significantly, whereas both espresso-type coffee and tea reduced iron absorption from Ferrochel by 50% ( $P < 0.05$ ). Ferrochel partially prevented the inhibitory effect of phytates. Because of its high solubility in aqueous solutions even at pH 6, its low interactions with food and high absorption, Ferrochel is a suitable compound for food fortification.

**COMMENT:** This study showed that in non-anemic adults, the relative bioavailability of iron from Ferrochel is two times that seen with iron from ferrous sulfate in the presence of known

iron absorption inhibitors (phytates and polyphenols). It also pointed out that there is some dietary inhibition of iron absorption from Ferrochel by polyphenols, which is polyphenol dose dependent. However, this interference is only partial, and is less than that seen with the interference of the absorption of iron from ferrous sulfate.

#### **SAFETY EVALUATION OF FERROUS BISGLYCINATE CHELATE**

Study by: Jeppsen RB; Borzelleca JF  
Technical Services, Albion Laboratories, Inc., Clearfield, UT 84015-2243, USA  
Food Chem Toxicol 1999 Jul;37 (7):723-31 (ISSN:0278-6915)

Ferrous bisglycinate chelate (Ferrochel) is a highly stable chelate that can be added to most foods. Data from human and animal studies indicate that the ferrous iron is readily bioavailable with fewer side-effects than the more commonly used iron salts. The acute oral LD50 for male and female Sprague-Dawley (S-D) rats is 2800 mg/kg body weight (560 mg/kg body weight iron [confidence limit (CL) 399-786] as the active ingredient). Male and female CD (Sprague Dawley-derived) rats were fed ferrous bisglycinate as a dietary admixture at doses of 0, 100, 250 and 500 mg/kg body weight/day. There were no biologically or statistically significant dose-related differences between the control and treated animals with respect to body weight gain, food consumption, food efficiency, behavioral effects, clinical chemistries, hematology, absolute and relative organ weights, or gross and microscopic findings. Hepatic non-heme iron concentrations were elevated, indicating that the ferrous iron had been absorbed. The no-observed-adverse-effect level (NOAEL) was 500 mg/kg body weight/day, the highest dose tested.

**COMMENT:** These scientists found the ferrous bisglycinate chelate (Ferrochel) to have a lower potential for acute toxicity than the much used ferrous sulfate. They also concluded that ferrous bisglycinate (Ferrochel) should cause very little, if any toxicity in humans. There was no mortality seen in 14 days

or in the 90-day subchronic toxicity study on this compound. It is most noteworthy to see that outside of the evidence of bioavailability, the administration of Ferrochel caused no changes in any gross or microscopic tissue findings in the 90 day subchronic toxicity study when compared to a placebo. This is a strong testament to the overall safety of this iron form.

**Relative Bioavailability of Iron From Ferrochel® Is Superior**

Over the years, ferrous bisglycinate chelate (Ferrochel®) has been the subject of many research studies. Bioavailability is one parameter that is most often an item of interest

when one is inquiring about nutritional minerals, such as iron. Since ferrous sulfate is the most commonly used and recognized standard for iron supplementation, it has been the iron form that researchers have wanted to compare to the Ferrochel® form of iron.

In Table 1, taken from a paper presented at the Bioavailability 2001 Conference in Switzerland (Bourdonnais, et al, Bioavailability of Iron Bisglycinate Chelate In Food), it is readily seen that the iron from Ferrochel® is far superior to the iron from ferrous sulfate and ferrous ascorbate in terms of relative bioavailability.

**Still Safe**

Although the iron from Ferrochel® (iron bisglycinate chelate) is better

absorbed than other forms of iron, its absorption is controlled by the body's iron status. It is regulated in a fashion like ferrous sulfate as shown by regression analysis. (See Table 2 from Bourdonnais, et al, Bioavailability 2001). Thus there is little chance of toxicity from long term use of this iron form.

**Summary**

Ferrochel® (iron bisglycinate chelate) is the only amino acid chelated form of iron approved for food fortification by a number of Governments, including the US FDA! It is the only amino acid chelated iron in the world that has been granted a CAS Registry Number and is Kosher-Paré.

Table 1

**Bioavailability of Iron Bis-Glycinate Chelate**

	Fe Bis-Glycinate	Fe Ascorbate	FeSO <sub>4</sub>	P
Non-Anemic Women	52.0%	40.0%		< 0.05
Anemic Infants	90.9%		20.7%	< 0.001
Non-Anemic Adult Men	13.6%		3.3%	< 0.05
Non-Anemic Adult Male/Female	13.0%		6.0%	< 0.05
Anemic Adolescents	46.6%		11.6%	< 0.001

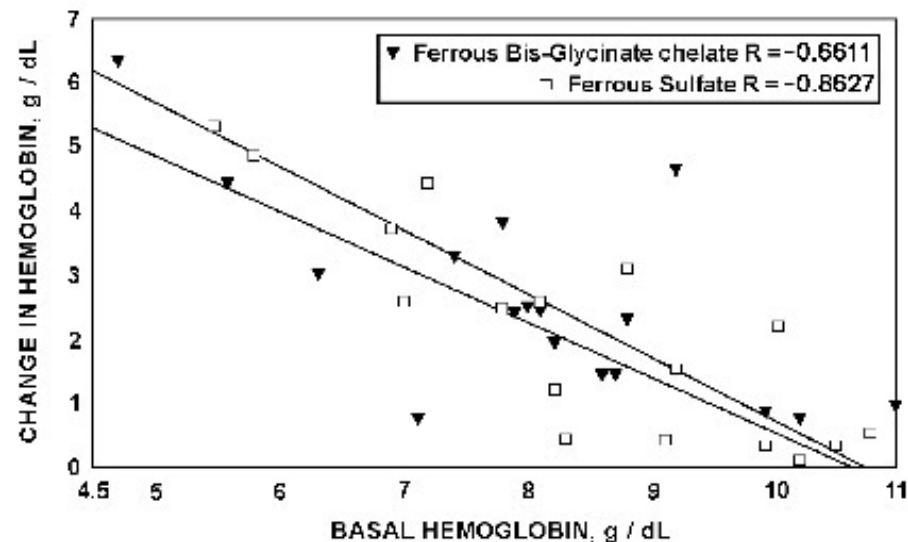


Table 2. Regression analysis shows that iron-absorption values were inversely proportional to the hemoglobin levels, regardless of the iron source.

**FERROUS BISGLYCINATE CHELATE:**  
 CAS NO. 20150-34-9  
 FDA GRAS NO. GRN201509

**Ferrochel® has demonstrated:**

- Higher Bioavailability
- Lower Toxicity
- Less Food Reactivity
- Less Dietary Interactions
- More Stable Product (Longer shelf life)

... than the other most commonly used iron form.



The Mineral People™

**ALBION**<sup>®</sup>  
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Albion Laboratories, Inc.  
101 North Main Street,  
Clearfield, Utah, 84015-2243,  
USA

Phone: (801) 773-4631  
(800) 453-2406  
Fax: (801) 773-4633

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Albion Laboratories, Inc.  
P.O. Box 750  
Clearfield, Utah 84089-0750

