

Is Iron Getting A Bad Rap?

For some time now, there has been a tendency for some nutritional supplement marketers to produce iron free products. Much of this trend started with the often quoted Finnish study by Salonen *et al*¹. In this study, the researchers found that Finnish men whose serum ferritin levels were high (<200 mcg/L) had a 2.2 fold increased incidence of myocardial infarction. Salonen, *et al*, hypothesized that free radicals induced by free iron cause increased peroxidation of low density lipoprotein and thereby contribute to atherogenesis. Recent evidence has provided an alternate explanation for the observations of Salonen *et al*. It is now believed that there is an inflammatory component to coronary heart disease, and that serum ferritin functions as an acute reactant and becomes elevated as part of the inflammatory process². In fact, three major studies^{3,4,5} have been published since this Finnish report, which have found no relationship between coronary heart disease and elevated iron status. In the 1994 review entitled *Iron Metabolism in Health and Disease*⁶, the authors looked at people with severe iron overload from hereditary hemochromatosis, and found an incidence of heart disease no higher than that found in the general population. They concluded that preexisting subclinical coronary

heart disease could very well explain the results of the Finnish study. The serum ferritin levels were elevated as the normal part of the inflammatory process surrounding the, as yet, subclinical coronary heart disease. Other than the Finnish report, there has been little evidence to show that supplemental iron played any role in increasing the incidence of coronary heart disease. Nevertheless, supplementing iron still causes some to raise their eyebrows, and call for iron-free products.

... no relationship between coronary heart disease and elevated iron status.

More recently, there has begun a movement to stop the fortification of foods with iron. The proponents of this movement cite the danger of iron overload to people with hereditary hemochromatosis results in tissue damage caused by excessive iron accumulation in individuals who are homozygous for this autosomal recessive trait. The incidence of this hereditary condition has been found to exist in between 1 in 200 (0.5%) and 1 in 400 (0.25%) of people of Northern European extraction, and has been reported to be as low as

1 in 1351 (0.07%) in other similar surveys⁷. Today, due to the work of Simmon *et al*⁸, we can screen people for the existence of this homozygous condition, before they develop the clinical problems associated with hereditary hemochromatosis. This allows them the opportunity to take appropriate action. Given the extremely low incidence of this hereditary problem, along with the ability to screen people for the existence of this trait, isn't the abolishing of iron fortification of food for the majority of the population an over reaction? In the recent report, *Nutrition monitoring in the United States*⁹, put out by the U.S. Department of Health and Human Services, it was shown that the per capita iron intake from food has risen from 1909 to 1985, and that this trend was the direct result of food fortification with iron - especially that seen with flour and cereal products. In the most recent year reported, an average of 41% of all iron consumed in foods came through iron fortified grain products such as flour and cereal. In spite of the fortification of foods, and the increase in per capita intake of iron, more than 95% of the women in the most recent dietary survey¹⁰ still had iron intakes below the RDA.

(Continued on page 2)

(Continued from cover page)

Data from the FDA Total Diet Study¹¹ found that the major source of iron in the diets of all the groups analyzed was grain and cereal products (contributing 52, 54, and 48 percent of the iron in the adult male, infant, and toddler diets, respectively). Given the overall contribution of iron from food fortification, would it be wise to eliminate this program? It would seem, based on these data, that the elimination of food fortification with iron would pose an additional threat to public health.

1. Salonen JU, Nyyssonen K, Korpela H, et al (1992). High Stored Iron Levels Associated with Excess Risk of Myocardial Infarction in Western Finnish men. *Circulation* 86: 803-811.
2. Alexander RW (1994). Inflammation and Coronary Heart Disease. *N Engl J Med* 331: 468-69.
3. Sempos CT, Looker AC, Gillum RF, Makuc DM (1994). Body Iron Stores and the Risk of Coronary Heart Disease. *N Engl J Med* 330: 1119-1124.
4. Stampfer MJ, Grodstein F, Rosenberg I, et al (1993). A Prospective Study of Plasma Ferritin and the Risk of Myocardial Infarction in US Physicians. *Circulation* 87: 11.
5. Giles WH, Anda RF, Williamson DF, et al (1994). Body Iron Stores and the Risk of Coronary Heart Disease. *N Engl J Med* 331: 1159-60.
6. Powell LW, Jazwinska E, Haliday JW (1994). Primary Iron Overload. In Brock JH, Halliday JW, Pippard MJ, Powell LW (eds), *Iron Metabolism in Health and Disease*. WB Saunders, London, pp. 227-270.
7. Lynch SR (1995). Iron Overload: Prevalence and Impact on Health. *Nutrition Reviews* (53)9:255-260.
8. Simon M, Bourel M, Fauchet R, Genetet B (1976). Association of HLA A3 and HLA B14 Antigens with Idiopathic Hemochromatosis *Gut*: 17:332-334.
9. *Nutrition Monitoring in the United States: An Update Report on Nutrition Monitoring*. US Department of Health and Human Services and US Department of Agriculture, Hyattsville, MD, Sept. 1989, pp. 139-41.
10. CSFII Report No. 85-5, Hyattsville, Md., US Department of Agriculture, 1988.
11. Pennington J.A.T., Wilson, D.B., Newell, R.F., et al., *Selected Minerals in Food Surveys, 1974 to 1981/82*. *J Am Diet Assoc* 84: 771-782 (1984).

Iron Is Well Absorbed From Ferrous Bisglycinate (Ferrochel) Added To A High Phytate, Whole Maize Meal

The fortification of whole maize is difficult due to its high phytates and fat content. The phytates tend to decrease the absorption of iron, while the high fat content makes the maize more susceptible to rancidity when a soluble form of iron is added. In the study, the researchers from the University of California at Davis compared the absorption of iron from ferrous bisglycinate (Ferrochel) versus ferrous sulfate when added to a whole maize meal. In the course of the study, a maize porridge was fed to 10 fasted non-anemic volunteers on three occasions. In the first part of the study, the 10 volunteers were fed radio-labeled ferrous sulfate fortified

porridge on day one, and a radio-labeled Ferrochel fortified porridge on day two. Each had equal amounts of iron in each porridge serving. Blood samples were later drawn to check for the absorption levels of the two iron forms. In the second part of the study, after a two week wait, the 10 volunteers were given the maize porridge fortified with both forms of iron together, and later blood samples were drawn again to compare levels of iron absorption from the two iron sources. Iron absorption from the Ferrochel was significantly higher ($p < 0.001$) than from ferrous sulfate in both parts of the study. In fact, the researchers found the iron from

Ferrochel to be absorbed at a rate that was from 4 to 7 times higher than the iron from ferrous sulfate. The researchers also found that the correlation between ferritin and iron absorption from the two iron compounds was similar, suggesting that Ferrochel's absorption, like that of ferrous sulfate, is regulated by iron status of the body for added safety.

1. Allen, LU, Bovell-Benjamin AS, and viteri F, Nutrition Department, Program in International Nutrition, UC Davis. Reported at International Nutrition Symposium, Montreal, Quebec August, 1997.

Iron Intake In The United States

It has been reported that more than 95% of the women in a recent dietary survey¹ had iron intakes below the RDA, and about half of the women in childbearing years have intakes below the estimated mean requirements. In the Table 1 (Dietary Iron Intake), some of the data gathered in a classic study by Raper, *et al.*² are listed. As is evidenced by the data, the majority of people in the study did not receive the RDA for iron. The majority of the women in the study did not take in even 70% of the RDA, which puts them at a strong nutritional risk for iron deficiency. In this study the researchers went a step further, and calculated the amount of bioavailable iron intake from the data, using the model developed by Monsen, *et al.*³ Basically the available iron from heme iron is calculated at a rate of 23%, and the non-heme iron's availability is factored in at a rate of 3-8% (based on logarithmic function with enhancing factors, like vitamin C, meat, etc.). The data in Table 1 clearly indicate that the vast majority of iron consumed in the typical U.S. diet is from non-heme sources, and thus of very low bioavailability. It would seem from these data that iron supplementation and iron fortification of foods are vital to the public health of the U.S. populace. Even with the current iron fortification of foods, many people in the United States are not getting close to the RDA of iron. Interestingly, this problem doesn't get any better for Canada. In a recent news release taken from the Canadian National Institute of Nutrition publication

Table 1
Dietary Iron Intake

Sex & Age Years	Number	Total Iron (mg)	Non-heme Iron (Percent)*	Heme Iron (Percent)*
Males & Females				
1-2	268	7.7	94	6
3-5	437	9.2	94	6
6-8	469	10.7	92	8
Males				
9-11	216	12.7	91	8
12-14	313	15.0	92	8
15-18	400	16.7	90	10
19-22	287	15.1	89	12
23-34	770	14.8	90	11
35-50	784	14.5	90	11
51-64	634	14.0	89	11
65-74	295	13.9	91	9
75+	128	12.2	91	8
Females				
9-11	241	11.6	92	8
12-14	309	11.0	91	9
15-18	402	10.7	92	9
19-22	337	10.7	90	10
23-34	949	9.9	90	10
35-50	942	9.9	90	10
51-64	792	10.4	90	10
65-74	377	9.9	92	9
75+	197	9.9	93	7

*Components may not add up to 100% due to rounding
Total, non-heme iron and heme iron intakes of persons by sex, age per single day.
Nationwide Food Consumption Survey 1977-78 (Raper, et al., 1984.)

NIN Review, comes the following statement:

“With so much hype about dietary excess, it is easy to forget that a problem like iron deficiency still exists in Canada. Yet, some studies have found signs of iron deficiency in 25% to 39% of young women...”

1. CSFII Report No. 85-5, Hyattsville, Md., US Department of Agriculture, 1988.

2. Raper, N.R., Rosenthal, J.C., and Woteki, C.E., *Estimates of Available Iron in Diets of Individuals One Year and Older in the Nationwide Food Consumption Survey*. J Am Diet Assoc, 84: 783-787 (1984).

3. Monson, E.R., Hallberg, L., Larysse, M., et al., *Estimation of Available Dietary Iron*. Am J Clin Nutr 31: 134-141 (1978).

Millions Estimated To Be Iron Deficient In The U.S.

(Most common in young women, teenage girls, and young children)

According to an article in the March 27, 1997 issue of *The Journal of the American Medical Association*, iron deficiency and iron deficiency anemia remains a significant health problem for toddlers, adolescent girls and women in their childbearing years. A total of 24,894 persons aged one year and older were examined in the third National Health Nutrition Examination Survey III, from 1988 to 1994 by Dr. Anne C. Looker and colleagues at the National Center for Health Statistics, Centers for Disease Control and Prevention, in Hyattsville, Maryland. In the study, iron deficiency was defined as having abnormal values for at least 2 of 3 laboratory tests of iron status (erythrocyte protoporphyrin, transferrin saturation, or serum ferritin), and iron deficiency anemia was defined as iron deficiency plus low hemoglobin. The researchers found that nine percent of all toddlers aged one to two years were iron deficient, and three percent of the toddlers had iron deficiency anemia. Nine to 11% of adolescent girls and women of childbearing age were iron

deficient, and iron deficiency anemia was seen in two to five percent of the women and girls. These prevalence's correspond to approximately 700,000 toddlers and 7.8 million women with iron deficiency, of these approximately 240,000 toddlers, and 3.3 million women have iron deficiency anemia. The researchers stated that these numbers indicated that this nutritional condition was still a significant health problem. Iron deficiency is a lack of an adequate

9 to 11% of adolescent girls and women of childbearing age were iron deficient, and iron deficiency anemia was seen in 2 to 5% of the women and girls.

amount of iron in the blood. Iron deficiency can have many negative effects on health, including negative changes in immune function, cognitive development, temperature regulation, energy metabolism, and work performance. According to

the study, iron deficiency declined in children aged three to five and in those six to eleven. Teenage boys and young men were seen to have the lowest incidence of iron deficiency, with middle aged men and older men having a lightly higher incidence. The prevalence among women over the age of 50 was slightly lower than that seen in the younger women's group. According to the report, the prevalence of iron deficiency among young children had decreased over the last few decades due to the increased use of iron fortified infant formula and the improved bioavailability of iron used to fortify infant foods. The researchers stated further: "Given the potential for psychomotor impairment associated with iron deficiency anemia in infants, it is important to continue to try to reduce the prevalence further. In addition, this age group should continue to be monitored for iron deficiency in population surveys¹.

1. Looker, A.C., et al., *Prevalence of Iron Deficiency in the United States*, JAMA. 1997;277:973-976.

Ferrochel Research Results keep Showing Advantages

Scientific evidence keeps accumulating on the positive advantages for Albion's patented iron bisglycine chelate - Ferrochel. To date, there have been 31 scientific reports published on Ferrochel. In these studies, documentation has been

gathered to support many advantages and benefits of supplementing or fortifying with Ferrochel. Ferrochel has been found to have superior absorption characteristics, greater tolerance, lower toxicity, less dietary interaction, higher stability,

much lower pro-oxidant activity, and greater physiological benefits than other forms of iron. Following are abstracts of two new studies that were recently completed on Albion's Ferrochel.

Milk Inhibits and Ascorbic Acid Favors Ferrous Bis-Glycine Chelate Bioavailability in Humans

In this study, the researchers at the University of Chile were looking at the use of ferrous bis-glycine chelate (Ferrochel) as a potential fortificant for milk in developing countries. They compared the absorption of Ferrochel to ferrous ascorbate in water, Ferrochel to ferrous sulfate in milk, and Ferrochel plus ascorbate to ferrous sulfate plus ascorbate in milk. The iron from Ferrochel had a slightly higher absorption rate (about 16% higher) than the iron from ferrous ascorbate in water. The absorption

of iron from Ferrochel in milk was 2.0 to 2.5 times higher than that seen with iron from ferrous sulfate in milk. The absorption of iron from Ferrochel plus ascorbate was found to be about 39% higher than the absorption of iron from ferrous sulfate plus ascorbate when given in milk. The researchers determined that the absorption of iron from Ferrochel was less affected by inhibiting factors found in milk than was the iron from ferrous sulfate, and also less affected by ascorbate.

In addition, the researchers found that the absorption of the iron from Ferrochel had an inverse correlation to the subjects' serum ferritin levels, suggesting that the absorption of iron from Ferrochel is regulated by the body's iron stores. This scientific study showed that Ferrochel is a highly absorbed, but safe form of iron.

1. Olivares M, et al., *J. Nutr.* 127:1407-1411, 1997.



A normal healthy body stores enough iron to replace about one third of the circulating hemoglobin in the event of hemorrhage. Most of the stored iron is in the form of ferritin, but some also exists as the larger insoluble agglomerate called hemosiderin. Stored iron forms are concentrated in the macrophages of the liver, spleen and bone marrow. In Table 2, the normal body distribution

of iron is listed.

Although ferritin is found predominantly in the body iron storage areas, minute amounts are found in the circulation, and the amount in the circulation closely reflects the iron stores within the body, thus serum ferritin can be used as a reliable indicator of iron deficiency or overload.

Albion's Ferrochel is composed of iron and the amino acid glycine. It is chemically designed as bisglycino-iron II, and consists of one mole of iron and two moles of glycine per molecule. Iron's role in the formation of hemoglobin is very well known. A fact that is less well known is the role that glycine plays in the formation of hemoglobin. The actual starting materials that the body uses in the synthesis of hemoglobin are succinyl CoA and the amino acid glycine. These two are condensed in the mitochondria to form gamma-aminolevulinic acid. Which then forms porphobilinogen, and after several more steps, the body forms hemoglobin. Therefore, Ferrochel contributes two factors that are key to the formation of hemoglobin- 100% nutrient density, a truly nutritionally functional mineral chelate!

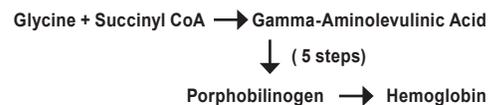


Table 2
Distribution Of Iron In the Adult

Body Sites	Approximate Percent of Total Iron
Circulating hemoglobin	75.0
Iron in body stores	20.0
Myoglobin	5.0
Heme enzymes	0.5
Transferrin	0.1

*Drabkin, D.L., *Physiol Rev.* 31, 245, 1951

In Closing. . .

The consensus of scientific research has demonstrated that iron is not the culprit in coronary heart disease. Ferritin levels are elevated during active coronary heart disease as part of the body's normal inflammatory process that is part of the sequel of this pathology. The fear that taking supplements containing iron will lead to heart disease is therefore unwarranted.

Iron fortification accounts for over 40% of the iron in the current U.S. diet. Despite the addition of iron to the diet via fortification, the majority of the people in the United States still do not take in the US RDA for iron. In fact, most women take in less than 11 mg of iron per day. The official health

agencies of the U.S. have reported that the decrease in iron deficiency anemia in the U.S. that has taken place since 1915 is the direct result of the impact of our food fortification process. Today, iron deficiency still affects millions of people in the United States, and is the leading cause of nutritional anemia throughout the world. The condition of hereditary hemochromatosis, which can be screened for, is extremely rare, affecting from 0.5% to as few as 0.07% of the populace. It would seem illogical to eliminate iron fortification of foods, which has had such a positive public health impact on the people of the U.S. out of concern for a problem that affects so few people. This is especially so, given that there

is a blood test available that can indicate whether or not one suffers from the disorder.

Albion's Ferrochel has been shown to be the highest absorbable form of iron tested. It works well in nutritional supplements and as a food fortificant. Data have been accumulating that show that not only is this form of iron highly absorbed and very efficacious, but it is also a very safe form of the mineral.

When you want a safe, tolerable, highly absorbable and efficacious form of iron, look to Albion's Ferrochel - It is the wisest choice!

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