

Rebuild Your Iron

Food Sources, Iron Enhancers, and Iron Inhibitors

Amanda Rose, Ph.D.

© 2007 Amanda Rose
All rights reserved

Table of Contents

I. Introduction	2
II. Examine Your Diet	4
III. Iron Contributors	5
1. Meat sources	5
2. Plant sources	6
3. Vitamin C an Iron Enhancer	7
Food Storage and Vitamin C	8
4. Grandma’s Cast Iron.....	9
IV. Iron Inhibitors	10
1. Phytic acid	10
a. Phytates matter.....	10
b. The solution in your kitchen.....	11
c. Rising, soaking, and sprouting: putting the enzyme phytase to work for you.....	11
d. Two Exceptions: oats and soy.....	13
2. Oxalic Acid.....	17
a. Reducing oxalic acid.....	17
b. What’s high in oxalic acid	18
3. Tannic Acid: Coffee and Tea	19
4. Competing Minerals: Iron, Calcium, and Zinc.....	20
V. Ferment Your Way to Health.....	21
VI. Summing It Up.....	22

I. Introduction

If you are iron-deficient, you are not alone.

Iron deficiencies are relatively common even in advanced industrial countries. A 1997 study found that about 11% of women of childbearing age, 9% of adolescent girls, and 9% of toddlers are iron deficient (Looker et al. 1997).

In a 2001-02 survey of iron intake among women, the average intake of iron was 13.1 milligrams; the recommended daily intake is 18 milligrams. Nearly 25% of women consumed only half of the recommended daily intake of iron.

Iron deficiency is most pronounced in pregnancy and breastfeeding because of the additional requirements of the baby for this nutrient.

Iron deficiency is related to symptoms of depression and fatigue. If you are deficient in iron and correct the deficiency, you will begin to have more energy and you will probably find that your depression is alleviated if you have struggled with depression. However, if you are deficient in iron, you may well be deficient in other nutrients as well which may also be impacting your energy and moods. Visit my website or read the book [Rebuild from Depression](#) (forthcoming 2007).

In this report you will find information to help improve your iron status including **iron contributors** and **iron inhibitors**.

Iron contributors include foods that literally are loaded with iron. Eat more of these foods to improve your iron status. I

list vitamin C as an iron contributor because it helps your body absorb iron. But while vitamin C will help you absorb more iron, do not rely on this strategy alone. There are organic acids that reduce your ability to absorb iron in your food most notably phytic acid and oxalic acid. These are the **iron inhibitors**. I provide strategies to reduce these iron inhibitors in your diet. Vitamin C will not compensate for all of the iron inhibitors, so your best strategy is to add vitamin C to your diet and to reduce the phytic and oxalic acid in your food with the strategies I discuss.

Iron supplementation

While this report focuses on food sources of iron, you should know that if your iron status is very low you will improve it much faster with a dietary supplement. A popular iron supplement that tastes good and is easily absorbed by your body is called [Floradix](#). The best price on Floradix is currently at [Vitacost.com](#). Or visit my website for updates.

More information

You can find more information on iron in a fact sheet developed by the National Institutes of Health:

<http://ods.od.nih.gov/factsheets/iron.asp>

If you like this report, you will find others on my website at www.rebuild-from-depression.com.

Best of luck to you.

II. Examine Your Diet

It is difficult to meet the recommended daily allowance of iron (which is a key reason many of us do not meet it). As a measure of how far you may be from the mark in your current diet, you can calculate the iron content of some of your typical daily meals.

Start by outlining a typical daily menu for yourself (or your child) and use the resources provided by the USDA to calculate the iron content of those foods. The USDA provides an on-line searchable database of the nutrient components of over 7,000 foods which you can find [here](#). You can also [download the nutrient software](#) to use on your computer when you are not on-line.

With the USDA software, you can use my [iron calculation spreadsheet](#) to determine the amount of iron in your daily menus. You will compare your daily intake to the RDA in the table below.

Once you have examined your diet, you can add iron to your diet with the iron contributors I describe below. You can use preparation and shopping techniques to enhance your iron.

Recommended Dietary Allowances for Iron for Infants (7 to 12 months), Children, and Adults				
Age	Males (mg/day)	Females (mg/day)	Pregnancy (mg/day)	Lactation (mg/day)
7-12 months	11	11	n/a	n/a
1-3 years	7	7	n/a	n/a
4-8 years	10	10	n/a	n/a
9-13 years	8	8	n/a	n/a
14-18 years	11	15	27	10
19-50 years	8	18	27	9
51+ years	8	8	n/a	n/a

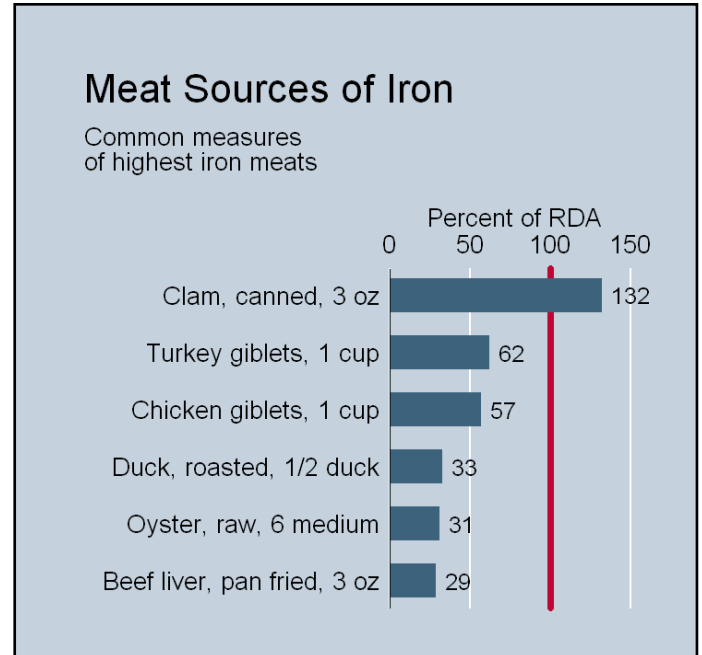
III. Iron Contributors

1. Meat sources

Iron is most easily absorbed from meat sources. If you eat meat, your best first line of defense in light of low iron levels is to increase the amount or type of meat in your diet. Clam, oyster, duck, and organ meats are the highest meat sources of iron. Clam is a standout for iron.

Generally speaking, a 3 ounce serving of beef will provide you with about 13% of your daily intake of iron, turkey about 12%, and ham about 6%.

Meat is particularly desirable for improving your iron status because it actually reduces the binding effect of some of the iron inhibitors I describe below. Phytic acid, for instance, is less likely to inhibit your iron digestion in a meal that includes even 50 grams of meat (about 1.8 ounces). Researchers found that absorption of iron from plant-based sources in a meal improved by 44% with the addition of 50 grams of meat. Seventy-five grams of meat improved absorption by 57% (Baech et al. 2003). This is a great improvement but reducing the phytic acid in the food before you eat it can improve your digestion by 200%. Be sure to read about iron inhibitors below even if you eat meat.



2. Plant sources

Vegetarian foods have the potential to provide you with a great deal of iron, but as you will learn in this book, how you prepare the food is critical to absorbing the iron it contains.

If there is a plant-based iron super-food, it is likely quinoa or amaranth, the grain-like seeds that are becoming increasingly available in health food stores. One cup of quinoa uncooked provides 87% of the recommended daily intake of iron for women. One cup of amaranth provides 82% of the RDA.

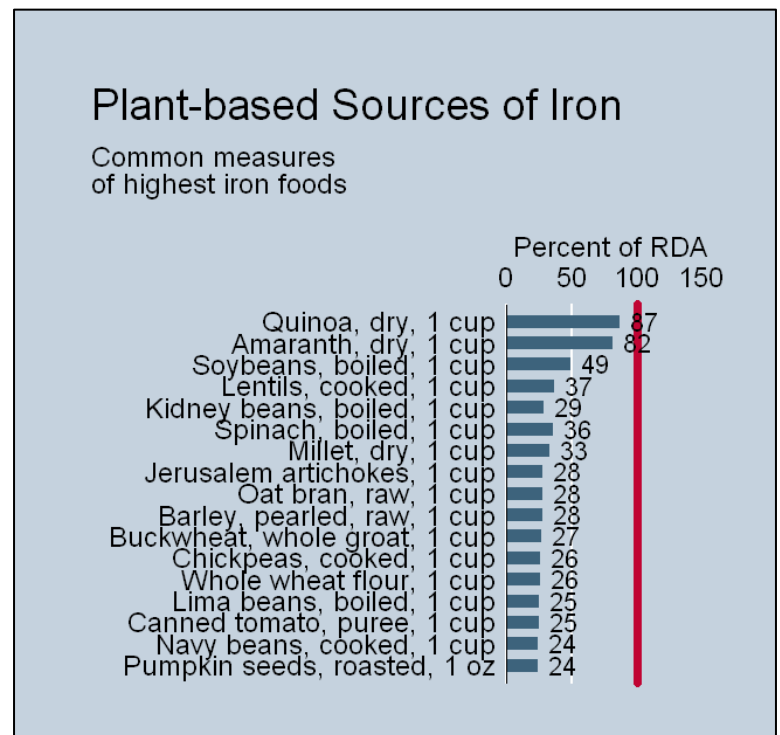
Legumes as a class have high iron content. Soybeans top the list providing nearly 50% of your daily recommended intake followed by lentils with 37%. Kidney beans, chickpeas, lima beans, and navy beans all can contribute about 25% of your daily recommended intake.

Some grains are notably high as well:

- oat bran (28%)
- barley (28%)
- buckwheat (27%)
- whole wheat (26%)

Before planning menus based on these plant-based sources of iron, read the section of this report on phytates. Without proper preparation of these foods, you will absorb much less

of the iron than you would expect. The preparation and shopping tips I describe will allow you to double your absorption of iron.

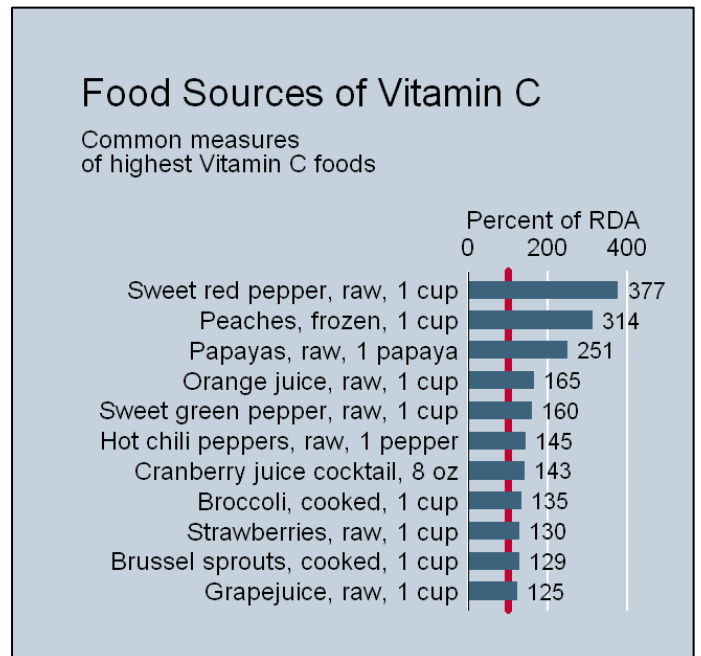


3. Vitamin C an Iron Enhancer

Increasing Vitamin C in your iron-rich meal may well improve your iron absorption. A 1977 study found that increasing the vitamin C content of a meal from 50 to 250 milligrams doubled iron absorption (Cook and Monsen 1977). It is this study that has led to widespread recommendations to consume foods high in vitamin C with your meals. A more recent study found an increase in only about 35%, not the 100% improvement in the 1977 study (Cook et al. 2001).

Adding vitamin C to your meals will improve your iron absorption. Keep in mind that vitamin C will not make up for the binding effects of the iron inhibitors I describe below, so your best approach is a mixed strategy: add vitamin C to your diet and reduce the phytic acid and oxalic acid in your foods.

At right is a list of foods highest in vitamin C from the USDA food database. Add fruit and fresh vegetables to your meal. Vitamin C levels are reduced with cooking, so your best bet is to add **raw fruit or vegetables** to you meal after your meal is already cooked.



Food Storage and Vitamin C

One of the issues we face in getting enough vitamin C is having fresh produce available for our meals. As food is stored or heated, its vitamin C is lost:

- Cooking food will reduce its vitamin C content
- As food is stored, its vitamin C declines
- Vitamin C loss is greatest if fruit or vegetables are juiced and then stored. The food begins to oxidize and vitamin C loss is rapid.

Fresh off of the tree and into your mouth is best in the case of vitamin C. However, there is one great solution if you want to preserve your fruit and vegetables along with their vitamin C: ferment them. I discuss below the benefits of fermentation for reducing iron-inhibitors in food but fermentation also preserves vitamin C.

The easiest place to start in fermentation is with juices. My favorite is a fruit-juice-based kefir soda – a tasty and simple fermentation solution. You can juice oranges in season and immediately begin to ferment your orange juice into a bubbly soda-like drink that maintains all of the original vitamin C of the orange. They also add beneficial bacteria to the drink.

Kefir sodas require a “starter” in the form of what is called “kefir grains.” They look nothing like a wheat or rye kernel, but much more like cauliflower. You add them to your juice and strain them out when you are ready to drink it. You can use the grains indefinitely if you care for them. Kefir grains grow and multiply. You might find a friend with some spares. My husband and son are also beginning to sell them on-line, along with some basic kitchen tools that will be handy in making your sodas.

4. Grandma's Cast Iron

When you cook in a cast iron skillet, some of the iron will leach into the food that you are preparing. Of course, this leaching of iron can be good or bad, depending on your iron status. For anyone interested in this report, cooking with cast iron is a good strategy to improve your iron status.

Yard sales and antique stores are good places to shop for cast iron. Even at antique stores I have found good pieces for under \$20.

As my website becomes developed, my mom will be sharing her tips on using cast iron.

IV. Iron Inhibitors

Many foods contain organic acids that actually reduce your ability to absorb iron. These organic acids are anti-nutrients that bind to minerals and keep your body from absorbing them. To some degree we can reduce these organic acids in our foods and, thus, increase our absorption of minerals. I discuss the primary organic acids here for which there is a fairly easy solution.

1. Phytic acid

In the research for my book [*Rebuild from Depression*](#) I am struck by the solid research about phytic acid and yet the American public's relative lack of knowledge about its effects. I certainly never heard about them in my vegetarian days, yet they have profound implications for the vegetarian diet. Some nutritionists estimate that vegetarians whose primary source of protein comes from grains and legumes absorb only about 15% of the minerals in those foods. Based on the research I present here, that is a fair estimate, though absorption from soy-based foods is even lower. If you are a vegetarian, you can very quickly double the minerals you are absorbing by using the techniques I describe.

a. Phytates matter

Whole grains and fresh legumes are problematic, unfortunately, because of their natural level of phytic acid, which inhibits the absorption of key minerals that we are trying to increase in our diets: zinc and magnesium specifically. Phytic acid binds to minerals in your digestive tract and escorts them out through your bowels. There will be no cell-building or body-building with these minerals, even though the label on the grain or legume suggests you

are eating mineral-rich food. Research has shown that phytates inhibit the absorption of significant levels of minerals in the phytate-laden food.

Researchers have conducted experiments on mineral absorption that show clearly that phytates matter. Experiments have provided two groups of people with bread – one group with a test bread with phytates and one with a control bread with the phytates removed. Researchers then studied participants' mineral absorption via stool samples. Without phytic acid, participants absorbed about 30% of magnesium and zinc. With phytic acid, participants absorbed only 13% of their magnesium and 23% of their zinc (Egli et al. 2004; Bohn et al. 2004).

b. The solution in your kitchen

Some grains and legumes are high in phytates, some are low. As a class, milled grains such as white flour, are low in phytates. Do not worry about the methods I mention here with milled grains (and you are cutting back on those anyway).

c. Rising, soaking, and sprouting: putting the enzyme phytase to work for you

For the most part, if grains and legumes are allowed to sit and stew for a while in warm water with a slightly acid medium, their phytic acid level will decline. These techniques will fight your phytates:

- 1) Bread rising time. As yeast bread dough sits and is allowed to rise, the phytic acid content will be reduced. Sourdough techniques are generally the most effective if only because the rise time tends to be longer.

- 2) Sourdough techniques for flatbreads, quick breads, pancakes, and waffles. We turn every quick bread into a sourdough around here and have a “cheater’s sourdough” process in the Appendix and recipes from my mom on the website.

- 3) Soak grains for porridges. Your breakfast porridge should be soaked in advance of cooking, as should grains to be used in dishes such as tabouli. Ground grains are preferable to whole kernels since the phytic acid breaks down easier. Follow these steps:
 - a. Soak in water, about equal parts water to grains (enough to cover them well).

 - b. The water temperature should be between 45° and 55°C (113-131° F), just above body temperature.

 - c. Add an acidic ingredient to water to achieve a pH level of 4.5 to 5.5. For best results use whey, yogurt, or kefir (approximately 2 tablespoons per cup of grain). Otherwise add about 2 tablespoons of lemon juice per cup of grain.

 - d. Cover with a clean dishcloth to keep the bugs out.

 - e. Soak in a warm spot for at least two and at best twelve hours.

- 4) Germinate grains and legumes. Make sprouts to reduce phytic acid. Sprouted grains are used in higher-end health breads increasingly. These are great options particularly for flat breads such as

tortillas and pizza crusts. Germinating will increase the folate content as well.

- 5) Soak your beans in very warm water (140° Fahrenheit) for about 18 hours in a warm spot. I start mine one morning and cook them the following evening.
- 6) Ferment any of the above to reduce the phytates and to add B-vitamins and beneficial bacteria to your food.

You will find a fairly extensive discussion of each of the above five areas on my website. Sign up for my free e-course on phytates for a fairly extensive review:

[Subscribe](#)
[Phytic Acid E-course – FREE](#)

d. Two Exceptions: oats and soy

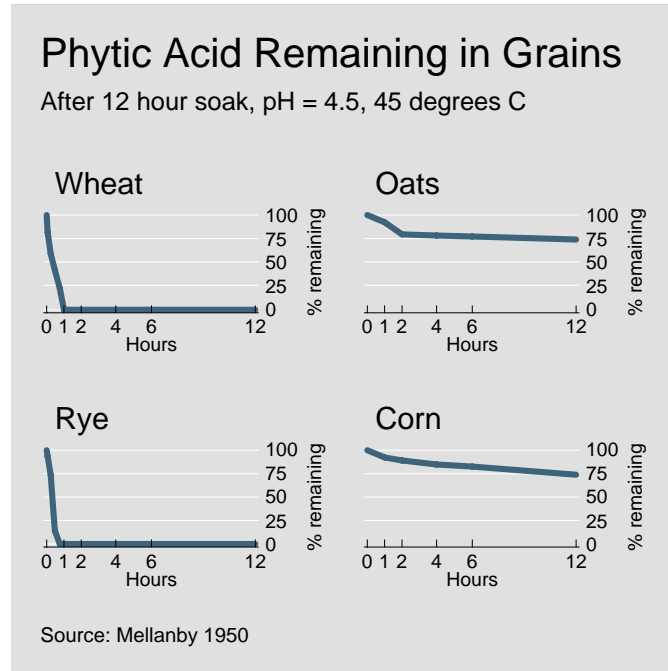
If you eat a lot of oatmeal or soy products, keep reading. You need to know that the basic techniques to reduce phytates are not very effective in these two cases. Oats and soy are both low in phytase (as are millet, corn, and sorghum), the enzyme that breaks down the phytic acid.

Oats

In a 1950 study, Mellanby reported an experiment reducing the phytic acid content of various grains which I present in the figure below. Note that with rye and wheat it takes only two hours to reduce the phytate content under optimum conditions. With oats and corn, soaking for 12 hours is insufficient – the phytic acid levels are still about 75% of their original levels.

Simple solution: Add rye flakes to your oats.

When making oatmeal, use about 10% rye flakes and follow the instructions I provide above on soaking. I do not highlight corn because baking with corn almost always includes wheat. For corn bread, see my website for sourdough recipes. The wheat in the corn bread recipe will also help break down the phytates in the corn.



[Subscribe](#)
[Phytic Acid E-course – FREE](#)

e. Soy and its unavailable minerals

We saw above that one cup of soybeans provides about 50% of your recommended daily intake of iron. That's impressive. However, with a high level of phytic acid, you will likely only absorb about 10% of that if you do not prepare it properly.

Soaking and cooking soybeans is a much less effective strategy at breaking down phytates than it is with other legumes. In the case of soybeans, you really must *ferment* them.

A study of phytic acid in soybeans documents in detail the phytic acid level at different stages of preparation. Researchers soaked the beans, boiled them, poured off the water, soaked them again, dehulled them, steamed them, drained them, and then cooled them. The phytic acid levels change very little with all of this effort.

It is only when they ferment the beans in the form of tempeh that the phytate levels reduce to about 45% of the levels of the soaked soybean. Fried tempeh is an improvement still, but if the tempeh is stored for two weeks at 5°C and then fried, the researchers reached the optimal (but not perfect) reduction of the phytic acid. A 2003 study also found that the phytic acid level decreased by only 31% by fermenting soybeans (Egounlety and Aworth 2003).

Keep these results in mind as you shop for soymilk and tofu. Soybeans in soymilk are soaked, strained, and cooked. Tofu has an additional step – a coagulant is added. Both of these products retain nearly 100% of the phytates according to the results of the research I present.

People who make their own soy milk and tofu might be able to improve them if not through fermentation techniques, by

soaking them with a high-phytase grain such as wheat. Researchers have combined grains and legumes strategically to reduce the phytates in one item with the phytase in another. In the case of soybeans, researchers included only 20% soy and 80% wheat. They successfully reduced the phytic acid in the porridge. Homemade milk aficionados might use a similar strategy. There is no research that I am aware of that would direct us with the proper ratio of soybeans to wheat to make a soymilk. I do not eat soy so this is an idea for experimental cooks who do.

2. Oxalic Acid

Because vegetable selection apparently cannot be easy, vegetables and some other food items have a substance called *oxalic acid* that binds with minerals in your digestive tract and keeps the minerals from being absorbed. But not only does oxalic acid reduce mineral absorption, oxalate is the primary component of kidney stones. There are good reasons to reduce oxalic acid in your diet.

In an interesting study reported in *The British Journal of Nutrition* in 2004, researchers compared magnesium absorption from high-oxalate and low-oxalate food: spinach and kale. Participants were given a meal of phytate-free white bread and either spinach or kale, cooked and puréed. In the high oxalate spinach meal, study participants absorbed about 27% of the magnesium in the meal. In the low oxalate kale meal, participants absorbed about 37% of the magnesium. As with the phytate studies I describe above, this study shows that you can increase your mineral absorption by eating foods lower in oxalic acid.

a. Reducing oxalic acid

A 2005 study found that boiling reduced the level of oxalic acid in food. Note in the table below that boiling spinach reduces oxalic acid by 87% whereas steaming reduces it by 42%. In every vegetable studied, boiling is more effective than steaming. And there is a good reason: unlike phytates where the phytase enzyme breaks down the phytic acid, as you will read about in the next chapter, oxalic acid is not “broken down” by cooking. It simply falls off of the food and into the water. You can then remove the oxalic acid by pitching the cooking water. So, the cooking strategy here is

to boil (or at least steam) the food and discard the cooking water. I know that all of our mothers saved this liquid for soup or gravy, but you'll want to toss the water of heavy offenders.

Oxalic acid content after cooking		
	Boiling, % reduced	Steaming % reduced
Spinach	87%	42%
Green Swiss chard leaves	84%	46%
Broccoli	57%	19%
Carrots	56%	53%
Beet roots	31%	6%
<i>Source: Chai and Liebman, 2005</i> Vegetables were chopped and cooked for 12 minutes.		

Fermentation, as I describe below, is another very effective method at decreasing the oxalic acid in your food.

b. What's high in oxalic acid

The oxalic acid big list below – the foods highest in oxalate – are the foods you would be better off avoiding if you have a choice. The big list includes foods you should avoid eating raw in large quantities. Beets are a popular choice in homemade raw vegetable juice, yet are high in oxalic acid. Carrots, parsley, and spinach tend to be eaten raw as well. Do not eat them in their raw form in great quantities; consider boiling them and tossing out the boiling water as an alternative to sautéing. Boiled vegetables can then be browned in oil if you do not like the taste of boiled produce.

The amount of oxalic acid in food samples is highly variable and, thus, so are oxalic acid food lists. Oxalate varies across foods, plant varieties, and picking times. To create this list, I used foods that appeared multiple times in the five sources I list below.

The Oxalic Acid Big List,

Foods high in oxalic acid to be boiled or used sparingly

Vegetables

- Beets
- Brussel sprouts
- Carrots
- Collard greens
- Parsley
- Spinach
- Sweet potato
- Swiss chard
- Rhubarb

Nuts

- Pecans
- Peanuts

Beverages

- Black tea
- Coffee
- Cocoa

Chocolate

Sources: Brzezinski et al. 1998 Duke 1992; Hodgkinson 1977; Chai and Liebman 2005; USDA 1984.

But do not oxalates drive you crazy. Spinach, for instance, is high in oxalates which bind to minerals but it is still a very good source of folate. If you eat raw spinach, eat it for its other properties, but do not count on it for your iron.

3. Tannic Acid: Coffee and Tea

Another organic acid that reduces your iron absorption is tannic acid, found in coffee and tea. If you are going to enjoy a cup of tea or coffee, consume it a couple of hours after your iron-rich meal.

4. Competing Minerals: Iron, Calcium, and Zinc

If you are taking an iron supplement, you have probably been directed to take it on an empty stomach. When minerals compete with one another, sometimes taking one mineral in a supplemental form will decrease your absorption of another mineral in your food. A calcium supplement with a meal will reduce your iron absorption. An iron supplement with a meal will reduce your zinc absorption. So if you rely on an iron supplement for the long term, you could end up with low zinc levels.

If you are taking supplemental zinc, iron, or calcium, it is best to take them at different times and avoid taking them with your iron-rich foods.

The competition between the minerals is what has led to the common recommendation to reduce your milk intake with meals – because the calcium competes with the iron. The jury is still out on this recommendation but your best bet is to hedge your bets and pass up the milk during meal time. You can also use cream instead – a couple of tablespoons of cream is fairly low in calcium.

V. Ferment Your Way to Health

Fermentation is a strategy everyone should learn and become comfortable with to improve their long-term health. Fermentation is free, sustainable, and it reduces all of the organic acid iron inhibitors I mentioned in this report.

In a 2005 study in *Food Microbiology*, researchers found that the soluble iron in the homemade vegetable juice in the study increased sixteen times with fermentation. **What this means is that if you juice your own vegetable juice with a high iron vegetable like spinach and you ferment it, your body will absorb *sixteen times* more iron than it would have absorbed had you consumed the juice right out of the juicer.**

The same study found that fermenting commercial juice increased the solubility of iron by seven times. So you can also buy a ready-to-drink juice and ferment it and digest about seven times the iron in the original juice.

What holds for juice holds for other foods as well. Find a good book on fermentation as you have time and familiarize yourself with the old-fashioned techniques of food preservation.

My favorite book on fermentation is [Wild Fermentation](#) by Sandor Katz available at [Amazon.com](#). Check [my website](#) for e-books or articles on fermentation.

VI. Summing It Up

As you work to improve your iron status, add iron rich foods to your diet and reduce the organic acids (phytates, oxalates, and tannins) in those foods.

Step 1: Use a supplement like [Floradix](#) in the short term.

Step 2: Don't take other mineral supplements with your iron-rich meals.

Step 3: Add iron-rich foods to your diet

Step 4: Reduce the phytates or oxalates in the iron-rich foods you eat most.

Step 5: Experiment with fermentation as a technique to reduce all of the binding organic acids in your foods.

Give it time

Your red blood cells renew themselves every three to four months. Everyday provides you with an opportunity to eat iron-rich foods so that your body has iron to rebuild itself. Continue to eat well for months and you will find that your energy is improving. At some point, you may be able to stop taking your iron supplement if you are taking one.

Best of luck to you. You can find me at my website:

www.rebuild-from-depression.com

Works Cited

Baech, Sussi B, Hansen, Marianne, Bukhave, Klaus, Jensen, Mikael, Sorensen, Sven S, Kristensen, Lars, Purslow, Peter P, Skibsted, Leif H, Sandstrom, Brittmarie, 2003. "Nonheme-iron absorption from a phytate-rich meal is increased by the addition of small amounts of pork meat," *American Journal of Clinical Nutrition* 77: 173-179.

Bergqvist, S.W., A. -S. Sandberg, N. -G. Carlsson and T. Andlid, 2005. "Improved iron solubility in carrot juice fermented by homo- and hetero-fermentative lactic acid bacteria," *Food Microbiology* 22(1): 53-61

Cook James D, Monsen ER., 1977. "Vitamin C, the common cold, and iron absorption." *American Journal of Clinical Nutrition* 30:235-41.

Cook, James D, Reddy, Manju B., 2001. "Effect of ascorbic acid intake on nonheme-iron absorption from a complete diet." *American Journal of Clinical Nutrition* 73: 93-98.

Looker, A.C.; P. R. Dallman; M. D. Carroll; E. W. Gunter; C. L. Johnson, 1997. "Prevalence of iron deficiency in the United States," *JAMA* 277: 973-976

Rosado, Jorge L., Diaz, Margarita, Gonzalez, Karla, Griffin, Ian, Abrams, Steven A., Preciado, Roxana, 2005. "The Addition of Milk or Yogurt to a Plant-Based Diet Increases Zinc Bioavailability but Does Not Affect Iron Bioavailability in Women." *Journal of Nutrition* 135: 465-468.