Evidence-based Iron Usage

Name(s): Iron sulfate, chelated iron

Warnings: People who are not diagnosed with iron deficiency should not supplement iron, because taking iron when it isn't needed does no good and may do some harm. Also, iron should not be taken at the same time as antioxidants.

Description: Iron is highly needed in large amounts during periods of growth. This nutrient must be present for the formation of red blood cells and is a constituent of these cells. For fatty acid oxidation to occur, iron has to be present. The main function of iron is its ability to combine with protein and copper, forming haemoglobin. Haemoglobin is the portion of the blood that carries oxygen and gives red blood cells their colour. The formation of myoglobin is also dependent on the presence of iron; however, calcium and copper must be present as well. This compound, myoglobin, is the transporter of oxygen to the muscle tissues. Liver is the best source of iron with tongue, heart, and oysters following a close second. However, these choices are not very appealing to the majority. More appetizing sources include chicken, lean meat, pumpkin, egg yolks, and legumes.[1]

Absorption/Storage: Iron is very poorly absorbed, only taking in 10% of what is ingested. This mineral requires a highly acidic environment for absorption. If the iron is consumed from animal sources, it is more readily absorbed than that obtained from vegetable sources. Other nutrients must be present for the complete absorption of iron. These nutrients are vitamin A, the B complex vitamins, copper, calcium, and manganese. Iron is really not stored in the body because it is used repeatedly. Small amounts are, however, excreted in the urine and faeces. Antacids reduce the amount of iron being absorbed because iron needs an acidic environment for absorption. Iron is lost in large amounts during pregnancy, menstruation, and injury.[1]

Recommended Dietary Allowance/Dietary Reference Intake:[2] Normal daily recommended intakes in milligrams (mg) for iron are generally defined as follows (Note that the RDA and RNI are expressed as an actual amount of iron, which is referred to as "elemental" iron. The product form [e.g., ferrous fumarate, ferrous gluconate, ferrous sulfate] has a different strength):

Persons	U.S. (mg)
Birth to 3 years of age	6-10
4 to 6 years of age	10
7 to 10 years of age	10
Adolescent and adult males	10
Adolescent and adult females	10-15
Pregnant females	30
Breast-feeding females	15

Optimum Daily Allowance (Adult): 18-30 mg (take only if a deficiency exists).[3]

Tolerable Upper Intake Levels: None available.

Principal Uses: Iron deficiency anaemia (with vitamins A and C),[4-6] and menorrhagia (heavy menstrual blood loss).[7,8]

Proposed Uses: Athletic performance (for treatment of iron-deficiency only), canker sores, celiac disease (for treatment of iron-deficiency only), depression (for deficiency), pre- and post-surgery health (if deficient or for major surgery) and restless legs syndrome (only if iron-deficient).[9]

Traditional Uses: Alzheimer's disease (in combination with coenzyme Q10 and vitamin B6), dermatitis herpetiformis,
HIV support and infertility (female) (for treatment of iron-deficiency only).[9]

Healthy Sources:
High (40%+ US DRI): boiled adzuki beans, dried agar, amaranth, homemade baked beans, whole groat buckwheat flour, boiled chickpeas (garbanzos), whole grain corn meal, boiled cowpeas, cracker meal, canned cranberry beans, Cream of Wheat cereal, dried figs, raw Irish moss, boiled kidney beans, boiled lentils, boiled or canned lima beans, dried logans, boiled moth beans, boiled or canned navy beans, canned great northern beans, dry oat bran, oatmeal, boiled pinto beans, potato flour, quinoa, refried beans, rice bran, brown rice flour, dark rye flour, sorghum, soy flour, soy meal, boiled soybeans, dried spirulina, sun-dried tomatoes, raw tofu, boiled or canned white beans, whole wheat flour, boiled wing beans, boiled yardlong beans and boiled yellow beans.[10]

Medium (25-39% US DRI): boiled artichoke, boiled black beans, boiled borage, boiled broad beans, raw cassava,

carob (St. John's bread) flour, raw cheimoya, whole grain corn flour, raw Jerusalem artichoke, raw kelp, canned kidney beans, dried mixed fruit, raw mulberries, boiled mung beans, boiled great northern beans, dried oriental radish, dried sulphured peaches, dried sulphured pears, boiled pink beans, canned pinto beans, baked potato with the skin, prune juice, raisans, boiled or canned spinach, boiled raw spirulina, split peas, canned mashed sweet potato raw tamarind, canned tomato paste, whole grain triticale flour, wheat bran and toasted wheat germ.[10]

Contraindications: If you are taking this dietary supplement without a prescription, carefully read and follow any precautions on the label. For iron supplements, the following should be considered:

Allergies--Tell your health care professional if you have ever had any unusual or allergic reaction to iron medicine. Also tell your health care professional if you are allergic to any other substances, such as foods, preservatives, or dyes.

Pregnancy--It is especially important that you are receiving enough vitamins and minerals when you become pregnant and that you continue to receive the right amount of vitamins and minerals throughout your pregnancy. Healthy foetal growth and development depend on a steady supply of nutrients from mother to foetus. During the first 3 months of pregnancy, a proper diet usually provides enough iron. However, during the last 6 months, in order to meet the increased needs of the developing baby, an iron supplement may be recommended by your health care professional.

However, taking large amounts of a dietary supplement in pregnancy may be harmful to the mother and/or foetus and should be avoided.

Breast-feeding--It is especially important that you receive the right amounts of vitamins and minerals so that your baby will also get the vitamins and minerals needed to grow properly. Iron normally is present in breast milk in small amounts. When prescribed by a health care professional, iron preparations are not known to cause problems during breast-feeding. However, nursing mothers are advised to check with their health care professional before taking iron supplements or any other medication. Taking large amounts of a dietary supplement while breast-feeding may be harmful to the mother and/or infant and should be avoided.

Children--Problems in children have not been reported with intake of normal daily-recommended amounts. Iron supplements, when prescribed by your health care professional, are not expected to cause different side effects in children than they do in adults. However, it is important to follow the directions carefully, since iron overdose in children is especially dangerous.

Studies on sodium ferric gluconate have been done only in adult patients, and there is no specific information comparing the use of sodium ferric gluconate in children with use in other age groups.

Older adults--Problems in older adults have not been reported with intake of normal daily-recommended amounts. Elderly people sometimes do not absorb iron as easily as younger adults and may need a larger dose. If you think you need to take an iron supplement, check with your health care professional first. Only your health care professional can decide if you need an iron supplement and how much you should take.

Medicines or other dietary supplements--Although certain medicines or dietary supplements should not be used together at all, in other cases they may be used together even if an interaction might occur. In these cases, your health care professional may want to change the dose, or other precautions may be necessary. When you are taking iron supplements, it is especially important that your health care professional know if you are taking any of the following:

- Acetohydroxamic acid (e.g., Lithostat)--Use with iron supplements may cause either medicine to be less effective
- Antacids--Use with iron supplements may make the iron supplements less effective; iron supplements should be taken 1 or 2 hours before or after antacids
- Dimercaprol--Iron supplements and dimercaprol may combine in the body to form a harmful chemical
- Etidronate or
- Fluoroquinolones (e.g., ciprofloxacin, enoxacin, lomefloxacin, norfloxacin, ofloxacin) or
- Tetracyclines (taken by mouth) (medicine for infection)--Use with iron supplements may make these medicines less effective; iron supplements should be taken 2 hours before or after these medicines.

Other medical problems--The presence of other medical

problems may affect the use of iron supplements. Make sure you tell your health care professional if you have any other medical problems, especially:

- Alcohol abuse (or history of) or
- Blood transfusions (with high red blood cell iron content) or
- Kidney infection or
- Liver disease or
- Prophyria cutaneous tarda--Higher blood levels of the iron supplement may occur, which may increase the chance of side effects
- Arthritis (rheumatoid) or
- Asthma or allergies or
- Heart disease--The injected form of iron may make these conditions worse
- Colitis or other intestinal problems or
- Iron overload conditions (e.g., haemo-chromatosis, haemosiderosis) or
- Stomach ulcer--Iron supplements may make these conditions worse
- Other anaemias--Iron supplements may increase iron to toxic levels in anaemias not associated with iron deficiency.[2]

Always take iron supplements separately, rather than in a multivitamin and mineral formula. Do not take iron with a supplement-containing vitamin E.[3]

Interactions:

Decreases Mineral Availability:	Antacids, calcium, cimetidine, eggs, etodolac, famotidine, green tea, haloperidol, hyoscyamine, ibuprophen, magnesium hydroxide, minocycline, nizatidine, phytate, ranitidine, red wine, sodium bicarbonate, soy protein, stanozolol, sulfasalazine, warfarin, wheat bran,[9] aspirin, coffee, manganese, neomycin,[9,11] ACE inhibitors, antibiotics, antihypertensive agents, black teas, calcium rich foods, cholestyramine cobalt, oxalates, trientine, zinc,[11] vitamin E and cholamphenicol.[12]
Increases Mineral Availability:	Vitamins A and C,[5,6] soy containing foods, oral contraceptives,[9] alcohol, calcium and hydrochloric acid.[11]
Is Decreased By Mineral Availability:	Dipyridamole, doxycycline, levofloxacin, minocycline, ofloxacin, penicillamine, risedronate, sulfasalazine, tetracyclines, warfarin,[9] ACE inhibitors, cobalt, copper, etidronate, magnesium, manganese, penicillamine, tetracyclines, thyroxine, trientine, zinc,[11] carbidopa, ciprofloxacin, methyldopa, [9,11] etidronate,[12] and quinolones.[13]
Is Increased By Mineral Availability:	Thyroid hormones.[9]
Adverse Reaction	Chlorhexidine, deferoxamine, indomethacin, NSAIDS,[9] and antioxidants.[11]

When iron is combined with certain foods it may lose much of its value. If you are taking iron, the following foods should be avoided, or only taken in very small amounts, for at least 1 hour before or 2 hours after you take iron:

- Cheese and yoghurt
- Eggs
- Milk
- Spinach
- Tea or coffee
- Whole-grain breads and cereals and bran

Do not take iron supplements and antacids or calcium supplements at the same time. It is best to space doses of these 2 products 1 to 2 hours apart, to get the full benefit from each medicine or dietary supplement.

If you are taking iron supplements *without a prescription*:

- Do not take iron supplements by mouth if you are receiving iron injections. To do so may result in iron poisoning.
- Do not regularly take large amounts of iron for longer than 6 months without checking with your health care professional. People differ in their need for iron, and those with certain medical conditions can gradually become poisoned by taking too much iron over a period of time. Also, unabsorbed iron can mask the presence of blood in the stool, which may delay discovery of a serious condition.

If you have been taking a long-acting or coated iron tablet and your stools have *not* become black, check with your

health care professional. The tablets may not be breaking down properly in your stomach, and you may not be receiving enough iron.[2]

Deficiency: Hypochromic anaemia is the most common condition caused by a deficiency in iron. This form of anaemia occurs when there is a reduction of haemoglobin in the red blood cells, eventually causing the red blood cells to become smaller. The amount of the oxygen carried by these cells is also depleted. Symptoms of anaemia are as follows: tiredness, brittle nails, constipation, difficulty in breathing, and reduced brain function. Cravings for odd foods or non-foods such as clay, starch, and ice are also signs of an iron deficiency, especially in children.[1]

Toxicity/Side Effects: Along with its needed effects, a dietary supplement may cause some unwanted effects. Although not all of these effects may occur, if they do occur they may need medical attention.
Check with your health care professional if any of the following side effects occur:

More common--with injection only
- Backache, groin, side, or muscle pain; chest pain; chills; dizziness; fainting; fast heartbeat; fever with increased sweating; flushing; headache; metallic taste; nausea or vomiting; numbness, pain, or tingling of hands or feet; pain or redness at injection site; redness of skin; skin rash or hives; swelling of mouth or throat; troubled breathing

More common--when taken by mouth only
- Abdominal or stomach pain; cramping (continuing) or soreness

Less common or rare--with injection only
- Double vision; general unwell feeling; weakness without feeling dizzy or faint

Less common or rare--when taken by mouth only
- Chest or throat pain, especially when swallowing; stools with signs of blood (red or black colour)

Early symptoms of iron overdose
- Diarrhoea (may contain blood); fever; nausea; stomach pain or cramping (sharp); vomiting, severe (may contain blood)

Note:	Symptoms of iron overdose may not occur for up to 60 minutes or more after the overdose was taken. By this time you should have had emergency room treatment. Do not delay going to emergency room while waiting for signs to appear.

Late symptoms of iron overdose
- Bluish-coloured lips, fingernails, and palms of hands; convulsions (seizures); drowsiness; pale, clammy skin; shallow and rapid breathing; unusual tiredness or weakness; weak and fast heartbeat

Other side effects may occur that usually do not need medical attention. These side effects may go away during treatment as your body adjusts to the dietary supplement. However, check with your health care professional if any of the following side effects continue or are bothersome:

More common
- Constipation; diarrhoea; nausea; vomiting

Less common
- Darkened urine; heartburn; stained teeth

Stools commonly become dark green or black when iron preparations are taken by mouth. This is caused by unabsorbed iron and is harmless. However, in rare cases, black stools of a sticky consistency may occur along with other side effects such as red streaks in the stool, cramping, soreness, or sharp pains in the stomach or abdominal area. Check with your health care professional immediately if these side effects appear.

If you have been receiving injections of iron, you may notice a brown discoloration of your skin. This colour usually fades within several weeks or months.
Other side effects not listed above may also occur in some individuals. If you notice any other effects, check with your health care professional.[2]

Treatment for Overdose: It is important to keep iron preparations out of the reach of children. Keep a 1-ounce bottle of *syrup* of ipecac available at home to be taken in case of an iron overdose emergency when a doctor, poison control centre, or emergency room orders its use.

Early signs of iron overdose may not appear for up to 60

minutes or more. Do not delay going to the emergency room while waiting for signs to appear.

If you think you or anyone else has taken an overdose of iron medicine:

- Immediate medical attention is very important.
- Call your doctor, a poison control centre, or the nearest hospital emergency room at once. Always keep these phone numbers readily available.
- Follow any instructions given to you. If syrup of ipecac has been ordered and given, do not delay going to the emergency room while waiting for the ipecac syrup to empty the stomach, since it may require 20 to 30 minutes to show results.
- Go to the emergency room without delay.
- Take the container of iron with you.[2]

Storage: To store this dietary supplement:

- Keep out of the reach of children because iron overdose is especially dangerous in children. As few as 3 or 4 adult iron tablets can cause serious poisoning in small children. Vitamin-iron products for use during pregnancy and flavoured vitamins with iron often cause iron overdose in small children.
- Store away from heat and direct light.
- Do not store in the bathroom, near the kitchen sink, or in other damp places. Heat or moisture may cause the dietary supplement to break down.
- Keep the liquid form of this dietary supplement from freezing.
- Do not keep outdated dietary supplements or those no longer needed. Be sure that any discarded dietary supplement is out of the reach of children.[2]

References:

1. Dr. Morrow's Library of Vitamins, Minerals, Amino Acids, and Herbs: Iron. [Online] http://www.nutritiondynamics.com/cgi-bin/process.asp?product=Iron
2. National Library of Medicine. (1999). Iron Supplements (systemic). [Online] http:/www.nlm.nih.gov/medlineplus/druginfo/ironsupplementssystemic202305.html
3. Balch, P.A. & Balch, J.F. (2000). Prescription for nutritional healing (third edition). Garden City Park: Avery Publishing.
4. Hunt, J.R., Gallagher, S.K. & Johnson, L.K. (1994). Effect of ascorbic acid on apparent iron absorption by women with low iron stores. American Journal of Clinical Nutrition, 59: 1381–1385.
5. Suharno, D., Muhilal, West, C.E. et al. (1993). Supplementation with vitamin A and iron for nutritional anaemia in pregnant women in West Java, Indonesia. Lancet, 342: 1325–1328.
6. Semba, R.D., Muhilal, West, K.P. Jr., et al. (1992). Impact of vitamin A supplementation on haematological indicators of iron metabolism and protein status in children. Nutrition Research, 12: 469–478.
7. Samuels, A.J. (1965). Studies in patients with functional menorrhagia: The antimenorrhagic effect of the adequate replication of iron stores. Israeli Journal of Medical Science, 1: 851.
8. Taymor, M.L., Sturgis, S.H. & Yahia, C. (1964). The etiological role of chronic iron deficiency in production of menorrhagia. JAMA, 187: 323–327.
9. Austin, S., Gaby, A., Appleton, J. et al. (2001). HealthNotes Online. [Online] http://healthnotes.com
10. Pennington, J.A. (1998). Boes and Church's food values of portions commonly used (seventeenth edition). Philadelphia, PA: Lippincott.
11. Meletis, C. & Jacobs, T. (1999). Interactions between drugs & natural medicines. Sandy, OR.: Eclectic Medical Publications.
12. Gillis, C. (editor). (1999). Compendium of pharmaceuticals and specialties. Ottawa, Canada: Canadian Pharmacists Association.
13. American Society of Health-System Pharmacists. (2000). AHFS drug information. Bethesda, MD: American Society of Health-System Pharmacists.

Evidence-based Iron Usage

Compiled by:
Michael John Nisbett, HBScN, RN
MSc (Nutrition) Candidate