The Lead Education and Abatement Design Group
Working to eliminate childhood and foetal lead poisoning
by the year 2012 and to protect the environment from lead
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Fact Sheet –Iron Nutrition and Lead Toxicity

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Note: a longer more comprehensive version of this article is available at:
www.lead.org.au/lanv9n3/Iron_Nutrition_and_Lead_Toxicity_Full.pdf

Iron metabolism: Overview

Iron is an essential micronutrient[123]. The total amounts involved are small; an adult female will have 2-4 grams of iron (around 38mg per kilo) in her body, an adult male up to six (around 50mg per kilo)[4]. Males tend to have more due to being larger, not suffering blood loss due to menstruation and some innate differences that begin at puberty[56]. Adult males normally have three times the stored iron of premenopausal females (1000 mg to 300mg seems a widely quoted figure but I have not sighted the original source), a fact true for vegetarians as well as omnivores (480 mg to 160 mg; the same source problem applies)[7].

The majority of iron in the body is bound in haemoglobin [or hemoglobin (US spelling)] (found in red blood cells [erythrocytes]) where it is used in transportation and processing of oxygen within the body[8910]. Up to 10% is used in myoglobin that stores oxygen in the muscles[11121314]. Over 4% is used in lung metabolism[15] playing a vital role in respiration[16]. Most of the remainder is stored in the compound ferritin, over two thirds of which is deposited in the liver, the bulk of the remainder being split between bone marrow and reticulo-endothelial cells[171819]. Transport of iron within the body is handled by the serum molecule transferrin and at a cellular level by DMT1 [Divalent Metal Transporter 1][202122]. The entire complex system is designed to ensure there is minimal free iron since free iron damages body organs through oxidation due to its highly reactive nature[2324].

Smaller trace amounts fulfill key roles within the body with functions such as immune defense[2526], neural function[272829], DNA synthesis[3031], cellular energy production[32], liver function[33], apoptosis[34], elastin production[35] and collagen production[36]. Iron levels are associated with bone strength and density[37]; iron deficiency is linked to stress fractures in female athletes[38].

Iron cannot be systematically excreted from the body and is recycled within the body[3940] predominantly by macrophages of the reticulo-endothelial system. Macrophages of the spleen and liver generally recycle red blood cells before they reach the end of their natural life (120 days) eliminating 1% per day[41]. The total iron absorbed from food each day is about 0.06% of total adult body iron[42] although for infants this figure can be multiplied by up to six[43]. The main cause of iron loss from the body is blood loss (including significant losses inside the gut[44], particularly for athletes[4546]). This is the primary determinant of iron status[4748] though some iron is lost through sweat (peaking within half an hour of heavy sweating) and skin loss[4950]. Losses from urine are minimal (about 0.1 mg)[51]. For most women menstruation will double to triple iron loss, with losses being slightly higher for adolescents, but it can be even higher[52]. Diet cannot outweigh heavy blood loss[5354]. Women with heavy menstrual flow should see their doctors as some medication (including the contraceptive pill) can reduce menstrual bleeding.

Iron & lead: interactions and iron supplementation

Low iron levels are associated with higher blood lead levels[555657], though there is no direct evidence of causation. Iron and lead occupy similar sites within the human body and so compete for likely binding sites particularly during absorption[58]. Iron deficiency increases the rate of lead transfer to the brain in rats since they share a common transporter (DMT1)[59]. Rat studies indicate iron may be able to reduce lead induced apoptosis (programmed cell death) in the brain[60] and reduce lead related disruption during brain development[61].

Rectifying significant iron deficiency may significantly impact blood lead levels[626364]. With pregnancy it directly impacts on the blood lead of the newborn[65]. Low maternal iron levels or high lead levels increase the risk to the

feotus of schizophrenia later in life[6667]. With children, correcting iron (or zinc) deficiency may lead to the cessation of pica (the compulsive consumption of non-food items such as paint or clay) which can be a source of lead contamination[68].

On the other hand the evidence is poor for supplementation where iron intake is adequate is poor[6970], especially with low lead levels[71]. There might still be advantages to iron supplementation for individuals whose environmental exposure is through ingestion[72].

Iron cooking vessels: The following items have their iron content more than doubled when cooked in iron container without a protective surface. *Rear Row:* red cabbage, tomato, rice, corn meal *Front Row:* tomatoes, capsicum (bell or banana peppers in USA), pureed vegetables, wild rice, apple sauce, scrambled egg, corn meal, *Foreground:* scrambled egg. *Not pictured:* milk.

Iron consumption & iron levels: A long term project

Iron levels can be modified by diet[737475] though the role of individual nutrients should not be overstated[76]. The body regulates the absorption of iron, so iron absorption falls as iron levels rise, due to the influence of the hormone hepcidin[77]. The more hepcidin is produced by liver cells the less iron will be absorbed[78]. Rapid changes in iron status should not be expected[7980].

Iron absorption enhancers

In terms of iron enhancement (increasing the body's iron level) one of the easiest methods is increasing meat in the diet. A significant quantity of the iron in meat is haem [or haeme or heme (US spelling)]. Between 15-40% of haem iron in the diet is absorbed compared with 1-15% of non-haem iron[81]. Haem iron is found in animal products and some supplements, whereas non-haem iron is found in animals, plants and supplements. Cooked beef contains more haem iron (65% of iron content) than cooked pork (39%) and poultry or fish (26%)[82].

For vegetarians and vegans a good supplementation technique is through cooking acidic vegetables (such as tomatoes or cabbage) in non enameled cast iron pots[83]. Non haem iron absorption can be reduced if stomach acidity is impaired[84] (for instance by aging, infection or the use of antacids[85]). Vitamin C (ascorbic acid) clearly enhances non-haem iron absorption[8687], though its impact should not be overstated[88]. Vitamin C may also enhance iron's capacity to displace lead during food absorption[89] Fish oil (and/or carbohydrates) enhances iron absorption where certain significant inhibitors are present[90].

Vitamin C: 120 g of the foods (pictured above) should provide sufficient Vitamin C to optimize iron absorption (up to 480g if cooked, for juice equivalent check labels). Top row: parsley, guava (juice pictured), blackcurrant (juice pictured), kale *Middle Row:* radish, capsicum (bell pepper in US), kiwi fruits, broccoli *Bottom row:* feijoa, baby capsicums, brussel sprouts, guava, horse radish *Not pictured:* Mustard greens, red peppers, thyme.

Vitamin C: 240 g of the foods (pictured above) should provide sufficient Vitamin C to optimize iron absorption (up to 960 g if cooked, for juice equivalent check labels). Top row: watercress, kohlrabi [kohl rabi, german turnip] (leaves), silver beet (spinach in Australia), popcorn. *Middle Row:* kohlrabi (bulbs), grapefruit, orange, lemon, cauliflower *Bottom row:* papaya [paw paw in Australia], strawberries, lime, dill, kaffir lime [K-lime, makrud lime]. *Not pictured:* Lychee

Alcohol reverses the effect of genes governing the hormone hepcidin (decreasing hepcidin levels) leading to much higher iron absorption[9192]. It is important to note that in spite of high iron levels, individuals who consume significant amounts of alcohol are up to five times more likely to have elevated blood lead[93] and, in the case of pregnant women, are more likely to transfer lead to the fetus[94].

Iron absorption inhibitors

Calcium can reduce iron absorption by 50-60%[95] but the experimental data contains inconsistencies and its impact on a whole diet is difficult to assess[96]. It is the only inhibitor that affects both haem and non-haem iron[97].

The following comments on inhibitors apply only to non-haem iron:

Soy proteins inhibit iron absorption[98] unless the product is fermented (like traditional soy sauce, tempe or miso)[99]. Phytic acid [phytate in salt form] (found abundantly in whole grains, bran, nuts and seeds[100]) can reduce iron absorption by as much as 90%. Even small quantities significantly inhibit iron absorption[101]. However this inhibitory effect is significantly reduced by the presence of ascorbic acid, with vitamin C's impact being proportional to the phytate content[102].

Calcium & soy: The pictured quantity of milk or cheese would minimize iron absorption, half that would little impact. For milk products (like yogurt) check label (impacts at 300ml or more with impact rapidly accelerating). Unfermented soy products (beans, milk and meat substitutes) inhibit iron absorption but are high in iron.

Phytates: The most powerful iron inhibitors. Least inhibitory when baked with yeast (*right rear:* wholegrain bread) and should always be consumed with vitamin C (*left rear:* apple & blackcurrant juice). *Middle row:* baked beans, beans (black turtle, black eye, lima, white, barlotti), bran, peanuts *Front row:* sunflower & sesame seeds, peas, beans, nuts (almond, brazil, cashew), muesli.

Tannins (polyphenols found in tea) can reduce absorption by up to 90%[103] (generally closer to two thirds[104]) but dissipate rapidly while other polyphenols found in coffee have roughly half the effect but are longer lasting[105]. Carotenoids (pigments in other than light green vegetables) and vitamin C can negate the impact of polyphenols[106][107].

Polyphenols: The above items contain polyphenols that may inhibit iron absorption. Note the considerable overlap with phytates. *Left to Right* Nuts (almond, brazil, cashew) beans (black turtle, black eye, lima, white, barlotti), coffee, tea, wine, string beans, snow peas, chocolate, nuts (peanuts), lentils, peanut butter, baked beans *Not Pictured:* Sorghum

Carotenoids – Some of the carotenoids found in the items pictured above may be able to counteract the inhibitory impact of polyphenols in coffee & tea. *Top row* Silver beet (spinach in Australia), yellow Indian corn, endives, lettuce, ruby red grapefruit juice, basil. *Middle row* Squash, red cabbage, broccoli, watermelon, pink grapefruit, cabbage, pumpkin. *Lower row* bananas, asparagus, carrots, tomatoes, red onions, red peppers, feijoa, guavas, apples, red peppers, beans, peas, banana capsicum (banana peppers in USA), avocado. *Not pictured* Pimentos, pepper grass, parsley, kiwi fruit.

Egg whites (egg albumin) can inhibit iron absorption by 27% per egg[108].

Eggs: Products that contain egg whites (such as pavlova centre rear) severely inhibit iron absorption and should be replaced with products such as papaya and egg yolk pudding (as vitamin C will enhance iron absorption from the egg). Simple ceramic egg separators are readily available. Traditional Italian gelato (not all gelato) may use egg yolks (right bowl) or less frequently egg whites (left bowl).

Metallic nutrients: Relatives in competition

Zinc supplements can inhibit iron absorption but only at significant levels[109] (doses of 15 mg/day seem to have no impact). Iron supplementation should have minimal impact on zinc levels[110] though an impact is possible[111]. Consuming iron supplements on other than a daily basis should minimize the problem[112]. Copper deficiency (generally caused by excessive zinc supplementation[113]) inhibits iron absorption in rats[114] and can negate iron supplementation[115][116]. Manganese severely impacts iron absorption[117] and its absorption is hindered by high iron stores[118].

Iron supplementation: approach with caution

Iron supplementation either directly by pill or multi-vitamin should be undertaken with extreme care; particularly with children[119][120]. Where supplements are taken low dosages may be almost as effective as high doses[121][122][123] and

Carotenoids & Vitamin C: The items (pictured above) are high in both of these nutrients and should optimize iron absorption when polyphenols are present: *Left to right:* kale (in pot), thyme, banana capsicum (banana pepper in USA), capsicum (bell peppers in USA), red pepper, guava, broccoli, feijoa, kiwi fruit.

General Note: Not all polyphenols inhibit iron absorption and there insufficient evidence to know exactly how effectively individual food items that contain carotenoids can offset those that do.

may even produce superior long term results with less risk[124][125][126][127]. A recent study of rats' brains found that a lower level of iron supplementation had a more positive effect on lead-induced damage than high level iron supplementation[128].

Although the body loses iron (eg through menstruation) it does not systematically excrete iron, and therefore the cumulative effect from supplementation can be dangerous; a continuous load exceeding 1-2 mg/day can eventually result in iron overload leading to organ failure[129]. Studies of pregnant women indicate that weekly iron supplementation may be preferable to daily supplementation[130]. Weekly or biweekly supplementation can radically reduce the risk of side effects from iron supplementation[131].

High Iron levels: Impacts

It is worth remembering that iron is also a neurotoxin and that in the USA iron is the largest cause of fatal accidental poisonings in children under 6[132]. High iron levels enhance the effect of malaria and tuberculosis[133]. High levels of iron doubles the risk of diabetes[134]. Having both high iron and high Very Low Density Lipoprotein (VLDL) cholesterol levels appears to doubles the risk of cancer[135] and triples risk of Alzheimer's disease[136]. High iron levels impact on the liver and can lead to liver failure[137].

High levels of iron during pregnancy are associated with gestational diabetes mellitus[138]. The birth weight of infants can be adversely affected by high maternal iron levels[139]. It must be emphasized however that for most individuals the risks of high iron during pregnancy are considerably less than those of low iron[140][141]; the argument for considering supplementation is strong[142][143].

'Iron deficiency is not a diagnosis'

Remember that iron deficiency can be the result of disease[144] including cancer[145]. **'Iron deficiency is not a diagnosis.'**[146] An inadequately balanced diet may be.

CITATIONS

[1] **Iron** Jane Higdon *Micronutrient Information Center, Linus Pauling Institute, Oregon State University* http://lpi.oregonstate.edu/infocenter/minerals/iron/

[2] **Iron (Fe)** *Enerex* http://www.enerex.ca/products/essential_nutrients/essential_book_iron.htm

[3] **Human iron metabolism** *Wikipedia* http://en.wikipedia.org/wiki/Human_iron_metabolism

[4] **Trace or Micro Minerals NHM 362: Iron** *College of Human Environmental Sciences University of Alabama* http://www.ches.ua.edu/departments/nhm/faculty/neggers/nhm362/Iron 362.pdf

[5] **VITAMIN AND MINERAL REQUIREMENTS IN HUMAN NUTRITION (second edition): 13. Iron** *World Health Organization/UN Food and Agriculture Organization* p249-251 http://whqlibdoc.who.int/publications/2004/9241546123_chap13.pdf

[6] **Iron Requirements in Adolescent Females** John L. Beard *Journal of Nutrition. 2000;130:440S-442S* http://jn.nutrition.org/cgi/content/full/130/2/440S

[7] **The iron balancing act: vegetarians may have the edge** *Loma Linda University* http://www.llu.edu/llu/vegetarian/iron.html

[8] **Hemoglobin** *Wikipedia* http://en.wikipedia.org/wiki/Hemoglobin

[9] **The Interaction of Iron and Erythropoietin** *Brigham's and Women's Hospital Harvard Education* http://sickle.bwh.harvard.edu/iron_epo.html

[10] **Iron Biology in Immune Function, Muscle Metabolism and Neuronal Functioning** John L. Beard *The Journal of Nutrition 131 (2): 568S. (2001)* http://jn.nutrition.org/cgi/reprint/131/2/568S

[11] **Trace or Micro Minerals NHM 362: Iron** *College of Human Environmental Sciences University of Alabama* http://www.ches.ua.edu/departments/nhm/faculty/neggers/nhm362/Iron 362.pdf

[12] **Myoglobin** *Wikipedia* http://en.wikipedia.org/wiki/Myoglobin

[13] **Iron Biology in Immune Function, Muscle Metabolism and Neuronal Functioning** John L. Beard *The Journal of Nutrition 131 (2): 568S. (2001)* http://jn.nutrition.org/cgi/reprint/131/2/568S

[14] **Iron Metabolism and Storage** Graham Jones *Sydney Pathology St Vincent's Hospital Sydney* www.sydpath.stvincents.com.au/other/Presentations/IronLectureOn-Line.PPT

[15] **Recommendations to Prevent and Control Iron Deficiency in the United States** Ray Yip, Ibrahim Parvanta, Mary E. Cogswell, Sharon M. McDonnell, BA Bowman, LM Grummer-Strawn and FL Trowbridge *CDC Morbidity and Mortality Weekly April 3, 1998 / Vol. 47 / No. RR-3* ftp://ftp.cdc.gov/pub/Publications/mmwr/rr/rr4703.pdf

[16] **Iron metabolism in the lower respiratory tract** Fernando Mateos, Jeremy H Brock, José Luis Pérez-Arellano *Thorax 1998;53;594-600* http://thorax.bmj.com/cgi/reprint/53/7/594

[17] **Trace or Micro Minerals NHM 362: Iron** *College of Human Environmental Sciences University of Alabama* http://www.ches.ua.edu/departments/nhm/faculty/neggers/nhm362/Iron 362.pdf
[18] **Iron Biology in Immune Function, Muscle Metabolism and Neuronal Functioning** John L. Beard *The Journal of Nutrition 131 (2): 568S. (2001)* http://jn.nutrition.org/cgi/reprint/131/2/568S
[19] **Iron Metabolism and Storage** Graham Jones *Sydney Pathology St Vincent's Hospital Sydney* www.sydpath.stvincents.com.au/other/Presentations/IronLectureOn-Line.PPT
[20] **Human iron metabolism** *Wikipedia* http://en.wikipedia.org/wiki/Human_iron_metabolism
[21] **Trace or Micro Minerals NHM 362: Iron** *College of Human Environmental Sciences University of Alabama* http://www.ches.ua.edu/departments/nhm/faculty/neggers/nhm362/Iron 362.pdf
[22] **Iron Metabolism and Storage** Graham Jones *Sydney Pathology St Vincent's Hospital Sydney* www.sydpath.stvincents.com.au/other/Presentations/IronLectureOn-Line.PPT
[23] **Human iron metabolism** *Wikipedia* http://en.wikipedia.org/wiki/Human_iron_metabolism
[24] **Iron Metabolism and Storage** Graham Jones *Sydney Pathology St Vincent's Hospital Sydney* www.sydpath.stvincents.com.au/other/Presentations/IronLectureOn-Line.PPT
[25] **Iron Biology in Immune Function, Muscle Metabolism and Neuronal Functioning** John L. Beard *The Journal of Nutrition 131 (2): 568S. (2001)* http://jn.nutrition.org/cgi/reprint/131/2/568S
[26] **Nutrients and their role in host resistance to infection** Catherine J. Field, Ian R. Johnson, and Patricia D. Schley *Journal of Leukocyte Biology Volume 71, January 2002* http://www.jleukbio.org/cgi/reprint/71/1/16
[27] **Role of red meat in the diet for children and adolescents** Geoffrey Cleghorn *The Free Library by Farlex* http://www.thefreelibrary.com/role+of+red+meat
[28] **Iron Biology in Immune Function, Muscle Metabolism and Neuronal Functioning** John L. Beard *The Journal of Nutrition 131 (2): 568S. (2001)* http://jn.nutrition.org/cgi/reprint/131/2/568S
[29] **Recent Evidence from Human and Animal Studies Regarding Iron Status and Infant Development** John Beard *J. Nutr. 137:524S-530S, February 2007* http://jn.nutrition.org/cgi/reprint/137/2/524S
[30] **Iron** Jane Higdon *Micronutrient Information Center, Linus Pauling Institute, Oregon State University* http://lpi.oregonstate.edu/infocenter/minerals/iron/
[31] **Human iron metabolism** *Wikipedia* http://en.wikipedia.org/wiki/Human_iron_metabolism
[32] **Trace or Micro Minerals NHM 362: Iron** *College of Human Environmental Sciences University of Alabama* http://www.ches.ua.edu/departments/nhm/faculty/neggers/nhm362/Iron 362.pdf
[33] **The Molecular Perspective: Cytochrome P450** David S.Goodsell *The Oncologist 2001;6;205-206* http://theoncologist.alphamedpress.org/cgi/reprint/6/2/205
[34] **The Molecular Perspective: Cytochrome c and Apoptosis** David S. Goodsell *The Oncologist, Vol. 9, No. 2, 226–227, April 2004* http://theoncologist.alphamedpress.org/cgi/reprint/9/2/226
[35] **Fluctuations of Intracellular Iron Modulate Elastin Production** Severa Bunda, N Kaviani, and A Hinek *J. Biol. Chem., Vol. 280, Issue 3, 2341-2351, Jan 21, 2005* http://www.jbc.org/cgi/reprint/280/3/2341
[36] **Effect of Ascorbic Acid, Silicon and Iron on Collagen Synthesis in the Human Dermal Fibroblast Cell(HS27)** Jin-ah Lee and Yunhi Cho *The FASEB Journal.2008;22:lb672* http://www.fasebj.org/cgi/content/meeting_abstract/22/2_MeetingAbstracts/672
[37] **Nutrition in Bone Health Revisited: A Story Beyond Calcium** Jasminka Z. Ilich, and Jane E. Kerstetter *Journal of the American College of Nutrition, Vol. 19, No. 6, 715-737 (2000)* http://www.jacn.org/cgi/content/full/19/6/715#SEC9
[38] **The Association between Hematological and Inflammatory Factors and Stress Fractures among Female Military Recruits** Merkel, Drorit; Moran, Daniel S.; Yanovich, Ran; Evans, Rachel K.; Finestone, Aharon S.; Constantini, Naama; Israeli, Eran *Medicine & Science in Sports & Exercise:Volume 40(11) Suppl 1November 2008pp S691-S697* http://www.acsm-msse.org/pt/re/msse/abstract.00005768-200811001-00013.htm
[39] **Iron Biology in Immune Function, Muscle Metabolism and Neuronal Functioning** John L. Beard *The Journal of Nutrition 131 (2): 568S. (2001)* Fig3 http://jn.nutrition.org/cgi/reprint/131/2/568S
[40] **Forging a field: the golden age of iron biology** Nancy C. Andrews *Blood, 15 July 2008 Volume 112, Number 2- ASH 50th anniversary review* http://bloodjournal.hematologylibrary.org/cgi/reprint/112/2/219
[41] **Molecular Control of Iron Transport** Tomas Ganz *J Am Soc Nephrology 18: 394–400, 2007.* http://jasn.asnjournals.org/cgi/reprint/18/2/394.pdf
[42] **Trace or Micro Minerals NHM 362: Iron** *College of Human Environmental Sciences University of Alabama* http://www.ches.ua.edu/departments/nhm/faculty/neggers/nhm362/Iron 362.pdf
[43] **Iron Metabolism and Storage** Graham Jones *Sydney Pathology St Vincent's Hospital Sydney* www.sydpath.stvincents.com.au/other/Presentations/IronLectureOn-Line.PPT
[44] **Occult Gastro-intestinal Bleeding :Detection, Interpretation, and Evaluation** M Beg, M Singh, MK Saraswat, BB Rewari *Journal, Indian Academy of Clinical Medicine Vol. 3, No. 2 April-June 2002* http://medind.nic.in/jac/t02/i2/jact02i2p153.pdf

[45] **Mineral Requirements for Military Personnel: Levels Needed for Cognitive and Physical Performance During Garrison Training - (3) Mineral Recommendations for Military Performance** Institute of Medicine of the National Academies *National Academies Press* p113 http://books.nap.edu/openbook.php?record_id=11610&page=R2

[46] **Gastrointestinal (GI) bleeding in endurance runners.** Stephanie Horn, Edward R. Feller *AMAA Journal Winter 2003* http://findarticles.com/p/articles/mi_m0NHG/is_1_16/ai_98542872/pg_1?tag=content;col1

[47] **Blood Loss Is a Stronger Predictor of Iron Status in Men Than C282Y Heterozygosity or Diet** Anne-Louise M. Heath, Mark A. Roe, Sarah L. Oyston, Andrew R. Gray, Sheila M. Williams and Susan J. Fairweather-Tait *Journal of the American College of Nutrition, Vol. 27, No. 1, 158-167 (2008)* http://www.jacn.org/cgi/content/abstract/27/1/158

[48] **Iron intake does not significantly correlate with iron deficiency among young Japanese women : a cross-sectional study** Keiko Asakuraa, S Sasaki, K Murakamia, Y Takahashia, K Uenishia, M Yamakawaa, Y Nishiwakia, Y Kikuchia, T Takebayashia and the JDSSNBG *Public Health Nutrition Cambridge University Press* http://www.journals.cambridge.org/action/displayAbstract?fromPage=online&aid=2842380

[49] **Mineral Requirements for Military Personnel: Levels Needed for Cognitive and Physical Performance During Garrison Training - (3) Mineral Recommendations for Military Performance** Institute of Medicine of the National Academies *National Academies Press* p112-114 http://books.nap.edu/openbook.php?record_id=11610&page=R2

[50] **The Interaction of Iron and Erythropoietin** *Brigham's and Women's Hospital Harvard Education* http://sickle.bwh.harvard.edu/iron_epo.html

[51] **Trace or Micro Minerals NHM 362: Iron** *College of Human Environmental Sciences University of Alabama* http://www.ches.ua.edu/departments/nhm/faculty/neggers/nhm362/Iron 362.pdf

[52] **VITAMIN AND MINERAL REQUIREMENTS IN HUMAN NUTRITION (second edition): 13. Iron** *World Health Organization/UN Food and Agriculture Organization* p249-251 http://whqlibdoc.who.int/publications/2004/9241546123_chap13.pdf

[53] **Blood Loss Is a Stronger Predictor of Iron Status in Men Than C282Y Heterozygosity or Diet** Anne-Louise M. Heath, Mark A. Roe, Sarah L. Oyston, Andrew R. Gray, Sheila M. Williams and Susan J. Fairweather-Tait *Journal of the American College of Nutrition, Vol. 27, No. 1, 158-167 (2008)* http://www.jacn.org/cgi/content/abstract/27/1/158

[54] **Iron intake does not significantly correlate with iron deficiency among young Japanese women : a cross-sectional study** Keiko Asakuraa, S Sasaki, K Murakamia, Y Takahashia, K Uenishia, M Yamakawaa, Y Nishiwakia, Y Kikuchia, T Takebayashia and the JDSSNBG *Public Health Nutrition Cambridge University Press* http://www.journals.cambridge.org/action/displayAbstract?fromPage=online&aid=2842380

[55] **Relation of Nutrition to Bone Lead and Blood Lead Levels in Middle-aged to Elderly Men: The Normative Aging Study** Yawen Cheng, Walter C. Willett, Joel Schwartz, David Sparrow, S Weiss, and H Hu http://aje.oxfordjournals.org/cgi/content/abstract/147/12/1162

[56] **Maternal blood lead concentration, diet during pregnancy, and anthropometry predict neonatal blood lead in a socioeconomically disadvantaged population** Lawrence M. Schell *E H P Vole111,No 2, Feb 2003* http://www.ehponline.org/members/2003/5592/5592.pdf

[57] **Iron Deficiency Associated with Higher Blood Lead in Children Living in Contaminated Environments** Asa Bradman, Brenda Eskenazi, P Sutton, M Athanasoulis, and L R Goldman *E H P • Volume 109 Number 10 October 2001* http://www.ehponline.org/members/2001/109p1079-1084bradman/EHP109p1079PDF.PDF

[58] **Disorders of the Iron Metabolism: Iron absorption** Brigham's and Women's Hospital http://sickle.bwh.harvard.edu/iron_absorption.html

[59] **Different Mechanisms Mediate Uptake of Lead in a Rat Astroglial Cell Line** Jae Hoon Cheong, Desmond Bannon, Luisa Olivi, Yongbae Kim and Joseph Bressler *Toxicological Sciences vol. 77 no. 2, 2004* http://toxsci.oxfordjournals.org/cgi/reprint/77/2/334

[60] **Iron supplementation protects against lead-induced apoptosis through MAPK pathway in weanling rat cortex** Qiang Wang, Wenjing Luo, Wenbing Zhang, Zhongming Dai, Yaoming Chen, Jingyuan Chen *NeuroToxicology 28 (2007) 850–859* *http://www.beyotime.com/reference/c1115-ref6.pdf*

[61] **Iron supplement prevents lead-induced disruption of the blood/brain barrier during rat development** Qiang Wang, Wenjing Luo, Wei Zheng, Y Liu, H Xua, G Zhenga, Z Dai, W Zhang, Y Chen and J Chen *Toxicology and Applied Pharmacology, Vol 219, Issue 1, 15 February 2007, p33-41 http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6WXH-4MHNRJ1-1*

[62] **Association between blood lead concentrations and body iron status in children** J W Choi, S K Kim *Archives of Disease in Childhood. 2003;88;791-792* http://adc.bmj.com/cgi/reprint/88/9/791

[63] **Iron Fortification Reduces Blood Lead Levels in Children in Bangalore, India** Michael B. Zimmermann, Sumithra Muthayya, Diego Moretti, A. Kurpad and R. F. Hurrell *Pediatrics 2006;117;2014-2021* http://pediatrics.aappublications.org/cgi/reprint/117/6/2014

[64] **Effects of iron therapy on infant blood lead levels** Abraham W. Wolf, Elias Jimenez, Betsy Lozoff *The Journal of Pediatrics Vol 143 Issue 6 p789-795 (December 2003)* http://www.jpeds.com/article/S0022-3476(03)00540-7/abstract

[65] **Maternal blood lead concentration, diet during pregnancy, and anthropometry predict neonatal blood lead in a socioeconomically disadvantaged population** Lawrence M. Schell *Environmental Health Perspectives Volume111,Number 2, Feb 2003* http://www.ehponline.org/members/2003/5592/5592.pdf

[66] **Maternal Iron Deficiency and the Risk of Schizophrenia in Offspring** Beverly J. Insel; C.A. Schaefer; I. W. McKeague; E.S. Susser; A.S. Brown *Arch Gen Psychiatry. 2008;65(10):1136-1144* http://www.coaching-for-health.net/eisenzentrum/studien/studie48.pdf

[67] **Prenatal Lead Exposure, delta-Aminolevulinic Acid, and Schizophrenia** MGA Opler, AS Brown, J Graziano, M Desai, W Zheng, C Schaefer, P Factor-Litvak, & ES Susser *Environmental Health Perspectives, Vol 112 No 5 April 2004* http://www.ehponline.org/members/2004/6777/6777.html

[68] **Pica** SBN Dugan http://www.healthatoz.com/healthatoz/Atoz/common/standard/transform.jsp

[69] **Managing Elevated Blood Lead Levels Among Young Children: Chapter 4 - Nutritional Assessment and Interventions** CDC Advisory Committee on Childhood Lead Poisoning Prevention http://www.cdc.gov/nceh/lead/casemanagement/caseManage_chap4.htm

[70] **Iron and/or Zinc Supplementation Did Not Reduce Blood Lead Concentrations in Children in a Randomized, Placebo-Controlled Trial** Jorge L. Rosado, Patricia Lo´ pez, Katarzyna Kordas, G. Garcı´a-Vargas, D. Ronquillo, J. Alatorre, and R. J. Stoltzfus *J. Nutr. 2006 136: 2378-2383*. http://jn.nutrition.org/cgi/content/full/136/9/2378

[71] **Low Blood Lead Levels Do Not Appear to Be Further Reduced by Dietary Supplements** Brian L. Gulson, Karen J. Mizon, Michael J. Korsch, and Alan J. Taylor • *EHP VOLUME 114, NUMBER 8, August 2006* http://www.ehponline.org/members/2006/8605/8605.pdf

[72] **The role of iron therapy in childhood plumbism** Wright, RO *Current Opinions in Pediatrics 11(3):255-258, June 1999.* http://www.ncbi.nlm.nih.gov/pubmed/10349106?dopt=Abstract

[73] **Iron Update: Why do I need iron? Types of iron, What are the factors that can affect iron absorption? What are some foods that contain iron? What about iron deficiency? Can I have too much iron? Iron intake & children, Iron intake in Teenagers, Final Iron-clad tips** Melinda Ramsay, Dec 2001 http://sanitarium-au.hosting.co.nz/article/article.do?art-id=88

[74] **Dietary treatment of iron deficiency in women of childbearing age** Amanda J Patterson, Wendy J Brown, David CK Roberts, and Michael R Seldon *Am J Clin Nutr 2001;74: 650–6.* http://www.ajcn.org/cgi/reprint/74/5/650

[75] **Can Dietary Treatment of Non-Anemic Iron Deficiency Improve Iron Status?** Anne-Louise M. Heath C. Murray Skeaff, Sue M. O'Brien , Sheila M. Williams and RS Gibson *J Am College of Nutrition, Vol. 20, No. 5, 477–484 (2001)* http://www.jacn.org/cgi/reprint/20/5/477

[76] **How important is dietary iron bioavailability?** Janet R Hunt *The American Journal of Clinical Nutrition 2001;73:3–4 Editorial* http://www.ajcn.org/cgi/reprint/73/1/3

[77] **Iron imports. IV. Hepcidin and regulation of body iron metabolism** Tomas Ganz and Elizabeta Nemeth *Am J Physiol Gastrointest Liver Physiol 290: G199–G203, 2006* http://ajpgi.physiology.org/cgi/reprint/290/2/G199

[78] **The Interaction of Iron and Erythropoietin** *Brigham's and Women's Hospital Harvard Education* http://sickle.bwh.harvard.edu/iron_epo.html

[79] **Iron Requirements in Adolescent Females** John L. Beard *Journal of Nutrition. 2000;130:440S-442S* http://jn.nutrition.org/cgi/content/full/130/2/440S

[80] **The iron balancing act: vegetarians may have the edge** *Loma Linda University* http://www.llu.edu/llu/vegetarian/iron.html

[81] **Bioavailability of iron, zinc, and other trace minerals from vegetarian diets** Janet R. Hunt *Am J Clin Nutr 2003;78(suppl):633S–9S* http://www.ajcn.org/cgi/reprint/78/3/633S

[82] **Heme and Chlorophyll Intake and Risk of Colorectal Cancer in the Netherlands Cohort Study** Helena F. Balder, Johande Vogel, Margje C.J.F. Jansen, Matty P. Weijenberg, Piet A. van den Brandt, Susanne Westenbrink, Roelof van der Meer and R. Alexandra Goldbohm *Cancer Epidemiology Biomarkers & Prevention Vol. 15, 717-725, April 2006* http://cebp.aacrjournals.org/cgi/content/full/15/4/717

[83] **Micronutrient Interactions: Impact on Child Health and Nutrition** *International Life Sciences Institute* http://hni.ilsi.org/NR/rdonlyres/8A79C2B5-FE87-4D0E-A165-66E3CB42BE46/0/o4.pdf

[84] **Principles Of Medical Physiology: Chapter 25 Hematinic Factors** Sabyasachi Sircar *Theime 2008* *http://books.google.com/books*

[85] **Gastric Balance: Heartburn Not Always Caused by Excess Acid** Jim English *Nutrition Review* http://www.nutritionreview.org/library/gastric.acid.html

[86] **Iron and Ascorbic Acid: Proposed Fortification Levels and Recommended Iron Compounds** Sean R. Lynch and Rebecca J. Stoltzfus *J. Nutr. 133:2978S-2984S, September 2003* http://jn.nutrition.org/cgi/content/full/133/9/2978S

[87] **Iron Metabolism and Storage** Graham Jones *Sydney Pathology St Vincent's Hospital Sydney* www.sydpath.stvincents.com.au/other/Presentations/IronLectureOn-Line.PPT

[88] **Effect of ascorbic acid intake on nonheme-iron absorption from a complete diet** James D Cook and Manju B Reddy *American Journal of Clinical Nutrition, Vol. 73, No. 1, 93-98, January 2001* http://www.ajcn.org/cgi/reprint/73/1/93

[89] **The Effect of Ascorbic Acid Supplementation on the Blood Lead Levels of Smokers** Earl B. Dawson, Douglas R. Evans, William A. Harris, MC Teter, WJ McGanity *J Am College of Nutr, Vol. 18, No. 2, 166–170 (1999)* http://www.jacn.org/cgi/reprint/18/2/166.pdf

[90] **Oily Fish Increases Iron Bioavailability of a Phytate Rich Meal in Young Iron Deficient Women** Santiago Navas-Carretero, Ana M. Pérez-Granados, Beatriz Sarriá, A Carbajal, MM Pedrosa, MA Roe, SJ Fairweather-Tait, and MP Vaquero *J Am College of Nutrition, Vol. 27, No. 1, 96-101 (2008)* http://www.jacn.org/cgi/content/abstract/27/1/96

[91] **The Interaction of Alcohol and Iron-Overload in the in-vivo Regulation of Iron Responsive Genes** Callie Crist, Elizabeth Klein, John Gollan and Dee Harrison-Findik, Jonathan Frye *Cantaurus, Vol. 15, 2-6, May 2007* http://www.mcpherson.edu/science/cantaurus/07-crist.pdf

[92] **Effects of Alcohol Consumption on Indices of Iron Stores and of Iron Stores on Alcohol Intake Markers** J. B. Whitfield, G. Zhu, A. C. Heath, L. W. Powell, and N. G. Martin Alcohol *Clin Exp Res, Vol 25, No 7, 2001: pp 1037–1045* http://genepi.qimr.edu.au/contents/p/staff/CV301.pdf

[93] **Determinants of the Blood Lead Level of US Women of Reproductive Age** Lee, Mi-Gyung Chun, Ock Kyoung Sung, Wan O. *Journal of the American College of Nutrition* http://www.jacn.org/cgi/reprint/24/1/1

[94] **Factors influencing the difference between maternal and cord blood lead** Harville,EW Hertz-Picciotto,I Schramm,M Watt-Morse,M Chantala,K Osterloh,J Parsons,PJ Rogan,W *Occupational and Environmental Medicine Online* *http://oem.bmj.com/cgi/reprint/62/4/263*

[95] **Calcium: effect of different amounts on nonheme and heme-iron absorption in humans** Leif Hallberg, Mats Brune, Martine Erlandsson, A-S Sandberg, and L Rossander-Hult *Am J Clin Nutr 1991;53: 112-19.* http://www.ajcn.org/cgi/reprint/53/1/112

[96] **Calcium Intake Is Weakly but Consistently Negatively Associated with Iron Status in Girls and Women in Six European Countries** L.P.L. van de Vijver, A.F.M. Kardinaal, J. Charzewska, M. Rotily, P. Charles,M. Maggiolini, S. Ando, K. Va¨ a¨ na¨ nen, B. Wajszczyk, J. Heikkinen, A. Deloraineand G. Schaafsma *J Nutr 1999;129:963-968.* http://jn.nutrition.org/cgi/reprint/129/5/963

[97] **Inhibitory effects of dietary calcium on the initial uptake and subsequent retention of heme and nonheme iron in humans: comparisons using an intestinal lavage method** Zamzam K (Fariba) Roughead, Carol A Zito, and Janet R Hunt *Am J Clin Nutr 2005;82:589–97.* http://www.ajcn.org/cgi/reprint/82/3/589

[98] **Effect of soy protein on nonheme iron absorption in man** Leıf Hallberg and Lena Rossander *Am J Clin Nutr 36: September 1982, Pp 5 14-520.* http://www.ajcn.org/cgi/reprint/36/3/514

[99] **Effect of traditional oriental soy products on iron absorption** Bruce J Macfarlane, William B van der Riet, Thomas H Bothwell, Roy D Baynes, David Siegenberg, Uta Schmidt, Anat Tal, John RN Taylor, and Fatima Mayet *Am J Clin Nutr 1990;5 I :873-80.* http://www.ajcn.org/cgi/reprint/51/5/873

[100] **Food Safety and Toxicity** John De Vries *CRC Press 1997 http://books.google.com/books?id=ag4z1Pp9cLAC&pg*

[101] **The influence of different protein sources on phytate inhibition of nonheme-iron absorption in humans** Manju B Reddy, Richard F Hurrell, Marcel A Juillerat, and JD Cook *Am J Clin Nutr Feb l996;63:203-7.* http://www.ajcn.org/cgi/reprint/63/2/203

[102] **Iron Metabolism and Storage** Graham Jones *Sydney Pathology St Vincent's Hospital Sydney* www.sydpath.stvincents.com.au/other/Presentations/IronLectureOn-Line.PPT

[103] **Inhibition of non-haem iron absorption in man by polyphenolic-containing beverages** Richard F. Hurrell, Manju Reddy and James D. Cook *Br J Nutr (1999), 81, 289–295* http://journals.cambridge.org/download.php?file=%2FBJN%2FBJN81_04%2FS00071

[104] **Inhibition of food iron absorption by coffee** Timothy A Morck, Sean A Lynch, James D Cook *Am J Clin Nutr 1983;73:416-420* http://www.ajcn.org/cgi/reprint/37/3/416

[105] **Disorders of the Iron Metabolism: Iron absorption** Brigham's and Women's Hospital [Note that this article predates the discovery of the regulatory role of hepcidin or DMT1; contrast with **Forging a field**] http://sickle.bwh.harvard.edu/iron_absorption.html

[106] **Plant Pigments Enhance Iron Absorption** *Softpedia* http://news.softpedia.com/news/Plant-Pigments-Enhance-Iron-Absorption-34897.shtml

[107] **Ascorbic acid prevents the dose-dependent inhibitory effects of polyphenols and phytates on nonheme-iron absorption** David Siegenberg, Roy D Baynes, Thomas H Bothwell, BJ Macfarlane, RD Lamparelli, NG Car, P MacPhail, U Schmidt, A Ta!, and F Mayet *Am J Clin Nuir l99l;53:537-41 Feb 1991* http://www.ajcn.org/cgi/reprint/53/2/537

[108] **Prediction of dietary iron absorption: an algorithm for calculating absorption and bioavailability of dietary iron** Leif Hallberg and Lena Hulthén *Am J Clin Nutr, Vol. 71, No. 5, 1147-1160, May 2000* http://www.ajcn.org/cgi/content/full/71/5/1147

109 **The Levels of Calcium and Zinc that Are Found Naturally in Foods or in Calcium-Fortified Foods Do Not Affect Iron Absorption** Penelope Nestel and Ritu Nalubola *ILSI* www.geocities.com/tiger_angie/ironcalc.pdf

110 **Effect of high-dose iron supplements on fractional zinc absorption and status in pregnant women** Linda J Harvey, Jack R Dainty, Wendy J Hollands, Victoria J Bull, Jurien A Hoogewerff, Robert J Foxall, L McAnena, JJ Strain, and SJ Fairweather-Tait *Am J Clinl Nutr, Vol. 85, No. 1, 131-136, January 2007* http://www.ajcn.org/cgi/reprint/85/1/131

111 **Micronutrient interactions: effects on absorption and bioavailability** Brittmarie SandstroÈm British Journal of Nutrition (2001), 85, Suppl. 2, S181±S185 *http://journals.cambridge.org/download.php?file=%2FBJN%2FBJN85_S2%2FS000711450100109Xa.pdf&code=8fa23a52c05c78cc50aadfcbedad50cd*

112 **A community-based randomized controlled trial of iron and zinc supplementation in Indonesian infants: interactions between iron and zinc** Torbjörn Lind, Bo Lönnerdal, Hans Stenlund, D Ismail, R Seswandhana, E-C Ekström, and L-Å Persson *Am J Clin Nutr 2003;77:883–90.* http://www.ajcn.org/cgi/reprint/77/4/883.pdf

113 **Element of caution: a case of reversible cytopenias associated with excessive zinc supplementation** Julie A. Irving, Andre Mattman, Gillian Lockitch, Kevin Farrell and Louis D. Wadsworth *CMAJ July 22, 2003; 169 (2)* http://www.cmaj.ca/cgi/content/full/169/2/129

114 **Dietary Copper Deficiency Reduces Iron Absorption and Duodenal Enterocyte Hephaestin Protein in Male and Female Rats** Philip G. Reeves, Lana C. S. DeMars, W. Thomas Johnson and Henry C. Lukaski *J. Nutr. 135:92-98, January 2005 http://jn.nutrition.org/cgi/content/full/135/1/92*

115 **Signs of Iron Deficiency in Copper-deficient Rats Are Not Affected by Iron Supplements Administered by Diet or by Injection** Reeves, Phillip and Demars, Lana *Journal of Nutritional Biochemistry Sepr 1, 2006* http:/www.ars.usda.gov/research/publications/publications.htm [address does not permit hyperlink form authors machine]

116 **Copper** Jane Higdon *Micronutrient Information Center, Linus Pauling Institute, Oregon State University* http://lpi.oregonstate.edu/infocenter/minerals/copper/

117 **Competitive inhibition of iron absorption by manganese and zinc in humans** Lena Rossander-Hulten, Mats Brune, Britimarie Sandstrom, Bo Lonnerdal, and Leif Hallberg *Am J Clin Nutr 1991;54:l52-6.* http://www.ajcn.org/cgi/reprint/54/1/152

118 **Manganese** Jane Higdon *Micronutrient Information Center, Linus Pauling Institute, Oregon State University* http://lpi.oregonstate.edu/infocenter/minerals/manganese/

119 **Iron** Jane Higdon *Micronutrient Information Center, Linus Pauling Institute, Oregon State University* http://lpi.oregonstate.edu/infocenter/minerals/iron/

120 **Iron supplementation in early childhood: health benefits and risks** Lora L Iannotti, James M Tielsch, Maureen M Black and Robert E Black *American Journal of Clinical Nutrition, Vol. 84, No. 6, 1261-1276, December 2006* http://www.ajcn.org/cgi/reprint/84/6/1261

121 **How much iron do pregnant women need?** Steve Austin *Original Internist Sept 2005* http://findarticles.com/p/articles/mi_m0FDL/is_3_12/ai_n17211125/pg_2?tag=content;col1

122 **Behavioral and Developmental Effects of Preventing Iron-Deficiency Anemia in Healthy Full-Term Infants** Betsy Lozoff. Isidora De Andraca, Marcela Castillo, Julia B. Smith, Tomas Walter and Paulina Pino *Pediatrics 2003;112;846*-854 http://pediatrics.aappublications.org/cgi/reprint/112/4/846

123 **Iron supplementation protects against lead-induced apoptosis through MAPK pathway in weanling rat cortex** Qiang Wang, Wenjing Luo, Wenbing Zhang, Zhongming Dai, Yaoming Chen, Jingyuan Chen *NeuroToxicology 28 (2007) 850–859* *http://www.beyotime.com/reference/c1115-ref6.pdf*

124 **Iron Supplementation Affects Growth and Morbidity of Breast-Fed Infants: Results of a Randomized Trial in Sweden and Honduras** Kathryn G. Dewey, Magnus Domellöf, Roberta J. Cohen, LL Rivera, O Hernell and B Lönnerdal *J. Nutr. 132:3249-3255, Nov 2002* http://jn.nutrition.org/cgi/content/full/132/11/3249

125 **Iron supplements might harm infants who have enough** *e!Science News* http://esciencenews.com/articles/2008/05/05/iron.supplements.might.harm.infants.who.have.enough

126 **Neurodevelopmental Delays Associated With Iron-Fortified Formula for Healthy Infants** Martha Kerr *Cidpusa Foundation* http://www.cidpusa.org/fortified%20food.htm

127 **Once-Weekly and 5-Days a Week Iron Supplementation Differentially Affect Cognitive Function but Not School Performance** Rassamee Sungthong, Ladda Mo-suwan, Virasakdi Chongsuvivatwong and Alan F. Geater *J. Nutr. 134:2349-2354, September 2004* http://jn.nutrition.org/cgi/reprint/134/9/2349

128 **Iron Deficiency Associated with Higher Blood Lead in Children Living in Contaminated Environments** Asa Bradman, Brenda Eskenazi, P Sutton, M Athanasoulis, and L R Goldman *E H P • Volume 109 Number 10 October 2001* http://www.ehponline.org/members/2001/109p1079-1084bradman/EHP109p1079PDF.PDF

129 **Body iron metabolism and pathophysiology of iron overload** Yutaka Kohgo, Katsuya Ikuta, Takaaki Ohtake, Yoshihiro Torimoto, Junji Kato *Int J Hematol (2008) 88:7–15* http://www.springerlink.com/content/324238m67285n133/fulltext.pdf

130 **Intermittent Iron Supplementation Regimens Are Able to Maintain Safe Maternal Hemoglobin Concentrations during Pregnancy** Juan P. Pena-Rosas, Malden C. Nesheim, Maria N. Garcia-Casal, D.W.T. Crompton,D Sanjur, FE Viteri, EA Frongillo, and P Lorenzana *J Nutr 134 (5): 1009 (2004)* http://jn.nutrition.org/cgi/reprint/134/5/1099

131 **Efficacy of Twice Weekly Iron Supplementation in Anemic Adolescent Girls** S. Shobha and D. Sharada *Indian Pediatrics 2003; 40:1186-1190* http://www.intensivenutrition.com/Intensive%20Nutrition/anemicgirls.pdf

132 **Iron deficiency in Europe** Serge Hercberg, Paul Preziosi and Pilar Galan *Public Health Nutrition: 4(2B), 537±545 2001* http://journals.cambridge.org/download.php?file=%2F7D42F368FEE9E89B68B5E3CB008D74F5_tomcat1

133 **Host-Pathogen Interactions: The Role of Iron** Conor P. Doherty *J. Nutr. 137:1341-1344, May 2007* http://jn.nutrition.org/cgi/content/full/137/5/1341

134 **The Role of Iron in Diabetes and Its Complications** Sundararaman Swaminathan, Vivian A. Fonseca, Muhammad G. Alam, Sudhir V. Shah *Diabetes Care 30:1926-1933, 2007* http://care.diabetesjournals.org/cgi/content/full/30/7/1926

135 **Iron, Lipids, and Risk of Cancer in the Framingham Offspring Cohort** Arch G. Mainous III, Brian J. Wells, Richelle J. Koopman, Charles J. Everett, and James M. Gil *Am Journal of Epidemiology 2005;161:1115–1122* http://aje.oxfordjournals.org/cgi/reprint/161/12/1115

136 **Cholesterol, Transferrin Saturation, and the Development of Dementia and Alzheimer's Disease: Results From an 18-year Population-based Cohort** Arch G. Mainous III; Stephanie L. Eschenbach; Brian J. Wells, CJ Everett,; JM Gill *Family Medicine January 2005* http://www.stfm.org/fmhub/fm2005/January/Arch36.pdf

137 **Iron overload and cofactors with special reference to alcohol, hepatitis C virus infection and steatosis/insulin resistance** Yutaka Kohgo, Katsuya Ikuta, Takaaki Ohtake, Yoshihiro Torimoto, Junji Kato *World J Gastroenterol 2007 September 21; 13(35): 4699-4706* http://www.wjgnet.com/1007-9327/13/4699.pdf

138 **Association of Elevated Serum Ferritin Levels and the Risk of Gestational Diabetes Mellitus in Pregnant Women: The Camden study** XINHUA CHEN, THERESA O. SCHOLL, T. PETER STEIN *DIABETES CARE, VOLUME 29, NUMBER 5, MAY 2006* http://care.diabetesjournals.org/cgi/reprint/29/5/1077

139 **Third trimester iron status and pregnancy outcome in non-anemic women: pregnancy unfavourably affected by maternal iron excess** T.T. Lao, K.-F. Tam and L.Y. Chan *Human Reproduction Vol15 No8 pp.1843-1848, 2000* http://humrep.oxfordjournals.org/cgi/reprint/15/8/1843

140 **Anemia and iron deficiency: effects on pregnancy outcome** Lindsay H Allen *Am J Clin Nutr 2000;71(suppl):1280S–4S.* http://www.ajcn.org/cgi/reprint/71/5/1280S

141 **The Plausibility of Micronutrient Deficiencies Being a Significant Contributing Factor to the Occurrence of Pregnancy Complications** Carl L. Keen, Michael S. Clegg, LA Hanna, L Lanoue, JM Rogers, GP Daston, P Oteiza and JY Uriu-Adams *J. Nutr. 133:1597S-1605S, May 2003* http://jn.nutrition.org/cgi/content/full/133/5/1597S

142 **Iron requirements in pregnancy and strategies to meet them** T H Bothwell *Am J Cl Nutr, Vol. 72, No. 1, 257S-264s, July 2000* http://www.ajcn.org/cgi/reprint/72/1/257S

143 **Iron supplementation - is it necessary for healthy pregnancy?** Sandra Elias *New Zealand College of Midwives Journal October 2007* http://findarticles.com/p/articles/mi_6845/is_37/ai_n28467158/print

144 **Why Iron levels remain Low** Tony Pearce *Femail* http://www.femail.com.au/iron-levels-tony-pearce.htm

145 **The Global Burden of Iron Deficiency** Suchitra Chinthapalli *The Lancet Student June 4th, 2008* http://www.thelancetstudent.com/2008/06/04/the-global-burden-of-iron-deficiency/

146 **Iron Metabolism and Storage** Graham Jones *Sydney Pathology St Vincent's Hospital Sydney* www.sydpath.stvincents.com.au/other/Presentations/IronLectureOn-Line.PPT