



Vegetarian Nutrition

a dietetic practice group of the
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RD Resources for Professionals:

Iron in Vegetarian Diets

Iron Overview

Iron is a mineral that is naturally present in many foods, added to some food products, and available as a dietary supplement.¹ It is an abundant mineral necessary for all living organisms. The human body requires iron for the synthesis of its oxygen transport proteins, in particular hemoglobin and myoglobin, and for the formation of heme enzymes and other iron-containing enzymes involved in electron transfer and oxidation-reduction reactions.² Iron is recycled and thus conserved by the body. It is not readily lost from the body, with the exception of menstruation, other bleeding or pregnancy.³

Iron Deficiency

Iron is transported throughout the body as part of the transferrin protein and is stored as ferritin. The earliest stage of iron deficiency occurs when stores are depleted, characterized by a drop in serum ferritin levels and an increase in total iron binding capacity that refers to incomplete saturation of the transferrin molecule. Serum ferritin levels below 12 µg/l are associated with complete depletion of storage iron.

In early functional iron deficiency, characterized by low serum transferrin saturation, normal red blood cell formation is impaired, but not enough to cause a measurable anemia.

Iron deficiency anemia (IDA) is characterized by small (microcytic) red blood cells due to a lack of hemoglobin. Low values for hemoglobin concentration in blood, red blood cell count, hematocrit (the percentage, by volume, of red blood cells in whole blood), mean corpuscular volume (the size of the average red blood cell), and erythrocyte hemoglobin concentration are all potentially indicative of IDA.

Because iron deficiency is not the only cause of anemia, multiple measures of iron status should be taken to determine if an anemia is truly from iron deficiency. The Centers for Disease Control (CDC) defines iron deficiency as abnormal values for any two of these parameters: serum ferritin, transferrin saturation, and free erythrocyte protoporphyrin. The CDC defines iron deficiency anemia as iron deficiency with a low hemoglobin value.

Many iron deficiency symptoms are related to tissue oxygen deprivation: fatigue, rapid heart rate, palpitations, rapid breathing on exertion, and increased lactic acid production.

Dietary Iron

Iron in foods is categorized as heme, which is part of hemoglobin and myoglobin, and non-heme. Meat contains both types of iron while plants contain only non-heme. Vegetarians generally consume as much iron as, or slightly more than, omnivores.⁴

Heme iron is more readily absorbed than non-heme, at a rate of about 15 to 35%. Non-heme iron absorption varies between 2 and 30%, depending on inhibitors and enhancers in the diet and on iron status. Absorption of iron, especially non-heme iron, increases when ferritin levels are low.⁴

Inhibitors include phytates found in legumes and grains, polyphenols in coffee and in black, green, and many herbal teas⁵, and calcium supplements. Vitamin C (ascorbic acid) is a strong enhancer of iron absorption and can counteract effects of inhibitors.

The addition of 50 mg of vitamin C counteracted the inhibiting effects of phytate, and adding 150 mg of vitamin C increased iron absorption to almost 30%.

Similarly, in the presence of a large dose of tannic acid, 100 mg of vitamin C increased iron absorption from 2 to 8%.⁶

Recommended Dietary Allowance for Iron

Age	Intake (mg)	UL (mg)
Children		
0 - 6 months	.27*	40
7 - 12 months	11	40
1 - 3	7	40
4 - 8	10	40
9 - 13	8	40
Men		
14 - 18	11	45
19+	8	45
Women		
14 - 18	15	45
19 - 50	18	45
51+	8	45
Pregnant	27	45
Breastfeeding 14-30	10	45
Breastfeeding 30+	9	45

*Adequate intake based on the amount of iron in breast milk

Tolerable Upper Intake Level (UL)

Adults with normal intestinal function have very little risk of iron overload from dietary sources of iron.² The tolerable upper limit (UL) for males and females under the age of 13 is 40 mg. The UL for anyone above 13 is 45 mg.⁴ The UL is based on gastrointestinal distress.⁷ The UL is not intended for people being treated for iron deficiency under close medical supervision.

Athletes

Due to gastrointestinal blood loss and red blood cell destruction, the average requirement for iron may be 30 to 70% higher for those who engage in regular, intense endurance exercise, especially running.⁷ The American College of Sports Medicine recommends that vegetarian athletes should exceed the RDA for iron, and should be screened periodically to assess and monitor iron status, especially during adolescence or pregnancy.⁸

Iron Status of Vegetarians

Cross-sectional studies show that average iron intakes of male vegetarians (including lacto-ovo vegetarians and vegans) range from 14-18 mg/day from food and 23 mg/day including supplements.^{9,10} Male vegetarians' average serum ferritin levels range from 30-75 µg/l.¹⁰⁻¹²

Among female vegetarians, average iron intake is 12-15 mg/day from food.^{10,17} Female vegetarians' average serum ferritin levels range from 11-35 µg/l.^{13,15,16} Between 25 and 50% of white vegetarian women have been found to be iron deficient, compared to 20-60% of the omnivore women.^{16,17} Vegan women over 50 had a deficiency rate of only 12%.¹⁵

Iron RDA for Vegetarians

Research suggests that iron absorption varies greatly between omnivore diets, vegetarian diets, and vegan diets at 18%, 10%, and 5% respectively.⁹ These recommendations are based on findings from two clinical trials in which omnivores consumed typical lacto-ovo vegetarian diets or diets with varying amounts of enhancers and inhibitors of absorption.^{17,18} However, these and other studies of omnivores placed on vegetarian diets don't consider adaptation that may take place over a longer period or the effects of vitamin C.

Conclusion

Despite lower iron stores, vegetarian men appear to have adequate iron status and these lower stores may be associated with reduced risk for chronic disease. Both vegetarian and non-vegetarian women are at risk for iron deficiency. Vegetarian women should give particular attention to including vitamin C sources with meals. Benefits of iron supplements are unknown, particularly if there is no evidence of deficiency. If there is any concern about a client's iron levels, a physician should examine the client's serum ferritin to assess and determine if dietary support or iron supplementation is needed. Iron supplements providing more than 20 mg of iron should be used only under the supervision of a physician.

References for this resource are available at <http://vndpg.org/resources/iron>