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Prenatal Nutrition Guidelines for Health Professionals



IRON

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ACKNOWLEDGEMENT

Health Canada sincerely thanks the members of the Expert Advisory Group on National Nutrition Pregnancy Guidelines who generously gave their time and expertise over the course of preparing these guidelines:

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We gratefully acknowledge Dr. George H. Beaton, Professor Emeritus, University of Toronto, who provided expert advice on the methodology for the modeling of supplement level and dietary iron adequacy.

Health Canada would also like to thank the many stakeholders who took part in the online consultation process and provided feedback on draft content of the guidelines.

Également offert en français sous le titre :

Lignes directrices sur la nutrition pendant la grossesse à l'intention des professionnels de la santé – Le fer contribue à une grossesse en santé

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Cat.: H164-109/1-2009E-PDF
ISBN: 978-1-100-12207-6

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Iron Contributes to a Healthy Pregnancy

Iron is an essential nutrient at every stage of life. It is a critical component of proteins such as enzymes and hemoglobin. Almost two-thirds of iron in the body is in the hemoglobin present in circulating red blood cells. Hemoglobin moves oxygen to the tissues for metabolism (IOM, 2001). During pregnancy, women need more iron to support the increased maternal red blood cell mass. This supplies the growing fetus and placenta, and supports normal brain development in the fetus. In the third trimester of pregnancy, the fetus builds iron stores for the first six months of life (Fernández-Ballart, 2000).

KEY MESSAGES ON IRON FOR PREGNANT WOMEN

- Eating according to Canada's Food Guide and taking a daily multivitamin that has 16 to 20 mg of iron will help you have a healthy pregnancy.
- Some women may need more iron than others. Talk to your health care provider to find out how much iron is right for you.

RECOMMENDED IRON INTAKE DURING PREGNANCY (IOM, 2001)

Hemoglobin mass changes very little during the first trimester of pregnancy. However, it expands greatly during the second and third trimesters. This means, as pregnancy progresses, women need more iron.

The Recommended Dietary Allowance (RDA)¹ for iron during pregnancy is 27 mg per day. This is the average amount of iron most healthy pregnant women need each day to meet their iron needs. The RDA is set at a level that lets women begin storing iron early in their pregnancy. That way, they build up the iron they'll need to take them through their third trimester. This level takes into account:

- normal iron losses,
- iron used by the fetus and related tissues,
- iron needed as a woman's hemoglobin mass expands, and
- that approximately 25% of iron from a mixed diet² is absorbed during the second and third trimesters of pregnancy.

(1) The Recommended Dietary Allowance or RDA is the average daily dietary nutrient intake that is sufficient to meet the nutrient requirements of nearly all (97-98%) healthy individuals in a particular life stage and gender group. The RDA for a nutrient can be used as a guide for daily intake (IOM, 2006).

(2) Typical North American mixed diets contain both heme and non-heme iron, as well as food sources of vitamin C.

TAKING AN IRON SUPPLEMENT DURING PREGNANCY

Most pregnant women in North America have trouble getting the iron they need through diet alone (Fernández-Ballart and Murphy, 2001; Hercberg et al, 2000; IOM, 2001; Turner et al, 2003; Cooper et al, 2006). Health Canada used a statistical modelling process to determine the level of iron from supplements that would be needed to complement usual dietary iron intakes of Canadian women. The combined intake (usual dietary intake + supplement) was evaluated using the iron requirement values given and assessment methods developed by the Institute of Medicine (IOM, 2000). Health Canada also conducted a safety assessment to ensure that the combined intake did not exceed the Tolerable Upper Intake Level (UL)³ for pregnancy, which is 45 mg of iron each day.

Information on this modelling process is available for review (Cockell et al, 2009).

HOW MUCH SUPPLEMENTAL IRON DO PREGNANT WOMEN NEED?

A daily supplement containing 16 to 20 mg of iron is recommended during pregnancy. Based on the results of the modelling process, it was concluded that a supplement of 16 mg per day throughout pregnancy would be effective and safe for pregnant women who are in good health. When added to the iron they get from a mixed diet⁴, these women would have all the iron they need for pregnancy (Cockell et al, 2009). Additionally, supplementing well nourished pregnant women with 20 mg of iron per day has been shown to be effective in reducing the prevalence of iron deficiency and iron deficiency anemia at the time of delivery (Makrides et al, 2003).

SELECTING AN IRON-CONTAINING SUPPLEMENT

Health Canada recommends a supplement that has 16 to 20 mg of iron in each daily dose. Health Canada also recommends that pregnant women take a daily multivitamin⁵ containing 400 mcg (0.4 mg) of folic acid (Health Canada, 2009). Women can find both nutrients in a multivitamin.

IRON DEFICIENCY AND IRON DEFICIENCY ANEMIA

During pregnancy women may not get enough iron because they:

- need more iron than they did before they were pregnant,

(3) The Tolerable Upper Intake Level or UL is the highest average daily nutrient intake level likely to pose no risk of adverse health effects to almost all individuals in a given life-stage and gender group. The UL is not a recommended level of intake. As intake increases above the UL, the potential risk of adverse effects increases (IOM, 2006).

(4) Health Canada did not define the amount of supplemental iron that vegetarians need during pregnancy. Canadian survey data did not have sufficient information to determine how much iron comes from vegetarian diets. Health Professionals should assess these women early in their pregnancies to provide specific advice on their iron needs.

(5) The term 'multivitamin' is used throughout this text as a short form for 'multivitamin/multimineral supplement'.

- do not eat enough foods containing iron, or
- do not absorb enough iron from the foods they eat due to low iron bioavailability of the diet.

Not getting enough iron during pregnancy can cause: fatigue, reduced work capacity, cardiovascular stress, lower resistance to infection and iron deficiency. Iron deficiency can lead to:

- maternal anemia,
- premature delivery,
- low birth weight, and
- an increased risk of perinatal infant mortality (Hercberg et al, 2000; IOM, 2001).

Iron deficiency anemia is the most common nutritional deficiency during pregnancy (WHO, 1992). It happens most often during the third trimester of pregnancy (IOM, 2001). The stages of iron deficiency and iron deficiency anemia are well documented and clinical diagnostic cut-off values have been established (IOM, 2006).

The recommendations in this document were not established for women who have pre-existing iron deficiency or iron deficiency anemia. These women should be assessed to determine how much additional iron they need from supplements.

CHOOSING DIETARY SOURCES OF IRON

Dietary iron has two forms: heme iron and non-heme iron. Heme is found only in meat, poultry and fish. It is better absorbed than the non-heme form. It is also less affected by dietary factors that hinder iron absorption. This makes it an important dietary source of iron. Heme iron can provide up to one third of the total dietary iron that the body absorbs (Bjorn-Rasmussen et al, 1974).

Most of the iron we eat is in the non-heme form (IOM, 2006). About 60% of the iron found in meat, poultry and fish is in the non-heme form (Beard et al, 1996). Eggs and plant-based foods, such as legumes, vegetables, fruit, grains, nuts, and iron fortified grain products contain only the non-heme form.

Tables 1 and 2 list foods that contain heme and non-heme iron.

TABLE 1 FOODS THAT CONTAIN A COMBINATION OF HEME AND NON-HEME IRON

Food	Iron in milligrams^a per Food Guide Serving (75 g, cooked)
Beef	1.5-3 mg
Shrimp	2 mg
Sardines	2 mg
Lamb	1.5-1.8 mg
Chicken	1 mg
Pork	0.5-1 mg
Fish (such as salmon, trout, halibut, haddock, perch) ^b	0.5-1 mg
Other sources of heme iron	
Seal	13.5-21 mg
Wild duck	7.5 mg
Heart, kidney	4-9 mg
Oysters, mussels	5-7 mg
Blood pudding	5 mg
Moose	4 mg

^a Amounts are approximate based on Canadian Nutrient File, 2007b. Total amount of iron consists of different amounts of heme and non-heme iron.

^b Health Canada provides advice for limiting exposure to mercury from certain types of fish. For the latest information, refer to www.healthcanada.gc.ca/mercuryandfish

Note: Although liver is an excellent source of iron, it is not included on this list because of its high vitamin A content. A single Food Guide Serving (75 g, cooked) from most types of liver exceeds the Tolerable Upper Intake Level (UL) for vitamin A for women of childbearing age.

TABLE 2 FOODS THAT CONTAIN ONLY NON-HEME IRON

Food	Food Guide Serving	Iron in milligrams ^a
Pumpkin seed kernels	60 mL	8.5 mg
Tofu, medium or firm	150 g	2-7 mg
Legumes (such as beans, lentils, chickpeas)	175 mL	2-6.5 mg
Instant hot cereal (enriched with iron)	175 mL	3-6 mg
Cold cereals (enriched with iron)	30 g	4 mg
Some vegetables (such as pumpkin, artichoke hearts, peas, potatoes, spinach)	125 mL	1-2 mg
Nuts, peanuts and sunflower seeds	60 mL	0.5-2 mg
Eggs	2	1.8 mg
Pasta (enriched with iron)	125 mL	1-1.5 mg
Prune juice	125 mL	1.5 mg
Peanut butter and nut butters, such as almond butter	30 mL	0.5-1.5 mg
Bread (enriched with iron)	1 slice	1 mg

^aAmounts are approximate based on Canadian Nutrient File, 2007b. Total amount of iron consists of non-heme iron only.

ABSORBING IRON FROM DIETARY SOURCES (IOM, 2001)

The amount of iron available to the body through food can vary greatly. How much iron gets absorbed depends on what other foods are eaten at the same time. These other foods can enhance or inhibit non-heme iron absorption. For example, in non-pregnant adults, the body absorbs only 18% of the iron it gets from food. This result is based on typical North American diets that contain both heme and non-heme iron, and vitamin C. This level lowers to 10% for vegetarian diets (containing only non-heme iron). Very strict vegetarian diets may have even lower results at approximately 5% overall absorption rate.

ENHANCERS AND INHIBITORS

Foods contain both enhancers and inhibitors. Paying special attention to the foods that make up meals can help women reduce the effect of inhibitors and improve dietary iron absorption.

There are three main inhibitors of non-heme iron absorption in the diet: polyphenols from tea and coffee, phytate in legumes and some vegetables, unrefined rice and grains, and calcium at levels greater than 300 mg (Hallberg and Huthen, 2000).

Ascorbic acid, or vitamin C, strongly enhances iron absorption. It releases non-heme iron bound to inhibitors (Fernández-Ballart, 2000). The effect is strongest when vitamin C containing foods are eaten with foods containing high levels of inhibitors. For instance, a glass of orange juice can help minimize the effect of phytate in breakfast cereal and calcium in milk.

Meat, fish and poultry can also improve non-heme absorption (IOM, 2006). Even modest amounts of these foods can improve the absorption of non-heme iron in a meal.

IMPLICATIONS FOR PRACTICE

SELECTING A MULTIVITAMIN CONTAINING IRON⁶

To ensure proper use of multivitamin supplements:

- Use the '*Key messages on iron for pregnant women*' on page 1 to write or talk about iron supplementation during pregnancy.
- Encourage women to look for a multivitamin⁷ that provides 16-20 mg of iron per daily dose. The supplement should also include vitamin B₁₂ and 400 mcg (0.4 mg) of folic acid per daily dose (Health Canada, 2009).
- Ensure that women look for a Drug Identification Number (DIN) or Natural Product Number (NPN) on the product label showing that the product is government-approved for safety, efficacy, and quality.
- Emphasize the importance of reading product labels. Some supplements may include cautionary notes about their use during pregnancy and breastfeeding.
- Caution women not to take more than one daily dose of their multivitamin. This will help women not to go over the UL for vitamin A, which is 3,000 mcg retinol activity equivalent (RAE)⁸ or 10,000 IU.
- Remind women to keep all supplements stored out of reach of young children.

OPTIMIZING DIETARY IRON INTAKE AND IRON ABSORPTION

Following a healthy eating pattern and choosing foods that are rich in nutrients helps women meet their requirement for iron, vitamin C and other nutrients. To promote adequate dietary iron intake:

- Encourage women to follow [Canada's Food Guide](#). It describes a healthy eating pattern that is rich in dietary iron. Following Canada's Food Guide will also help women meet their needs for other nutrients and will help them achieve overall health.
- Promote the use of tools such as [My Food Guide Servings Tracker](#). This can help women keep track of the amount and type of food they eat each day and compare their intake to Canada's Food Guide.

(6) The recommendations in this document were not established for women who have pre-existing iron deficiency or iron deficiency anemia. These women should be assessed to determine how much additional iron they need from supplements.

(7) Eligible First Nations and Inuit women of childbearing age can access multivitamins through the Non-Insured Health Benefits Program (NIHB). For more information, please see www.hc-sc.gc.ca/fniah-spnia/nihb-ssna/index-eng.php

(8) According to the Health Canada's [Multi-vitamin/mineral supplement monograph](#), the vitamin A content per daily dose must not exceed the UL for vitamin A.

- Emphasize that meat, poultry and fish are important dietary sources of iron. They also help the body absorb non-heme iron.
- Suggest the use of nutrition labelling⁹ to help women choose foods fortified with iron. They can make informed choices by looking for the term 'iron' in the ingredient list when choosing grain products such as cereals, bread and pasta¹⁰. Women can also use the Nutrition Facts table on food labels to compare and choose products that contain more iron per serving.
- To optimize non-heme iron absorption, encourage women to include at least one source of vitamin C with their meals. This is particularly important at meals that do not include meat. Vitamin C is found in a variety of foods: broccoli, cantaloupe, citrus fruits and their juices, kiwis, mangos, potatoes, strawberries, sweet peppers, tomatoes, and tomato sauce.
- Encourage women to drink tea or coffee 1 or 2 hours between meals rather than with meals. These drinks can interfere with iron absorption.
- Advise women not to take a calcium supplement or calcium-containing antacids with meals. Too much calcium can reduce the amount of iron absorbed by the body. If the supplement is taken 1 to 2 hours after a meal, the high dose of calcium will not interfere with the absorption of iron in the meal (Gleerup et al, 1993).
- Refer women to a Registered Dietitian if they have a significantly restricted food intake. This can happen when women exclude an entire food group or have severe nausea or vomiting. These women can benefit from comprehensive nutritional assessment and counselling.
- Refer nutritionally at-risk women to services or programs that can help. The [Canada Prenatal Nutrition Program](#)¹¹ Website provides contact information for programs and services for vulnerable pregnant women.

REFERENCES

Beard JL, Dawson H, Pinero DJ. 1996. Iron metabolism: a comprehensive review. *Nutr Rev* 54(10):295-317.

Bjorn-Rasmussen E, Hallberg L, Isaksson B, Arvidsson B. 1974. Food iron absorption in man. Application of the two-pool extrinsic tag method to measure heme and non-heme iron absorption from the whole diet. *J Clin Invest* 53(1):247-56.

Cockell KA, et al. 2009. Application of the Dietary Reference Intakes in Developing a Recommendation for Pregnancy Iron Supplements in Canada. Submitted January, 2009.

Cooper MJ, Cockell KA, L'Abbé MR. 2006. The iron status of Canadian adolescents and adults: Current knowledge and practical implications. *Can J Diet Pract* 67(3):130-8.

Fernández-Ballart J. 2000. Iron metabolism during pregnancy. *Clin Drug Invest* 19(Suppl. 1):9-19.

Fernández-Ballart J, Murphy MM. 2001. Preventive nutritional supplementation throughout the reproductive life cycle. *Publ Health Nutr* 4(6A):1363-6.

(9) A ready-to-use presentation was designed for use by health professionals and educators to teach consumers on how to use the nutrition information from food labels to make informed food choices. The presentation and additional resources can be found at: www.healthcanada.gc.ca/nutritionlabelling

(10) Some imported grain products, such as pasta, may not be enriched. Most rice is also not enriched.

(11) The Canada Prenatal Nutrition Program is developed and delivered in partnership with the provinces and territories, and with First Nations and Inuit communities. The services provided include food supplementations, nutritional counselling, breastfeeding support, education, referral and counseling on health and lifestyle issues.

- Gleerup A, Rossander-Hulthen L, Hallberg, L. 1993. Duration of the inhibitory effect of calcium on non-haem iron absorption in man. *Eur J Clin Nutr* 47(12):875-9.
- Hallberg L, Huthen L. 2000. Prediction of dietary iron absorption: an algorithm for calculating absorption and bioavailability of dietary iron. *Am J Clin Nutr* 71(5):1147-60.
- Health Canada. 2009. Prenatal Nutrition Guidelines for Health Professionals - Folate contributes to a healthy pregnancy (Ottawa: Health Canada). Available online.
- Hercberg S, Galan P, Preziosi P, Aissa M. 2000. Consequences of iron deficiency in pregnant women. Current issues. *Clin Drug Invest* 19suppl(1):1-7.
- Institute of Medicine. 2000. Dietary Reference Intakes: Applications in Dietary Assessment. (Washington DC: National Academies Press).
- Institute of Medicine. 2001. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc (Washington DC: National Academy Press).
- Institute of Medicine. 2006. Dietary Reference Intakes – The essential guide to nutrient requirements (Washington DC: National Academies Press).
- Makrides M, Crowther CA, Gibson RA, Gibson RS, Skeaff CM. 2003. Efficacy and tolerability of low-dose iron supplements during pregnancy: a randomized controlled trial. *Am J Clin Nutr* 78(1):145-53.
- Turner RE, Langkamp-Henken B, Littell RC, Lukowski MJ, Suarez MF. 2003. Comparing nutrient intake from food to the estimated average requirements shows middle- to upper-income pregnant women lack iron and possibly magnesium. *J Am Diet Assoc* 103(4):461-6.
- WHO. 1992. The prevalence of anemia in women: a tabulation of available information (Geneva: WHO).