



Health
Canada

Santé
Canada

*Your health and
safety... our priority.*

*Votre santé et votre
sécurité... notre priorité.*

Prenatal Nutrition Guidelines for Health Professionals



FOLATE

Canada 

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:

Aline Allain-Doiron, RD, Public Health Nutritionist-Dietitian, Regional Health Authority B, Zone 7

Andrée Gruslin, MD, FRCS, Director of the Post-graduate Residency Training Program in Obstetrics and Gynaecology, University of Ottawa

Sheila M. Innis, RD, PhD, Director of Nutrition Research Program, Child and Family Research Institute, University of British Columbia

Kristine G. Koski, RD, PhD, Director School of Dietetics and Human Nutrition, McGill University

Michel Lucas, PhD, MPH, RD, Epidemiologist/Nutritionist, Axe Santé des populations et environnement, Centre Hospitalier de l'Université Laval (CHUL-CHUQ)

Ann Montgomery, RM, associate midwife and preceptor, Midwifery Collective of Ottawa

Deborah L. O'Connor, RD, PhD, Director of Clinical Dietetics, The Hospital for Sick Children, and Associate Professor, Department of Nutritional Sciences, University of Toronto

Kay Yee, RD, Public Health Nutritionist, Regina Qu'Appelle Health Region

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 folate contribue à une grossesse en santé

© Her Majesty the Queen in Right of Canada, represented by the Minister of Health Canada, 2009

This publication may be reproduced without permission provided the source is fully acknowledged.

Cat.: H164-109/2-2009E-PDF
ISBN: 978-1-100-12208-3

Prenatal Nutrition Guidelines for Health Professionals

Folate Contributes to a Healthy Pregnancy

Folate¹, a B vitamin, plays an important role in cell division and in the synthesis of amino acids and nucleic acids like DNA (Antony, 2007). It is essential to the normal development of the spine, brain and skull of the fetus, especially during the first four weeks of pregnancy. This is a time when many women are not yet aware that they are pregnant. Folate also supports the pregnant woman's expanding blood volume and growing maternal and fetal tissues (IOM, 1998).

KEY MESSAGES ON FOLATE FOR WOMEN OF CHILDBEARING AGE

- Eating according to Canada's Food Guide and taking a daily multivitamin that has 400 mcg (0.4 mg) of folic acid will help you prepare for a healthy pregnancy. Doing this can also reduce the risk to your baby of developing a neural tube defect (NTD).
- Make sure your supplement contains vitamin B₁₂.
- Because many pregnancies are unplanned, all women who could become pregnant should take a daily multivitamin containing 400 mcg (0.4 mg) of folic acid. At a minimum, start taking your supplement 3 months before you get pregnant. Continue taking this supplement throughout your pregnancy to help meet your need for folic acid and other nutrients like iron.
- If you have had a pregnancy affected by a NTD or have a family history of this problem, you should see your doctor. You may need to take a higher dose of folic acid.
- If you have diabetes, obesity or epilepsy, you may be at higher risk of having a baby with a NTD. See your doctor before planning a pregnancy.
- Do not take more than the 1 daily dose of a multivitamin. Do not increase your dose of folic acid beyond 1000 mcg (1 mg) per day without talking to a doctor first.

RECOMMENDED FOLATE INTAKES FOR WOMEN OF CHILDBEARING AGE

Folate requirements have been set mainly based on the amount of dietary folate equivalents (DFEs)² needed to maintain normal red blood cell concentrations (IOM,

(1) The term **folate** includes both **natural folate** found in food, and the synthetic form, **folic acid**, found in fortified foods and vitamin supplements. The term **dietary folate** is used to describe all forms found in food: natural folate, plus folic acid from fortified foods.

(2) The concept of dietary folate equivalents or DFEs for folate intake attempts to adjust for the bioavailability of natural folate compared to folic acid, as natural folate is thought to be less bioavailable (IOM, 1998).

1998). The Recommended Dietary Allowance (RDA)³ for women of childbearing age is 400 mcg DFEs (IOM, 1998). In addition to dietary folate intake from a varied diet, all women who can become pregnant should take a multivitamin⁴ containing 400 mcg (0.4 mg) of folic acid every day. This reduces the risk of neural tube defects (Van Allen et al., 2002).

RECOMMENDED FOLATE INTAKE DURING PREGNANCY

Folate requirements increase during pregnancy. There is a dramatic acceleration in cell division and red blood cell development as the uterus enlarges, the placenta develops, maternal blood volume expands, and the fetus grows (IOM, 1998). The mother also transfers folate to the fetus (Antony, 2007). Evidence supports a RDA of 600 mcg DFEs per day to maintain normal folate status during pregnancy (IOM, 1998).

NOT GETTING ENOUGH FOLATE

Because the body has a high demand for folate, women may not get enough of this nutrient during their childbearing years (Power, 2005; Ortega et al, 2006; Sherwood et al, 2006; Kirkpatrick and Tarsuk, 2008). Women who are at higher risk include those who:

- are not taking the recommended folic acid supplement,
- are on restricted diets (such as chronic dieters),
- have a lower socio-economic status, and
- are experiencing food insecurity⁵.

HOW FOLATE HELPS PREVENT NEURAL TUBE DEFECTS

Neural tube defects (NTDs)⁶ include spina bifida and anencephaly. They occur when the neural tube fails to close properly during the third and fourth week of pregnancy. Often a woman doesn't yet know that she is pregnant during this critical time. A decreased risk of NTD is associated with both increased folate intake and higher red blood cell folate concentrations (greater than 906 nmol/L); though the experimental evidence is stronger for increased folate intake and NTD risk reduction (IOM, 1998).

The risk is reduced when women start taking a daily multivitamin containing folic acid three months before the beginning of pregnancy and continuing in early pregnancy while the neural tube is closing (from 21 to 28 days after conception, or the 6th week after the

(3) 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).

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

(5) Food insecurity refers to the limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways.

(6) For more information on the risk and development of NTDs, see [Preconception health: folic acid for the primary prevention of neural tube defects. A resource for health professionals](#)

beginning of the last menstrual period)⁷ (Van Allen et al, 2002). The reduced risk has been observed in women who took a supplement containing 360 to 800 mcg of folic acid per day, in addition to an intake of 200 to 300 mcg per day of natural folate (IOM, 1998).

Many studies also show that multivitamins containing folic acid taken in the early weeks of pregnancy are associated with a decreased risk of oral cleft and cardiovascular anomalies (IOM, 1998; Cziezel et al, 1999; Cziezel, 2004; Eichholzer et al, 2006; Goh et al, 2006). Some evidence also suggests an association with reduced risk of preeclampsia (Bodnar et al, 2006; Wen et al, 2008). This is an area of active and on-going research.

In light of this evidence, and recognizing that pregnancies are not always planned, the Government of Canada has taken steps to help women of childbearing age increase the amount of folate they consume through mandatory food fortification and the promotion of vitamin supplementation for all women who could become pregnant.

REDUCING THE RISK OF NEURAL TUBE DEFECTS

MANDATORY FOOD FORTIFICATION

Adding folic acid to white flour, enriched pasta, and enriched corn meal has been mandatory in Canada since November 1998. Studies show that this measure has increased folate intake and improved folate status in Canadian women of childbearing age (Ray et al, 2002; Liu et al, 2004). This population health approach has also been associated with a significant reduction in the rate of NTDs. For example, a 7-province study (from 1993 to 2002) showed a reduction of 46% in the overall rate of NTDs⁸ post-fortification (De Wals et al, 2007).

VITAMIN SUPPLEMENTATION FOR ALL WOMEN WHO COULD BECOME PREGNANT

Considering that the level of intake of folic acid from fortified foods is estimated to be no more than 100 to 200 mcg per day,⁹ and recognizing that many pregnancies are unplanned, all women who could become pregnant should take a multivitamin containing 400 mcg (0.4 mg) of folic acid daily. This is in addition to the dietary folate provided by a varied diet. Having women supplement their diets with folic acid between pregnancies can help reduce the risk of NTDs in subsequent births.

Some women, such as those who have had a previous NTD affected pregnancy and those with a near relative who has a NTD, are at higher risk of having a NTD-affected pregnancy. They may need more than 400 mcg (0.4 mg) of folic acid daily (Van Allen and McCourt, 2002). These women should be assessed early and advised on the steps to take to prepare for a healthy pregnancy.

PROMOTING THE USE OF FOLIC ACID SUPPLEMENTATION

(7) This is a time when many women are not yet aware of their pregnancy.

(8) Data included births, stillbirths and cases detected prenatally that were subsequently terminated.

(9) These estimates are based on mandated levels of folic acid fortification (Canada Gazette part II, 1998).

According to Canadian survey data, 58% of women said they took a multivitamin containing folic acid or a folic acid supplement in the three months before becoming pregnant (Public Health Agency of Canada, 2009). It has been shown that the use of supplements is influenced by economic status and educational background (Botto et al, 2005). For instance, the use of folic acid supplements before pregnancy in Canada was lowest among women in lower-income households, among women with less than high school graduation, and among immigrant mothers (Millar, 2004). Women with unplanned pregnancies, mothers under the age of 25 and single mothers are also less likely to supplement with folic acid (Ray et al, 2004).

Although the majority of Canadian women take folic acid supplements in the three months before pregnancy, continued public health efforts are needed to promote awareness of the importance of folic acid supplementation for all women of childbearing age. To avoid increasing socio-economic inequalities in folic acid use, interventions should provide practical support to vulnerable groups (Stockley and Lund, 2008).

CONTINUED SUPPLEMENTATION THROUGHOUT PREGNANCY

Canadian survey data show that it is difficult for most women of childbearing age to consume enough folate from diet alone to meet their pregnancy needs. Over 75% of non-pregnant/non-breastfeeding women aged 19 – 50 have intakes less than the Estimated Average Requirement (EAR)¹⁰ for pregnancy, 520 mcg of DFEs (Health Canada, 2008). To meet folate needs during pregnancy, women should consume a varied diet that provides dietary folate (see Table I), and continue taking a multivitamin containing 400 mcg (0.4 mg) of folic acid throughout their pregnancy.

TABLE I SOURCES OF DIETARY FOLATE

Food	1 Food Guide Serving	Micrograms ^a of folate as dietary folate equivalents (µg DFEs)
Lentils and romano beans	175 mL	265-270
Black beans	175 mL	190
Okra	125 mL	140
White beans	175 mL	125
Asparagus and spinach, cooked	125 mL	120
Salad greens, such as Romaine lettuce, mustard greens and endive	250 mL	80-110
Pinto beans, kidney beans and chickpeas	175 mL	70-100
Pasta made with enriched wheat flour	125 mL	90
Avocado	½ fruit	80
Sunflower seeds, shelled	60 mL	80
Bagel made with enriched wheat flour	½ bagel (45 g)	60-75

(10) The Estimated Average Requirement or EAR is the average daily nutrient intake level that is estimated to meet the requirements of half of the healthy individuals in a particular life stage and gender group. The EAR is the primary reference point for assessing the adequacy of estimated nutrient intakes of groups; it is the basis for calculating the RDA (IOM, 2006).

Food	1 Food Guide Serving	Micrograms ^a of folate as dietary folate equivalents (µg DFEs)
Brussels sprouts, beets and broccoli, cooked	125 mL	70
Bread made with enriched wheat flour or enriched corn meal	1 slice or ½ pita or ½ tortilla (35 g)	45-65
Spinach, raw	250 mL	60
Orange juice from concentrate	125 mL	60
Parsley	125 mL	50
Parsnips	125 mL	50
Peanuts, shelled	60 mL	45
Eggs	2 large	45
Corn	125 mL	40
Seaweed	125 mL	40
Orange	1 medium	40
Green peas	125 mL	40
Raspberries, strawberries, blackberries	125 mL	15-35
Enriched ready to eat cereal	30 g	10-35
Broccoli and cauliflower, raw	125 mL	30
Snow peas	125 mL	30
Pineapple juice	125 mL	30
Walnuts, almonds and hazelnuts, shelled	60 mL	20-30
Baby carrots	125 mL	25
Kiwifruit	1 large	20
Clementine	1 fruit	20

^a Amounts are approximate based on Canadian Nutrient File, 2007b.

IMPLICATIONS FOR PRACTICE

OPTIMIZING DIETARY FOLATE INTAKE

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

- Encourage women to use [Canada's Food Guide](#). It describes a healthy eating pattern that is rich in dietary folate. Following Canada's Food Guide will also help women meet their needs for other nutrients and can help them achieve overall health.
- Promote 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.

- Encourage women to include grain products fortified with folic acid each day, such as enriched bread or enriched pasta¹¹. They can make informed choices, by looking for the term ‘folic acid’ in the ingredient list.
- Encourage women to have legumes, such as beans or lentils, often and eat at least one dark green vegetable, such as peas or romaine lettuce, each day. (See Table 1 for more dietary choices.)
- 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](#)¹² Website provides contact information for programs and services for vulnerable pregnant women.

SELECTING A MULTIVITAMIN CONTAINING FOLIC ACID

For women who can become pregnant, health care professionals play an important role in motivating them to use supplements (Eichholzer et al, 2006). To ensure proper use of multivitamin supplements:

- Use the ‘*Key messages on folate for women of childbearing age*’ on page 1 to write or talk about folic acid supplementation during the childbearing years.
- Encourage women to look for a multivitamin¹³ that provides 400 mcg (0.4 mg) of folic acid per daily dose. The product should also include vitamin B₁₂.
- Advise women that prenatal supplements contain higher amounts of nutrients than are usually needed by women who are not pregnant. A non-prenatal multivitamin supplement is often enough. Following this advice can help women avoid taking excessive amounts of nutrients over time.
- 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. This will help women not go over the Tolerable Upper Intake Level (UL) for vitamin A¹⁴, which is 3,000 mcg retinol activity equivalent (RAE) or 10,000 IU.
- Remind women to keep all supplements stored out of reach of young children.

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

(12) 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 counselling on health and lifestyle issues.

(13) 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

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

ADVISING ON THE UPPER LIMITS OF FOLIC ACID SUPPLEMENTATION

High doses of folic acid can hide signs of vitamin B₁₂ deficiency. They can also bring on or accelerate neurological complications associated with B₁₂ deficiency (IOM, 1998). As well, women who have low vitamin B₁₂ status are at higher risk for NTD (Van Allen and McCourt, 2002; Ray et al, 2007; Molloy et al, 2009). The prevalence of vitamin B₁₂ deficiency in women of childbearing age is considered very low (IOM, 1998). However, some studies suggest that more women in this life stage group may have low vitamin B₁₂ status than expected (Ray et al, 2008). Women who do not or infrequently consume foods of animal origin and do not take a vitamin B₁₂ containing supplement are most likely to have deficient or marginal vitamin B₁₂ status (Allen, 2009).

Emerging data also suggest there may be additional health risks associated with taking folic acid, including the development of colon cancer when preneoplastic cells are present (Kim, 2006; Ashokkumar et al, 2007; Smith et al, 2008). It is important that health care professionals do not advise higher doses of folic acid than is recommended in this document, unless duly warranted.

REFERENCES

- Allen LH. 2009. How common is vitamin B-12 deficiency? 89(2):693S-6S. Epub 2008 Dec 30.
- Antony AC. 2007. In utero physiology: role of folic acid in nutrient delivery and fetal development. *Am J Clin Nutr* 85(suppl):598S-603S.
- Ashokkumar B, Mohammed ZM, Vaziri ND, Said HM. 2007. Effect of folate oversupplementation on folate uptake by human intestinal and renal epithelial cells. *Am J Clin Nutr* 86(1):159-166.
- Bodnar LM, Tang G, Ness RB, Harger G, Roberts JM. 2006. Periconceptional multivitamin use reduces the risk of preeclampsia. *Am J Epidemiol* 164(5):470-7.
- Botto LD, Lisi A, Robert-Gnansia E, Erickson JD, Vollset SE, Mastroiacovo P, Botting B, Cocchi G, de Vigan C, de Walle H, Feijoo M, Irgens LM, McDonnell B, Merlob P, Ritvanen A, Scarano G, Siffel C, Metneki J, Stoll C, Smithells R, Goujard J. 2005. International retrospective cohort study of neural tube defects in relation to folic acid recommendations: are the recommendations working? *Br Med J* 330(7491):571. Epub 2005 Feb 18.
- Canada Gazette part II. 1998. Regulatory impact analysis statement, SOR/98-550. 132(24):3029-33.
- Czeizel AE, Timar L, Sarkozi A. 1999. Dose-dependent effect of folic acid on the prevention of orofacial clefts. *Pediatrics* 79(4):257-68.
- Czeizel AE. 2004. The primary prevention of birth defects: multivitamins or folic acid? *Int J Med Sci* 1(1):50-61.
- De Wals P, Tairou F, Van Allen MI, Uh SH, Lowry RB, Sibbald B, Evans JA, Van den Hof MC, Zimmer P, Crowley M, Fernandez B, Lee NS, Niyonsenga T. 2007. Reduction of neural-tube defects after folic acid fortification in Canada. *N Engl J Med* 357(2):135-42.
- Eichholzer M, Tönz O, Zimmermann R. 2006. Folic acid: a public-health challenge. *Lancet* 367(9528):1352-61.
- Goh YI, Bollano E, Einarson TR, Koren G. 2006. Prenatal multivitamin supplementation and rates of congenital anomalies: A meta-analysis. *J Obstet Gynaecol Can* 28(8):680-9.
- Health Canada. 2008. Canadian Community Health Survey, Cycle 2.2, Nutrition (2004) - Nutrient Intakes from Food, Volume 2. Cat.: H164-45/2-2008E-PDF.
- Institute of Medicine. 1998. Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin and Choline (Washington DC: National Academies Press).
- Institute of Medicine. 2006. Dietary Reference Intakes – The essential guide to nutrient requirements (Washington DC: National Academies Press).

- Kim YI. 2006. Does a high folate intake increase the risk of breast cancer? *Nutr. Rev.* 64(10 Pt 1):468-475.
- Kirkpatrick SI, Tarasuk V. 2008. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. *J. Nutr.* 138(3):604-12.
- Liu S, West R, Randell E, Longerich L, Steel O'Connor K, Scott H, Crowley M, Lam A, Prabhakaran V, McCourt C. 2004. A comprehensive evaluation of food fortification with folic acid for the primary prevention of neural tube defects. *BMC Pregnancy and Childbirth* 4(1):20.
- Millar WJ. 2004. Folic acid supplementation. *Health Rep* 15(3):49-52.
- Molloy AM, Peadar PN, Troendle JF, Burke H, Sutton M, Brody LC, Scott JM, Mills JL. 2009. Maternal vitamin B12 status and risk of neural tube defects in a population with high neural tube defect prevalence and no folic acid fortification. *Pediatrics* 123(3):917-23.
- Ortega RM, López-Sobaler AM, Andrés P, Rodríguez-Rodríguez E, Aparicio A, Bermejo LM, López-Plaza B. 2006. Changes in folate status in overweight/obese women following two different weight control programmes based on increased consumption of vegetables or fortified breakfast cereals. *Br J Nutr* 96(4):712-8.
- Power EM. 2005. Determinants of healthy eating among low-income Canadians. *Can J Public Health* 96 (Suppl. 3):S37-S42.
- Public Health Agency of Canada. 2009. What Mothers Say: The Canadian Maternity Experiences Survey. Available online: <http://www.phac-aspc.gc.ca/rhs-ssg/pdf/survey-eng.pdf> (Accessed March 31, 2009).
- Ray JG, Goodman J, O'Mahoney PRA, Mamdani JM, Jiang D. 2008. High rate of maternal vitamin B12 deficiency nearly a decade after Canadian folic acid flour fortification. *QJM* 101(6):475-7. Epub 2008 Mar 12.
- Ray JG, Singh G, Burrows RF. 2004. Evidence for suboptimal use of periconception folic acid supplements globally. *Br J Obstet Gynaecol* 111(5):399-408.
- Ray JG, Vermeulen MJ, Boss SC, Cole DE. 2002. Increased red cell folate concentrations in women of reproductive age after Canadian folic acid fortification. *Epidemiology* 13(2):238-40.
- Ray JG, Wyatt PR, Thompson MD, Vermeulen MJ, Meier C, Wong P-Y, Farrell SA, Cole DEC. 2007. Vitamin B12 and the risk of neural tube defects in a folic-acid-fortified population. *Epidemiology* 18(3):362-6.
- Sherwood KL, Houghton LA, Tarasuk V, O'Connor DL. 2006. One-third of pregnant and lactating women may not be meeting their folate requirements from diet alone based on mandated levels of folic acid fortification. *J Nutr* 136(11):2820-6.
- Smith AD, Young-In K, Refsum H. 2008. Is folic acid good for everyone? *Am J Clin Nutr* 87(3): 517-33.
- Stockley L., Lund V. 2008. Use of folic acid supplements, particularly by low-income and young women: a series of systematic reviews to inform public health policy in the UK. *Public Health Nutr* 11(8):807-21. Epub 2008 May 6.
- Van Allen MI, McCourt C, Lee NS. 2002. Preconception health: folic acid for the primary prevention of neural tube defects. (Ottawa: Minister of Public Works and Government Services Canada)
- Wen SW, Chen XK, Rodger M, White RR, Yang Q, Smith GN, Sigal RJ, Perkins SL, Walker MC. 2008. Folic acid supplementation in early second trimester and the risk of preeclampsia. *Am J Obstet Gynaecol* 198(1):45.e1-7.