Folate (Folic Acid) for Women During Childbearing Age November 27, 2012

Background

Folate, an essential micronutrient, is a water-soluble B vitamin, also called vitamin B9. Folic Acid is the form of folate that is found in supplements and added to fortified foods. Folic acid is approximately twice as bioavailable as naturally occurring food folate.

Everyone requires daily folate / folic acid. Women of childbearing age can improve birth outcomes and decrease the risk of birth defects by ensuring adequate folic acid intake. In addition to a healthy, varied diet, women of childbearing age should consume 400 micrograms of folic acid every day.\(^2\) (See Table 1)

Folate is required for DNA synthesis and cell division, red blood cell formation, some metabolic reactions involving lipids (fats) and amino acids (proteins), and it functions as a coenzyme. Because of the rapid maternal and fetal cell division and tissue growth of pregnancy, especially in the first months, the need for folate increases. It is recommended that women begin taking folic acid prior to pregnancy and during pregnancy and lactation. This daily consumption of folic acid prior to pregnancy reduces the risk of neural tube defects (NTDs) by 50-70\%. NTDs are serious birth defects of the spine (spina bifida) and brain (anencephaly). According to the 2010 California Maternal and Infant Health Assessment, 33.9\% (95%CI 31.9-36.0) of women between 20-44 years of age and 23.9\%, (95%CI 17.5-30.2) adolescents between 15-19 years of age and with a recent live birth consumed a folic acid supplement daily before their pregnancy.\(^5\)

Benefits of Adequate Folate/ Folic Acid Intake\(^3\)

* Folate helps produce and maintain new cells
* Promotes normal fetal and infant growth and development. During lactation, breast milk is the folate source for the breastfed infant.
* Reduces risk of birth defects, such as neural tube defects (NTDs) of brain, skull and spinal cord.
* Decreases the risk of folic acid deficiency and folic acid deficiency anemia.
* Decreases homeocysteine, which may reduce the risk of developing cardiovascular disease
Recommendations for Folic Acid

The importance of folic acid as a public health issue is addressed by the U.S. Department of Health and Human Services, Healthy People 2020 objective to increase optimal folic acid intake.\(^6\)

Folic Acid Related Healthy People 2020 Objective\(^6\)

MICH-16 Increases the proportion of women delivering a live birth who received preconception care services and practiced key recommended preconception health behaviors.

MICH-16.2 Took multivitamins/folic acid prior to pregnancy

The Dietary Reference Intakes (DRI) for folate are given in Dietary Folate Equivalents (DFEs).\(^2,7\) The DFE was developed to address the differences in absorption of naturally occurring dietary folate and the more bioavailable synthetic folic acid.\(^3\) Dietary folate equivalents may be expressed in different ways, depending on the type of conversion needed. DFEs include a combination of naturally occurring food folate from a varied diet and folic acid from supplements and fortified foods. Consumer publications normally use micrograms of folic acid per day. To simplify the translation of the recommendations, this publication uses micrograms of folic acid per day.\(^2,7\)

Dietary Folate Equivalents (DFEs)\(^2,7\)

* 1 mcg DFE = 1.0 mcg food folate = 0.6mcg (of folic acid added to foods)=0.5 mcg folic acid taken without food.

* 1 mcg folic acid as a fortificant = 1.7 mcg DFE.

* 1 mcg folic acid as a supplement, fasting = 2.0 mcg DFE.

Folate / folic acid needs are increased for the following populations: women of childbearing age, pregnant and lactating women, those with a history of NTD, who have some preexisting conditions or diseases, take certain medications or use various substances. The recommendation for women at a higher risk for a NTD affected pregnancy, i.e. a history of NTD-affected pregnancy, a family history of NTDs or being an individual with a NTD, is to consume 4,000 mcg (4.0 mg) folic acid prior to and during the first months of pregnancy.\(^8\)
The summary of recommendations for Folate/ Folic Acid (Table 1) was adapted from the DFE calculations, the Institute of Medicine (IOM), the Centers for Disease Control and Prevention (CDC), and the U.S Public Health Service (USPHS) recommendations. A user friendly format of recommended micrograms of folic acid per day is shown below.

Table 1: Summary of Recommendations for Folate/ Folic Acid

<table>
<thead>
<tr>
<th>Life-stage Group</th>
<th>U.S. Public Health Service and the Institute of Medicine Recommendation</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women of child-bearing age</td>
<td>400 mcg (0.4 mg) folic acid/day</td>
<td>All women capable of becoming pregnant</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>400 mcg (0.4 mg) folic acid/day</td>
<td>Plus unfortified foods for a total intake of 600 mcg (0.6mg) DFE/day. There may be increased need for more than one fetus. There are no additional guidelines at this time.</td>
</tr>
</tbody>
</table>
| Previous NTD-affected pregnancy or family history showing a high risk of NTDs, planning a pregnancy | 4000 mcg (4.0 mg) folic acid/day after consulting with prescribing health care provider | To decrease the risk for NTD in women who have:  
  - A prior NTD-affected pregnancy  
  - A NTD  
  - A family history of NTDs  
By prescription, starting one month before conception and continuing throughout the first 3 months of pregnancy. Then reduce to 400 mcg (0.4 mg) folic acid/day. |
| Lactating women                                      | 400 mcg (0.4 mg) folic acid/day                                         | Plus unfortified foods for a total intake of 500 mcg/day  
  - To replace folate secreted in breast milk and maintain maternal folate status.  
  - There may be increased need for more than one infant. |
| Infant from birth to 3 months                        | 25-100 mcg (0.25-0.1mg) folic acid/day                                  | Folate / folic acid intake is considered adequate when the baby is  
  - Breastfed by a mother consuming 400 mcg (0.4 mg) folic acid/day.  
  - Fed commercial artificial baby milk |
| Other NTD risk factors, when planning a pregnancy, include:  
  - Obesity  
  - Seizure disorder  
  - Diabetes | 400 mcg (0.4 mg) folic acid/day                                         | Consult with a health care provider prior to pregnancy |
Consequences of Excessive Intake of Folate / Folic Acid

Folic acid toxicity risk is low. Folate is a water-soluble vitamin, so excess intake is usually excreted in urine. The tolerable upper limit (UL) only includes folic acid from fortified or enriched foods or supplements or a combination of the two. It does not include naturally occurring food folates. Before cereal grains were fortified, the average amount of folate consumed, from unfortified foods, averaged 250 mcg (0.2 mg) per day. Naturally occurring food folate is not a concern.

The UL of Folic Acid for Women (including during pregnancy)

* 14-18 years old is 800 mcg/day (0.8 mg) per day
* 19-50 year olds is 1,000 (1.0 mg) per day

Sources of Folate / Folic Acid

Adequate amounts of dietary folate / folic acid from a variety of foods and beverages should be consumed daily. Such foods also provide other nutrients that are essential components of a healthful diet. In addition to naturally-occurring food folate, all women of childbearing age, should be encouraged to consume folic acid in the recommended doses. Table 2 summarizes some sources of folate / folic acid.

Table 2: Sources of Folate / Folic Acid

<table>
<thead>
<tr>
<th>Source</th>
<th>Dietary and supplement sources include, but are not limited to</th>
</tr>
</thead>
</table>
| Foods naturally folate-rich | • Legumes, i.e. blackeye peas, lentils, black beans, navy beans, pinto beans  
| | • Dark green leafy vegetables, e.g., spinach, collards, turnip greens, broccoli, asparagus, okra  
| | • Citrus fruits and juice, e.g., orange  
| | • Nuts and nut butter, e.g., peanuts, almonds, pecans, mixed nuts  
| | • Sunflower seeds  
| | • Meat, eggs  
| Folic-acid-fortified or enriched foods with less than 400 mcg folic acid per serving | Folic-acid- fortified or enriched cereals, bread, flour, cornmeal, pasta, rice and other grain products |
| Folic-acid-fortified or enriched foods with 400 mcg folic acid per serving | Enriched or fortified cereals with \( \geq 400 \text{ mcg (0.4 mg) folic acid per serving} \) (Since folic acid is sprayed on fortified cereal and this washes off with milk, the milk left in the cereal bowl should be consumed.) For a list of cereals with \( \geq 400 \text{ mcg (0.4 mg) folic acid per serving} \), see [http://www.cdc.gov/ncbddd/folicacid/cereals.html](http://www.cdc.gov/ncbddd/folicacid/cereals.html). |
| Oral folic acid supplement | *Prenatal or multiple vitamin and mineral with folic acid or folic acid supplement which only contains folic acid |

*No individual should consume more than one multivitamin a day because of possible toxic dose of other nutrients; e.g., vitamin A.
Folate Deficiency

There are many causes of folate deficiency. The condition may result from a failure to meet the increased bodily demand during pregnancy and lactation. Folate deficiency may also be caused by a genetic condition that decreases the active form of methylene tetrahydrofolate reductase and may result in abnormal absorption, excretion or metabolism of folate. The negative consequences of inadequate folate during pregnancy include impaired fetal growth and development, neural tube defects (NTDs) including spina bifida and anencephaly and possibly other congenital anomalies including cleft lip and palate and some heart defects.

The risk for having a baby with an NTD is higher for women with a previous pregnancy affected by NTDs. Other risk factors for NTDs are overweight and obesity, diabetes, use of some antiseizure medications and exposure to prolonged high temperatures early in pregnancy.

Nutrition Assessment of Folic Acid Intake

After a positive screen for anemia, screen for folic acid (Table 3) and B12 deficiency. Screening for anemia includes identifying risks, such as a positive CBC or a positive health history, such as being a vegan.

<table>
<thead>
<tr>
<th>Assessment Area</th>
<th>Assessment Data</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemical</td>
<td>● Decreased serum folate</td>
<td>● Serum folate is a short-term indicator of deficiency</td>
</tr>
<tr>
<td></td>
<td>● Decreased red blood cell folate</td>
<td>● Red blood cell folate is a long-term indicator of reduced body stores. Maintenance of red cell folate is an indicator of adequacy of folate status during pregnancy.</td>
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<tr>
<td></td>
<td>● Increased serum homocysteine</td>
<td>● Serum homocysteine reflects inadequate folate intake or metabolism</td>
</tr>
<tr>
<td>Clinical factors</td>
<td>Clinical assessment criteria - See Table 2</td>
<td></td>
</tr>
<tr>
<td>Dietary practices and</td>
<td>Sources of folate / folic acid - See Table 3</td>
<td></td>
</tr>
<tr>
<td>patterns</td>
<td></td>
<td></td>
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</tbody>
</table>
Increased folate / folic acids needs

Table 4 summarizes some specific criteria for the clinical assessment of individual folate/folic acid needs. In those women with vitamin B12 deficiency, excessive intake (usually >5.0 mg) of folic acid supplements might mask or delay the diagnosis of vitamin B12 deficiency. Vitamin B12 deficiency can cause neurological damage.²

**Table 4: Increased Folate / Folic Acid Needs**²,³,⁸,¹⁵

<table>
<thead>
<tr>
<th>Increased folate / folic acid needs, include, but are not limited to</th>
<th>Clinical assessment criteria include, but are not limited to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reproductive status</td>
<td>• All women of childbearing age</td>
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<tr>
<td></td>
<td>• Pregnancy</td>
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<tr>
<td></td>
<td>• Lactation</td>
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<tr>
<td>NTD history</td>
<td>• Previous NTD-affected pregnancy</td>
</tr>
<tr>
<td></td>
<td>• Individual with NTD</td>
</tr>
<tr>
<td></td>
<td>• Family history of NTD</td>
</tr>
<tr>
<td>Preexisting conditions or diseases</td>
<td>• Folate deficiency or folate deficiency anemia</td>
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<tr>
<td></td>
<td>• Genetic defect which decreases methylene</td>
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<tr>
<td></td>
<td>tetrahydrofolate reductase effectiveness</td>
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<tr>
<td></td>
<td>• Gastrointestinal malabsorption/ prior bariatric surgery</td>
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<td></td>
<td>• Kidney dialysis</td>
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<tr>
<td></td>
<td>• Liver disease</td>
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<tr>
<td>Medication intake</td>
<td>• anticonvulsant medications (such as dilantin, phenytoin</td>
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<tr>
<td></td>
<td>and primidone)</td>
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<tr>
<td></td>
<td>• metformin (sometimes prescribed to control blood sugar</td>
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<tr>
<td></td>
<td>in type 2 diabetes)</td>
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<td></td>
<td>• sulfasalazine (used to control inflammation associated</td>
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<td></td>
<td>with Crohn's disease and ulcerative colitis)</td>
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<td></td>
<td>• triamterene (a diuretic)</td>
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<tr>
<td></td>
<td>• methotrexate (used for cancer and other diseases such</td>
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<tr>
<td></td>
<td>as rheumatoid arthritis)</td>
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<td></td>
<td>• barbiturates (used as sedatives)</td>
</tr>
<tr>
<td>Substance Use</td>
<td>• Alcohol, chronic excessive consumption</td>
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<tr>
<td></td>
<td>• Cigarette smoking</td>
</tr>
</tbody>
</table>

**Nutrition Education**

Because folate is water-soluble, cooking methods and duration affect food folate retention, particularly in green vegetables.¹⁶ Practical advice about food preparation and the retention of water-soluble vitamins is encouraged.
When educating women on consuming 400mcg of folic acid daily, include these points:

- Encourage daily consumption of folate / folic acid rich foods and folic acid fortified foods along with one of the following:
  - Cereal fortified with \( \geq 400 \text{ mcg} \) (0.4 mg) folic acid per serving
  - Folic acid supplements or
  - Prenatal or multiple vitamins and minerals with folic acid
- Teach cooking methods which retain folate, particularly in green vegetables (4)
  - Steaming in preference to boiling
  - If boiling, do so for a short time in a minimum of water
  - Use folate-rich cooking water in other food preparation
- Discourage use of:
  - Cigarettes
  - Alcohol

**Referrals**

Multidisciplinary interventions contribute to improved short-term and long-term maternal and fetal health outcomes. When there is an identified need for consultation, assessment, intervention, therapy or resources refer to the appropriate health care professionals, who have expertise in nutrition and health:

- Medical Nutrition Therapy Specialist (RD)
- Behavioral Medicine Specialist (LCSW, MSW, MFCC, MD, PhD)
- Healthcare Provider (MD, DO, PA, CNP, CNM)
- Lactation Specialist (IBCLC)
- Women, Infants and Children (WIC) Program
- Other specialist

**Resources**


*Folic Acid: Every Woman, Every Day from* California Department of Public Health Services, Maternal, Child and Adolescent Health Division, Center for Family Health. Available through local March of Dimes offices.

English:

http://www.cdph.ca.gov/HealthInfo/healthyliving/childfamily/Documents/MO-NUPA-FolicAcidPamphlet-ENG.pdf
Spanish:
http://www.cdph.ca.gov/HealthInfo/healthyliving/childfamily/Documents/MO-NUPA-FolicAcidPamphlet-SPN.pdf

Useful web sites
- CDC Folic Acid http://www.cdc.gov/ncbddd/folicacid/
- March of Dimes www.modimes.org
- Advocating For Folic Acid: A Guide For Health Professionals www.folicacid.net

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References


5. California Department of Public Health, Maternal, Child and Adolescent Health Division, Center for Family Health. Maternal Infant and Health Assessment 2010; [http://www.cdph.ca.gov/data/surveys/Pages/MaternalandInfantHealthAssessment%28MIHA%29survey.aspx](http://www.cdph.ca.gov/data/surveys/Pages/MaternalandInfantHealthAssessment%28MIHA%29survey.aspx).


