



# Grains of truth about FOLIC ACID

## Definition

The words folate, folacin and folic acid are often used interchangeably, but there are differences in the forms. Folate is the collective term, but also describes the nutrient found naturally in foods. Folate and folacin are generic descriptions for compounds with nutritional properties and chemical structures similar to those found in folic acid, the synthetic form, often used in fortified foods and in vitamin supplements.

## History

The need for folic acid, one of the B vitamins, was discovered in the 1930s when anemia during pregnancy was cured with a yeast extract. Further research in the 1940s isolated the cure for anemia from spinach. It was named folate after the Latin word *folium*, meaning leaf.

## Sources of Folate

Sources of folate include leafy green vegetables (spinach, broccoli, asparagus), legumes (lentils, black beans), yeast, liver and enriched grain foods such as ready-to-eat cereals, breads, and pasta, in addition to certain nuts.

About half of naturally occurring folate is absorbed, compared to 80 percent of fortified folic acid and all of supplemented folic acid. Although many foods contain folate, it is difficult for most people to consume enough from these foods, often making supplementation necessary. (Table 1)

## Health Benefits

Folate, grains and the healthful benefits they provide have been in the forefront of nutrition and health. The 1998 folic acid flour fortification plan was implemented to reduce the number of **neural tube defects** (NTDs) in newborns in the U.S. Studies have shown that three or more daily servings of whole

Table 1. Selected Food Sources of Folate

Food	Amount	Folate (mcg)* DFE**	% Daily Value (DV) (Based on 400 mcg)
<b>Grains</b>			
Cheerios	1 cup	330	80
Wheat germ	¼ cup	80	20
Oatmeal, instant, cooked	½ cup	80	20
Pasta, plain, cooked	2 ounce	60	15
Bread, white, enriched	1 slice	40	10
Crackers, saltines	4	20	6
Bread, whole wheat	1 slice	15	4
<b>Vegetables &amp; Fruits</b>			
Asparagus, cooked	½ cup	130	30
Spinach, cooked	½ cup	130	30
Broccoli, cooked	½ cup	90	25
Avocado	½ medium	80	20
Beets, cooked	½ cup	65	15
Orange juice	6 ounces	35	10
<b>Legumes &amp; Nuts</b>			
Lentils	½ cup	180	45
Black beans	½ cup	130	30
Kidney beans, red	½ cup	115	30
Garbanzo beans	½ cup	80	20
Soy nuts, roasted	1 ounce	60	15
Peanuts, dry roasted	1 ounce	40	10
<b>Meat</b>			
Beef liver, cooked	3 ounces	185	45

\*Based on USDA National Nutrient Database, 2007

\*\*DFE = Dietary Folate Equivalents



grain foods reduce the risk of **heart disease** by 20-30 percent. Similarly, diets high in whole grains, fruits, vegetables and legumes may offer protection against **coronary heart disease, vascular disease, strokes and cancer.**

## **Folic Acid and Neural Tube Defects**

NTDs occur very early in pregnancy when developing fetal cells first become the brain and spinal cord, forming a tube-like structure from which the entire nervous system is created. Spina bifida, which accounts for 90 percent of NTDs, involves incomplete formation of the spine. Bones of the vertebrae that protect the spinal cord do not fuse completely, leaving an unprotected gap or bulge through the spinal cord. While these defects can sometimes be repaired, permanent nerve damage often occurs, resulting in leg and foot deformities and weakness, learning disabilities, and mental retardation.

The U.S. Public Health Services estimates that if folic acid supplements or foods with fortified folic acid were consumed daily, the incidence of NTDs may be reduced by as much as half.<sup>1</sup> NTD incidence has dropped by an estimated 26 percent in the U.S. due to folic acid fortification, and by as much as 39 percent in Canada.<sup>1</sup>

## **Heart Health**

Many epidemiological studies show a low dietary intake of folate with elevated blood levels of homocysteine (a risk factor indicator in the blood) can increase risk of coronary heart disease, heart attack and stroke. Consuming higher levels of whole grains or folic acid fortified foods could potentially reduce the risk of heart disease and stroke by up to 20-30 percent.

While increased levels of folic acid in the daily diet have demonstrated some protective measures against coronary heart disease and stroke, the exact mechanism is not yet clear. Researchers speculate that other components of whole grains, such as vitamin B<sub>6</sub>, magnesium, fiber and vitamin E may also play important, yet unknown, roles.

## **Cancer**

Epidemiological studies have also suggested that folate deficiency is linked to an increased risk for certain types of cancer. For instance, high folate intake could reduce risk of **colon cancer** by as much as 40 percent when compared to low folate intake. Researchers also found a 75 percent reduction in colon cancer risk for women with at least 15 years of high folic acid intake (400 mcg/day or more)<sup>1</sup>. This is extremely significant as colon cancer is the second-most prevalent cancer in the U.S. Newer data suggest that increased consumption of whole grains, fruits and vegetables (sources of folate) along with a reduced intake of red meats correlate with decreased risk of **colorectal cancer**.

Adequate folic acid intake has also shown to be effective in protecting against **pancreatic cancer** in men who smoke and against **breast cancer** in women who drink even moderate amounts of alcohol.

While research continues, the mechanism behind the protective effect of folic acid against cancer has not yet been ascertained.

# **Health Connections**

## **Bone**

Newer research suggests there may be a connection between reduced homocysteine levels, folate, vitamins B<sub>6</sub> and B<sub>12</sub> with reduced risk of hip fractures, and osteoporosis in women. However excess folic acid supplementation, especially in older individuals, may mask a vitamin B<sub>12</sub> deficiency.

## **Nervous System**

Folic acid is critical for proper functioning of the nervous system and it can affect cognition, especially in older individuals. Low folate levels are linked to cognitive impairment, depression, and dementia in older patients, and contribute to an overall slowing of brain processes. Supplementation with folic acid has been shown to improve the mental health of patients.

## **Kidney**

Adequate folic acid intake may help reduce cardiovascular disease in those with kidney disease. Improving folate intake may be beneficial in reducing high levels of homocysteine for those patients.

## **Other**

Emerging research also shows a decreased risk of prostate cancer in men consuming diets high in folate. There may also be a role of high folate intake in eye health. Data on these is still preliminary.

## **Summary**

Grain foods fortified with folic acid plus foods which naturally contain it should be consumed on a daily basis. Much research suggests that many people could benefit from taking a folic acid supplement to ensure adequate intake. Diets rich in folic acid may provide numerous health benefits.

## **Resources:**

<sup>1</sup>Center for Disease Control and Prevention. Morbidity and Mortality Weekly Report. 2007;55:1377-1380.

See also *Folate, Grains & Health*, 2007 Wheat Foods Council white paper. This is available at [www.wheatfoods.org](http://www.wheatfoods.org).

Additional information available from: United States Department of Agriculture, National Nutrient Database 2007; Centers for Disease Control; March of Dimes; MyPyramid; Whole Grains Council; U.S. Food and Drug Administration.

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