Frequently asked questions about folate and folic acid

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The term "folate" denotes a water-soluble vitamin that is essential for human health. The vitamin plays a role in many metabolic processes in the human body and must therefore be supplied in adequate amounts through the food we eat.

Folate compounds occur naturally in foods of plant and animal origin, such as green cabbage, lamb's lettuce or eggs. The synthetically produced form of folate is called "folic acid". Folic acid is used in food supplements and for fortification of foods.

Women who want to or might become pregnant and women in the first trimester of pregnancy are advised to take folic acid in supplement form, in addition to a high-folate diet, as this can reduce the risk of a neural tube defect (spina bifida) in their child.

The BfR has put together the following important FAQ on folate and folic acid.

What is folate?
Folate is the collective term for a water-soluble vitamin that is essential for human health. The name comes from the Latin "folium" (leaf), as the vitamin was first detected in green leafy vegetables. Foods contain various different folate compounds (folates).

Why does the body need folate?
Folates ingested with food are converted in the body into an active form, tetrahydrofolate. In this active form, they are involved in many metabolic processes as transmitters of molecular structures with one carbon atom (C1 groups). Among other things, folates are required for the synthesis of purines and thymidylate, and therefore for DNA synthesis. Due to this function, the vitamin is of particular importance for cell division and growth processes.

What is folic acid?
The synthetically produced form of the vitamin folate is called "folic acid". Folic acid is used in food supplements, fortified foods or medicinal products.

What are folate equivalents?
Food folates and synthetic folic acid are ingested and converted into the active "tetrahydrofolate" form in the body at differing rates. There are also differences in terms of sensitivity to light, heat or oxygen. This means that the human body cannot use food folates as well as it can use folic acid. In order to take account of these differences in bioavailability, the concentration of folate and folic acid is specified in folate equivalents:

1 microgram of folate equivalent corresponds to 1 microgram of dietary folate or 0.5 micrograms of synthetic folic acid (if taken on an empty stomach) or 0.6 micrograms of folic acid (if consumed in combination with other foods).

In which foods do folates occur naturally?
Folates occur naturally in foods of animal and plant origin. Green vegetables like spinach, some cabbage and fruit varieties, pulses and whole grain cereal products, egg yolk and liver are good natural sources of folates. Wheat germ and soybeans are particularly rich in folates.

It should be noted that folates are water-soluble and sensitive to light and heat. Losses can therefore occur during the preparation and storage of food. Food products should be carefully prepared in order to minimise the folate losses.

How much folate or folate equivalents should people consume?
The German Nutrition Society (DGE) has defined age-dependent reference values for the intake of folate equivalents and recommends a daily intake of 300 micrograms for children from the age of 13 as well as for adolescents and adults. Pregnant and breast-feeding women have higher requirements, and their recommended intake is 550 and 450 micrograms per day, respectively.

In addition to the recommended dietary intake of folate equivalents, women who want to or might become pregnant should take a supplement supplying 400 micrograms of synthetic folic acid per day, as this can reduce the risk of birth defects (neural tube defects). Intake should begin at least four weeks before pregnancy and continue up to the end of the first trimester.

The DGE has published a detailed overview of age-dependent intake recommendations (in German) at the following URL:
http://www.dge.de/wissenschaft/referenzwerte/folat/

Why are women advised to supplement with folic acid before becoming pregnant and during the first trimester of pregnancy?
Studies have shown that the intake of folic acid by pregnant women can reduce the risk of congenital malformations (neural tube defects). Women should begin taking folic acid supplements at least four weeks before becoming pregnant and continue to take them until the end of the first trimester.

As up to 50 % of pregnancies in Germany are unplanned, it is difficult for these women in particular to choose the right time to start taking folic acid. Women of child-bearing age should therefore always take care to ensure good folate supply by choosing folate-rich foods.

In the case of women who have already given birth to a child with neural tube defect or have terminated a pregnancy due to this kind of defect, the risk of neural tube defects in future children is particularly high. If these women wish to have another child, they should consult their doctor.

Why should women start taking folic acid before they become pregnant?
The neural tube from which the central nervous system (brain and spinal marrow) is developed is formed during the first four weeks of pregnancy, in other words during a phase when many women do not yet know that they are pregnant. Full closure of the neural tube normally occurs towards the end of the fourth week of pregnancy. If this closure does not take place or is only partial, this is called a "neural tube defect". The most well-known defect of this kind is spina bifida.

In Germany, neural tube defects are estimated to occur in 1 to 2 out of every 1,000 pregnancies. There are many causes of this. Studies have shown, however, that the intake of folic acid before and during the critical phase of neural tube closure can reduce the risk. In order to ensure an effective folate concentration up to the time when the neural tube is closed, women should already begin with folic acid supplementation around four weeks before becoming pregnant.

Is it possible to ingest the amount of folate recommended by the German Nutrition Society through our diet?
Normally, the amount of folate recommended by the German Nutrition Society can be supplied by a balanced, varied diet containing plenty of vegetables, pulses and whole grain products. The increased intake recommendations during pregnancy and lactation (550 or 450 micrograms per day) can also be covered by an appropriate diet, but it is then necessary to carefully choose foods that are particularly rich in folates.

The following overview lists possible folate intakes in micrograms [µg] from usual consumption amounts of selected foods (source: Souci-Fachmann-Kraut, 2013):

- Green cabbage (cooked, 150 g) 147 µg
- Wheat bran (cooked, 40 g) 78 µg
- Lamb's lettuce (50 g) 73 µg
- Lentil stew (720 g) 72 µg
- Roasted peanuts (50 g) 63 µg
- Broccoli (steamed, 100 g) 39 µg
- Hen's egg (1 egg, 60 g) 35 µg
- Orange (150 g) 33 µg
- Hard cheese (30 g) 32 µg
- Mixed wheat bread/Rye-wheat bread (50 g) 17 µg

Do people in Germany have an adequate intake of folate?
According to the data from the National Nutrition Study II (NVS II), more than 50 % of adults in Germany do not reach the recommended daily intake of 300 micrograms of folate equivalents.

It should be noted, however, that the data on food consumption does not allow any reliable statements on the folate status of the population. One of the problems is that the consumption of fortified foods and the use of food supplements are not reliably documented in the relevant surveys, with the result that actual intake may be underestimated.

Biomarkers like serum and erythrocyte folate concentration are better indicators for assessing the folate status. In the 1998 German Health Interview and Examination Survey, these parameters were measured specifically in women of child-bearing age. The study showed that, although women did not reach the intake recommendations, analysis of the biomarkers showed that fewer than 5 % had to be classified as "deficient". No current data is available on the folate status of children and adults in Germany.

Is it advisable to use folic acid supplements or to eat foods fortified with folic acid in order to improve folate status?
The intake of folic acid supplements is only recommended for the general population if there is evidence of a deficiency. There is no scientific proof of a benefit of folic acid supplements above the quantities that are necessary to ensure an adequate intake. Nevertheless, women who want to or might become pregnant are advised to use folic acid supplements (400 micrograms per day) during a period from at least four weeks before up to the end of the first trimester of pregnancy.

There are many food products on the German market that are fortified with folic acid, such as breakfast cereals, dairy products, salt and soft drinks. In some cases, these food products can go a long way towards ensuring an adequate folate status. 2 g (half a teaspoon) of salt

enriched with folic acid provide 200 micrograms of folic acid, for example. This corresponds to 340 micrograms of folate equivalents - a quantity that is above the daily intake of 300 micrograms recommended for adults by the German Nutrition Society. Dietary habits and the reasons for selecting a certain food product vary widely, however. Fortified food products therefore lead to uncontrolled increases in the intake of folic acid and folate equivalents in the population. These products are thus not suitable as an effective means of improving folate provision.

What are the effects on health of folate deficiency?
Clinical chronic folate deficiency can result in megaloblastic anaemia. In addition, the importance of this vitamin for DNA synthesis means that cell division can be adversely affected, and this can negatively impact the rapidly dividing cells in the bone marrow and the digestive tract in particular.
During pregnancy, inadequate folate provision can have a negative effect on the development and health of the unborn child.

What effects can high intakes of folate or folic acid have on health?
No undesirable effects have been observed to date due to the intake of **folate** from regular diets. Moreover, current information indicates that the recommended dose of 400 micrograms of **folic acid** per day before and during pregnancy is safe for women. If folic acid intake exceeds 1,000 micrograms, this can mask the neurological changes caused by possible vitamin B12 deficiency. Consequently, the European Food Safety Authority (EFSA) has defined a safe upper intake level (UL) of 1,000 micrograms for adults and suitably lower intake amounts for children. Vitamin B12 deficiency may be found above all in older people, who cannot effectively absorb vitamin B12 from their food, and in vegans. A folic acid intake permanently above the UL increases the risk of undesirable effects on health.

What does the BfR recommend?
The BfR recommends that all consumers have a diet which is rich in natural folates. A folate-rich diet is particularly important for women during pregnancy and breastfeeding. The BfR further recommends that women wishing to start a family and women in the first trimester of pregnancy should supplement their diet with folic acid (400 micrograms per day). Doctors, midwives and pharmacists should provide targeted information and advice regarding the effect of folic acid.