

AIS SPORTS SUPPLEMENT FRAMEWORK



FOLATE (Folic Acid, Folacin, Vitamin B9) | GROUP A

1 of 5

What is it?

- > Folate is the commonly used group name for folic acid and its derivatives with similar activity. Folate is also known as vitamin B9 and folacin.
- > Folate is **an essential nutrient** as the human body cannot make it.
- > Folate functions as a coenzyme in single-carbon transfers, donating methyl groups. It is involved in the metabolism of amino acids involved in cell division and red blood cell maturation, as well as nucleotides involved in DNA and RNA synthesis. The need for folate is higher when cell turnover is increased, such as in fetal development.
- > For **women considering pregnancy**, there is high level evidence that folic acid supplementation at 400-800 µg per day preconception (at least the month before) and in the first 3 months of pregnancy is associated with a reduction in risk of neural tube defects (NTD).¹⁻⁵
- > Population-level fortification of folate results in a decrease in the incidence of NTD by about 70%.¹

What does it look like?

- > Folate or tetrahydrofolate (THF) is the natural occurring vitamin found in food, whereas folic acid (pteroyl glutamic acid, (PGA)) is the form used in vitamin supplement and fortification of food as it is more stable than folate.
- > Once folate is consumed the gut enzymes hydrolyse this compound to a monoglutamate ready for absorption. Folate appears as 5-methyl THF in the blood. In cells, it appears as PGA. Folic acid (as supplements or in fortified food) converts to THF prior to absorption. Within cells it returns to PGA. The liver contains about 50% of the body stores of folate.
- > The enzyme methyl tetrahydrofolate reductase (MTHFR) is involved in the conversion of 5,10-methylenetetrahydrofolate to 5-methyl THF.
- > Food Standards Australia New Zealand (FSANZ) developed a mandatory folic acid fortification standard to help reduce the incidence of NTDs in the population. These standards, effective from September–October 2009, required the addition of folic acid to bread-making flour in Australia. These products include all wheat breads, rolls, flatbreads, muffins, and bread making flour, but excludes organic bread and those made with other grains.
- > Natural dietary sources of folate include green leafy vegetables (e.g. spinach, kale, brussels sprouts, asparagus, bok choy and other Asian greens), fruits, nuts, and legumes (beans, peas, chickpeas soybeans, lentils), rice, avocado, fruit, beef liver (although not recommended in pregnancy due to high levels of vitamin A).
- > Fortified products that contain folic acid include many breakfast cereals, bread, fruit juice, and vegemite.
- > It is estimated that food folate bioavailability is 50% and that folic acid bioavailability is 85% when taken with food (either as a food fortificant or as a supplement) and 100% when taken on an empty stomach with water.



How and when should I use it?

- > General folate deficiency can be detected from a blood test. In general, indicators of folate status include erythrocyte, serum or urinary folate, plasma homocysteine and haematological measures as well as clinical endpoints such as NTDs or chronic degenerative disease. Of these, erythrocyte folate is generally regarded as the primary indicator as it reflects tissue folate stores. For some age groups, erythrocyte folate is used in conjunction with plasma homocysteine and plasma or serum folate.⁶
- > Low folate status may be caused by low dietary intake, poor absorption of ingested folate and alteration of folate metabolism due to genetic defects (homo or heterozygous for MTHFR (methyl THF reductase gene)) or drug interaction (e.g. anti-convulsants, anti-malarial drugs, methotrexate, and barbiturates).
- > Importantly, women considering pregnancy require 400-800 µg of folate daily in the **month before, and 600-800 µg daily in the first three months of pregnancy**. This often requires considering supplementation after reviewing dietary intake.

Folate Requirements

- > For the general population the EAR* and RDI* for folate are 320 and 400 µg, respectively (not weight or gender dependent).
- > During pregnancy, both EAR and RDI increase to 520 µg (EAR) and 600 µg (RDI). Women require 400-800 µg of folate daily in the **month before and 600-800 µg daily in the first three months of pregnancy**.⁵
- > This dose increases to 5000 µg folic acid for the month before and first three months of pregnancy for women in certain groups. These include women with personal or family history of NTDs, women with diabetes or women with a pre-pregnancy body mass index of >30kg/m². Women who take epilepsy medication also need to take this higher dose of folic acid.
- > Males looking to support their partner in conceiving are encouraged to ensure sufficient dietary folate intake.

(*NOTE: **EAR**: Estimated Average Requirement - the median usual intake estimated to meet the requirement of half the healthy individuals in an age group. Can be used to examine the probability that an **individual's** intake of a particular nutrient is inadequate. **RDI**: Recommended Dietary Intake - This is the average daily dietary intake to meet the nutrient requirements of 97% of the population (i.e. > 2SD above the average))



Food Sources of Folate^{7,8}

- > 1 µg dietary folate equivalent (DFE) = 1 µg food folate
= 0.5 µg folic acid on an empty stomach
= 0.6 µg folic acid with meals or as fortified foods

Table 1: Folate content of foods

Food	Folate (µg)
Bread	
Slice (30g)	45
Grain wrap (60g)	120
Avocado (1/4)	45
Rice, cooked (1/2 cup)	White / brown / wild
	5 - 25
Vegetables, cooked (75g)	
Green peas, asparagus, broccolini, bok choy	20 - 60
Vegetables, salad (1 cup)	50
Legumes, canned, drained (1/2 cup)	
Baked beans	70
Broad beans	100
Chickpeas	50
Red kidney beans	30
Soy beans	250
Tofu (100g)	75

Prescription

- > **What:** Wherever possible achieve folate requirements through consumption of a variety of foods. Where this is insufficient to meet daily needs, inclusion of a folate supplement in capsule/ tablet form may be warranted.
- > **When:** Folate supplements are absorbed most effectively when taken on an empty stomach with water.
- > **How much:** For women planning pregnancy or in the first trimester of pregnancy, a supplement containing 300-500 µg folate/ capsule should be sufficient in addition to dietary intake.
- > **Product Information:** Fefol contains 300 µg folate, while single folate supplements generally contain 500 µg folate. There are currently no batch-tested folate supplements.



Are there any concerns or considerations?

> Synergy and Deficiencies

- There is synergy between folate and vitamin B12. DNA synthesis is strongly linked to vitamin B12 status. A deficiency of vitamin B12 results in altered folate metabolism pathways. Megaloblastic (or microcytic) anaemia symptoms of folate deficiency can emerge similarly to that of vitamin B12.

> An Over-Reliance on Pregnancy Multivitamins?⁹

- Folate, B12, iodine and iron are required in pregnancy where the mother is found to be deficient, and many women require supplementation to meet requirements for both themselves and their developing fetus.
- Multivitamins are advertised as an essential part of the pregnancy toolkit, and maternity care providers often prescribe them. In Australia, more than four in five people take multivitamins while pregnant. A common motivating factor for supplement use is 'peace of mind' that their nutritional needs are being met and they're often seen as a more efficient way of obtaining required nutrients compared with food.
- The most popular pregnancy multivitamin on the market costs, at minimum, \$300 when taken from the month before conception and throughout pregnancy. Compare this to \$40 for a supplement containing only folic acid and iodine. Expensive brands are not better – they generally contain more nutrients, at higher doses than necessary.
- While folic acid supplementation beyond the first trimester, at 400-800 µg per day, may yield positive effects on the child's cognitive development,¹⁰ supplementation during the third trimester might be associated with an increased risk of childhood asthma.¹¹ The effects of high doses are mostly unknown and should be avoided unless medically indicated.

> Polymorphisms

- There is much attention online to the enzyme MTHFR, involved in the conversion of 5,10-methylenetetrahydrofolate to 5-methyltetrahydrofolate; the primary form of circulating folate in the blood.¹²
- This is out of proportion to the known association of folate deficiency and neural tube defects in pregnancy, and the importance of identifying women with low pre-conception folate levels to supplement appropriately.¹²
- There are two predominant MTHFR polymorphisms, 677C>T and 1298A>C, and in the general population, 60–70% of individuals will have at least one of these variants. A polymorphism is a variant within a gene that does not necessarily affect its function, unlike a pathogenic mutation.¹²
- Given the prevalence of the MTHFR polymorphisms (60–70% of the population) and the frequency of neural tube defects (approximately 1 in 1000 in Australia), it is unlikely that the polymorphisms alone have a significant role in the formation of neural tube defects.¹²
- While there may be some increased risk of neural tube defects in individuals with the homozygous 677C>T variant, the level of risk has not been quantified and the impact of environmental factors, such as folate supplementation, has a more significant role. Specialist (RANZCOG) Obstetricians can advise on evidence-based testing for high-risk individuals.



Where can I find more information?

Food Standards ANZ: Folic acid/folate in pregnancy	https://www.foodstandards.gov.au/consumer/nutrition/pregnancy/folic-acidfolate-and-pregnancy
Batch tested products list	https://www.informed-sport.com/ https://hasta.org.au/
Supplement safety information	https://www.asada.gov.au/substances/supplements-sport

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The Australian Institute of Sport (AIS) Supplement Framework is an initiative of the Australian High Performance Sport System. The AIS acknowledges the support of members of the National Institute Network (NIN) and National Sporting Organisations (NSO) and their staff in delivering content expertise. This information is intended to help athletes, coaches and scientists make evidence-based decisions about the use of supplements and sports foods. Before engaging in supplement use, we recommend that each individual refer to the specific supplement policies of their sporting organisation, sports institute or parent body, and seek appropriate professional advice from an accredited sports dietitian (<https://www.sportsdietitians.com.au/>).

Athletes should be aware that the use of supplements may have anti-doping implications. Athletes are reminded that they are responsible for all substances that enter their body under the 'strict liability' rules of the World Anti-Doping Code. Some supplements are riskier than others. The Sport Integrity Australia (SIA) app is a useful resource to help mitigate the risk of inadvertent doping by helping to identify supplements that have been batch-tested. The SIA App provides a list of more than 11,000 batch-tested products. We recommend that all athletes consult the educational resources of SIA regarding the risks associated with supplements and sports foods. While batch-tested products have the lowest risk of a product containing prohibited substances, they cannot offer you a guarantee that they are not contaminated (www.sportintegrity.gov.au/what-we-do/supplements-sport).

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