

# NUTRIENTS

## Vitamins: Folate

### What is it?

Folate is a general name used for the water-soluble B-complex vitamin. It includes folate, which occurs naturally in food, and folic acid, which is the synthetic form of the vitamin and is used in vitamin supplements and fortified foods. Folate gets its name from the Latin word "folium" for leaf, which relates to the vitamins occurrence in dark green leafy vegetables.

### Functions - what does it do?

#### DNA and RNA Synthesis

Folate is necessary for the formation of the essential building blocks of DNA and RNA. DNA and RNA are involved in cell division, when a cell divides and forms 2 new identical copies, and in the transmission of genes. As folate is necessary for the production and maintenance of new cells it especially important during periods of rapid cell division and growth such as infancy and to make fetal tissues and organs early in pregnancy.

#### Formation of Red Blood Cells (Erythrocytes)

Folate is essential for the formation of both red blood cells (erythrocytes) and white blood cells in the bone marrow, and for their development. Folate deficiency greatly affects red blood cell formation.

**Erythrocytes** are mature red blood cells. These have no nucleus and a life span of 120 days. Contains haemoglobin, which carries oxygen and carbon dioxide

#### Amino acids

Folate functions as an co-enzyme in many of the reactions during the metabolism of amino acids.

### Requirements - How much do we need?

Life-Stage (years)	Recommended Dietary Allowance*	
	(µg/day)	
	Males	Females
0 - 0.5 (0 - 6 months)	65#	65#
0.5 - 1 (7 - 12 months)	80#	80#
1 - 3	150b	150b
4 - 8	200b	200b
9 - 13	300b	300b
14 - 18	400b	400b

19 - 50	400	400
> 50	400	400
Life-Stage (years)	Pregnancy	Lactation
18 and younger	600	500
19 - 30	600	500
Ages 31 - 50	600	500

DFE = dietary folate equivalents (1 µg DFE = 1 µg of food folate = 0.5 µg synthetic (supplemental) folic acid on an empty stomach = 0.6 µg folic acid from fortified food or supplement consumed with food). Synthetic folic acid is absorbed more easily than natural food folate.

\*The Recommended Dietary Allowance (RDA) is the average daily dietary intake level that is sufficient to meet the nutrient requirements of nearly all (97-98%) healthy individuals in each life-stage and gender group.

#Adequate Intakes (AI) are used as no RDA is established. The AI is a recommended daily intake level based on observed or experimentally determined approximations of nutrient intake by a group of healthy people who are assumed to be maintaining an adequate nutritional state.

bNo data was found thus the EARs and the RDAs were extrapolated from adult values.

### Sources - Where is it found?

Food Groups	Food Sources	Nutrient Density		
		High	Medium	Low
Vegetables	Leafy green vegetables (Spinach, Asparagus, Broccoli, Collards, Turnip greens)			
Meat, poultry, fish, dry beans, eggs, and nuts	Liver			
Bread, cereals, rice and pasta	Fortified breakfast cereal, Wheat germ (whole-wheat products)			
Fruit	Oranges, Strawberries, Cantaloupe and other melons			
Meat, poultry, fish, dry beans, eggs, and nuts	Eggs, Beans, Sunflower seeds			

### Deficiency - When you have too little

Deficiency in folate results in poor growth, megaloblastic anaemia (and other blood disorders), glossitis (inflammation of the tongue), and increased levels of homocysteine (an amino-acid which could increase one's risk for heart disease)

### Neural Tube Defect (NTDs)

Neural tube defects are birth defects that develop very early in pregnancy, between the 17th and 28th day after conception. This is generally before a woman knows she is pregnant. During this critical time of pregnancy, the proper formation and closure of the neural tube, which later becomes the spinal cord, brain, and bone surrounding the spinal cord and brain, normally takes place. A neural tube defect occurs when the neural tube fails to close properly.

A maternal deficiency of folate and a genetic predisposition have been linked to the development of birth defects, such as neural tube defects.

The most common neural tube defects include: -

- **spina bifida**: - the lower part of the neural tube, which develops into the spinal cord and the bones that enclose them, does not close properly, leaving the spinal cord exposed or covered only with skin
- **anencephaly**: - a fatal condition in which the upper end of the neural tube does not close and the brain fails to completely develop or is entirely absent

**Other possible complications in pregnancy.** Limited evidence in humans suggest that deficiency of folate may be associated with spontaneous abortion and other complications during pregnancy such as preterm labour and low birth weight (LBW).

## Anaemia

A deficiency in folate prevents the immature **red blood cells** from dividing in the early phases of cell synthesis. The cells then become progressively larger because they continue to make protein and other cell components. However the cells produce insufficient DNA to form two nuclei, due to the folate deficiency, and as a result the cell cannot divide.

**Megaloblasts** are large, nucleated, immature red blood cells that results when the cell is unable to divide as it normally should.

They then remain as large immature cells, called **megaloblasts**. Fewer mature red blood cells (erythrocytes) enter the bloodstream, which decreases the blood's oxygen carrying capacity, causing an anaemia called megaloblastic anaemia. Megaloblasts can develop into abnormally large red blood cells called macrocytes.

White cell formation and cell division throughout the body is disrupted, but to a lesser degree.

## Toxicity - When you have too much

No toxicity from folate has been reported in adults with daily doses as high as 15 mg. Although not toxic to adults, at these high levels, the effects on the fetus is unknown. The safest during pregnancy is to avoid intakes greater than 2 1/2 times the RDA.

Life-Stage (years)	Upper Limit+ (µg/day)	
	Males	Females
0 - 0.5 (0 - 6 months)	ND	ND
0.5 - 1 (7 - 12 months)	ND	ND
1 - 3	300	300
4 - 8	400	400
9 - 13	600	600
14 - 18	800	800
Ages 19 - 50	1000	1000
> 50	1000	1000
Life-Stage (years)	Pregnancy	Lactation
18 and younger	800	800
Ages 19+	1000	1000

DFE = dietary folate equivalents (1µg DFE = 1 µg of food folate = 0.5 µg synthetic (supplemental) folic acid on an empty stomach = 0.6 µg folic acid from fortified food or supplement consumed with food). Synthetic folic acid is absorbed more easily than natural food folate.

+Upper Limits (UL) = The maximum level of daily nutrient intake that is likely to pose no risk of adverse effects. Unless otherwise specified, the UL represents total intake from food, water, and supplements.

ND = Not determinable due to lack of data of adverse effects in this age group and concern with regard to lack of ability to handle excess amounts. Source of intake should be from food only to prevent high levels of intake.

**For further, personalized and more detailed information, please contact a dietitian registered with the Health Professions Council of South Africa. References from the scientific literature used to compile this document are available on request.**

## Human Nutrition | Menslike Voeding

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