

Vitamin C

Vitamin C, mg/d		Women	Men	Children		
				2-5 y	6-9 y	10-13 y
Recommended intake	RI	75	75	30	40	508
Average requirement	AR	50	60			
Lower level of intake	LI	10	10			

The term vitamin C refers to both ascorbic acid and dehydroascorbic acid, since both forms have an anti-scorbutic effect. Ascorbic acid is, however, the primary and functional *in vivo* form of the vitamin. Although the classical vitamin C deficiency, scurvy, is prevented by small daily intakes (about 10 mg/d) (1), current knowledge of the antioxidant functions of vitamin C has recently had a great influence on the paradigm of daily vitamin C allowances.

Physiology and metabolism

Vitamin C is a cofactor for several enzymes involved in the biosynthesis of collagen, carnitine and neurotransmitters (2). In all these functions, the effects of ascorbic acid are based on its ability to be an electron donor. Consequently, ascorbic acid is oxidised to dehydroascorbic acid. The vitamin is also involved in the biosynthesis of corticosteroids and aldosterone and in the microsomal hydroxylation of cholesterol in the conversion of cholesterol to bile acids. Due to its reducing power, ascorbic acid also improves absorption of non-haem iron.

Ascorbic acid is an extremely potent antioxidant. The vitamin readily scavenges reactive oxygen species and reactive nitrogen species, in addition to singlet oxygen and hypochlorite. It is evident that ascorbic acid provides meaningful antioxidant protection in the eye, in neutrophils, in semen and in plasma (e.g. against LDL oxidation) (2,3). Ascorbic acid may also regenerate other antioxidants, such as vitamin E and glutathione. As a reducing agent, ascorbic acid may also inactivate carcinogenic substances, such as nitrosamines.

Ascorbic acid is absorbed from the intestine by a sodium-dependent, active process that is saturable and dose-dependent. The bioavailability

Upper intake levels and toxicity

There is no evidence that high intakes (> 1,000 mg/day) of vitamin C are carcinogenic or teratogenic (23). However, high intakes may cause diarrhoea and other gastrointestinal disturbances, increased oxalate formation and kidney stone formation in susceptible individuals. In theory, too high an intake of vitamin C may have pro-oxidative effects.

Dietary sources and intake

The concentration of vitamin C is high in many vegetables, berries and fruits (*e.g.* citrus fruits). Moreover, intake from vitamin C-enriched products (*e.g.* juices) may be considerable. The average intake of vitamin C in the Nordic countries is adequate (80-160 mg/10 MJ).

REFERENCES

1. Weber P, Bendich A, Schalch W. Vitamin C and human health - a review of recent data relevant to human requirements. *Int J Vitam Nutr Res* 1996; 66:19-30.
2. Carr AC, Frei B. Toward a new recommended dietary allowance for vitamin C based on antioxidant and health effects in humans. *Am J Clin Nutr* 1999; 69:1086-107.

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