Vitamin B_1 (Thiamin)

Introduction

Thiamin is a sulfur-containing member of the water-soluble B-complex family, which is essential for normal development, growth, reproduction, lactation, and physical performance. It is involved in releasing energy from macronutrients that provide energy, especially from carbohydrates. Thiamin is an essential vitamin that cannot be synthesized and must come from the diet. Thiamin is widely distributed in small amounts in foods, but it is easily lost during the milling, heating, canning, blanching, and storage of foods. It is readily absorbed from the intestine and readily excreted through the kidneys (Tanphaichitr 1999; Expert Group on Vitamins and Minerals [EVM] 2003).

Thiamin is especially sensitive to the antinutritive effects of excess alcohol consumption (Tanphaichitr 1999), which decreases the absorption of thiamin and increases its excretion. Alcohol also inhibits the activation of thiamin to its coenzyme forms. Overt thiamin deficiency in Western countries occurs mostly among alcoholics. Thiamin deficiency may result from dependence on unfortified, polished rice as the staple food and from the consumption of a diet that is limiting in other respects.

Safety Considerations

Oral thiamin, or vitamin B_1, is virtually nontoxic, as demonstrated by a long history of use as an oral supplement—often as many multiples of recommended intakes—without adverse effects. In fact, there are no reports of adverse effects of oral thiamin, even at dosages of several hundred milligrams (Life Sciences Research Office [LSRO] 1978; Department of Health, Education, and Welfare [DHEW] 1979; Institute of Medicine [IOM] 1998). Rare cases of allergic sensitivity are documented and have occurred solely in patients who received thiamin by the parenteral route (Miller and Hayes 1982; Wrenn et al. 1989). These reactions have no apparent relevance to the safety of oral intake and may have been related to the injection vehicle. The efficiency of thiamin

absorption rapidly declines when intake reaches 5 mg. This limitation has been cited as a possible explanation for the lack of toxicity of orally administered thiamin (Hayes and Hegsted 1973; LSRO 1978). The absence of adverse effects, aside from a rare allergic reaction after repeated daily doses of 100 mg injected intravenously, argues for an inherently low order of toxicity for thiamin.

Official Reviews

IOM (1998). The IOM found no data to identify a LOAEL for oral thiamin in either humans or animals. Thus, with no adverse effects from oral thiamin that would support selection of a LOAEL or specific NOAEL value, the IOM did not set a UL.

European Commission, Scientific Committee on Food (EC SCF 2001). The EC SCF found evidence of adverse effects only for injected thiamin. Since it found none for oral thiamin, it saw no need to set a UL value.

EVM (2003). The UK's EVM found that a small clinical trial (Meador et al. 1993) revealed no adverse effects of thiamin at daily oral intakes of 6,000 to 8,000 mg for 5 to 6 months. Based on a clinical trial with 556 young women given 100 mg thiamin for 60 to 90 days (Gokhale 1996), the EVM found no evidence of adverse effects at any level of intake; therefore, it set 100 mg per day as the guidance level for supplemental thiamin.

CRN Recommendations

CRN identifies a UL of 100 mg supplemental thiamin hydrochloride per day, based on clinical trial data (Gokhale 1996). The safe use of thiamin products at much higher levels, in addition to the clinical trial data of Meador and colleagues (1993), strongly suggests that much higher levels of thiamin are safe, but there is insufficient data to firmly support that conclusion.

Quantitative Summary for Thiamin (Vitamin B_1)

CRN UL, supplemental intake	100 mg/day
IOM UL, total intake	Not determined
EC SCF UL, total intake	Not determined
EC supplement maximum	Not determined
EVM, guidance level, supplemental intake	100 mg/day

References

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