Molybdenum

Introduction

Molybdenum has a number of valences and functions in oxidation-reduction reactions in plants and lower organisms. In humans only three molybdenum-containing enzymes are known: sulphite oxidase, xanthine oxidase and aldehyde oxidase. The enzymes are involved in catabolism of sulphur amino acids and heterocyclic compounds, including purines and pyridines.

Dietary sources and intake

Molybdenum is ubiquitous in food and water as soluble molybdates, although the content of molybdenum in plants varies widely with soil concentration and pH. Good food sources are grains, legumes, nuts, offal, milk and milk products and eggs, while fruits, root vegetables and muscle meat are poor sources (Scientific Committee for Food 1993). High concentrations have been found in shellfish. Molybdenum levels in drinking water are mostly low, typically less than 0.01mg/L. However, in areas near mining sites, molybdenum concentrations up to 0.2 mg/L have been reported (WHO 2004).

There are few published data on the dietary intake of molybdenum in the Nordic countries. Typical intakes according to supermarket baskets or dietary surveys are in the range 100-150 µg/day (Räsänen et al 1985, Bro et al 1990, Becker and Kumpulainen 1987). Many multivitamin-mineral supplements contain molybdenum and must be taken into consideration when estimating total dietary intake.

Physiology and metabolism

Molybdenum absorption from the diet is efficient (> 80 %). The body content is primarily regulated via the kidneys.

There is only one recorded case of apparent molybdenum deficiency, which occurred in a subject receiving total parenteral nutrition (50 µg Mo/day) for 18 months due to Crohn’s disease (Abumrad et al 1981, Mullee et al 2012). Unconsciousness, heart disturbances and night blindness were observed; the symptoms disappeared after supplementation with 160 µg Mo/day.

Stable isotopes have been used to investigate molybdenum metabolism in healthy men aged 22-33 years (Turnlund et al 1995 a; b, Turnlund and Keyes 2004, Novotny and Turnlund 2007). Molybdenum absorption was efficient (about 90 %) when subjects ingested diets containing five levels of the metal (ranging from 22 to 1490 µg/day) for 24 days each. Excess molybdenum was rapidly excreted in urine, although whole-body retention was increased when the dietary level was low.
Molybdenum status is difficult to determine as low plasma levels are tightly maintained by up-regulated urinary excretion after increased intakes (Mullee et al. 2012).

**Requirement and recommended intake**

Adult men fed a diet with only 22 µg/day molybdenum for 102 days did not develop any symptoms of molybdenum deficiency, leading Turnlund and co-workers (1995b) to suggest that the minimum daily requirement for this trace element is about 25 µg. Based on the findings of Turnlund and co-workers (1995b), the U.S. Food and Nutrition Board (2001) has set a Recommended Dietary Allowance (RDA) for adult men and women to 45 µg/day. The average dietary intake of molybdenum in US men and women is more than twice this level.

The Nordic Recommendations of 2004 did not include recommendations for molybdenum intake. The evidence regarding molybdenum in relation to setting dietary reference values is still limited (Mullee et al 2012) and not considered sufficient to establish requirements. Accordingly, recommendations are not given for any age group.

**Upper intake levels and toxicity**

The absence of toxicity symptoms in men fed 1490 µg molybdenum per day for 24 days (Turnlund et al 1995a) provides a working upper boundary for further studies. The US Food and Nutrition Board (2001) set a Tolerable Upper Intake Level (UL) of 2 mg/day based on impaired reproduction and growth in animals. A British expert group concluded that there are insufficient data from animal and human studies to establish a Safe Upper Level for molybdenum (FSA 2003). The Scientific Committee on Food (SCF) set the UL at 0.6 mg/day for adults and between 0.1 and 0.5 mg/day for children aged 1-17 years (SCF, 2006).

**References**


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