

# USANA Technical Bulletin

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## Molybdenum

### Technical Background

- Molybdenum was first shown to be an essential mineral in 1953.
- Molybdenum functions primarily as an oxidizing agent. It is very important for the transport of electrons in oxidation-reduction reactions.<sup>1</sup>
- Molybdenum is a cofactor for enzymes referred to as molybdoenzymes. These enzymes catalyze the hydroxylation (the addition of an -OH group) of various molecules.<sup>2</sup> The three found in humans are aldehyde oxidase, sulfate oxidase, and xanthine oxidase/dehydrogenase.
- Aldehyde oxidase oxidizes and detoxifies pyrimidines, purines, pteridines, and similar compounds.
- Sulfate oxidase catalyzes the transformation of sulfites to sulfate. It is believed that people with sulfite sensitivities may have a problem with this pathway or a deficiency of molybdenum.<sup>3</sup>
- Xanthine oxidase/dehydrogenase catalyzes the transformation of hypoxanthine to xanthine and xanthine to uric acid. Disturbance of the metabolism of uric acid is one of the signs of molybdenum deficiency.<sup>1</sup>

### Sources and Recommended Intake

- Rich sources of molybdenum include cereals and grains, dried legumes, milk and milk products, nuts, and organ meats (kidney and liver).
- The Recommended Dietary Allowance (RDA) for molybdenum has been set at 45 µg (micrograms) per day for men and women, but recent research suggests that this amount may be too low.<sup>4</sup>
- Molybdenum has a low order of toxicity. Very large amounts (100-500 mg/kg) are required in food or water to cause clinical toxicity.<sup>5</sup> At this level, molybdenum may compete with copper for absorption. For this reason, toxic levels may be manifested by symptoms associated with copper deficiency.<sup>1</sup>

### Abstracts

*Turnlund JR; Keyes WR; Peiffer GL. Molybdenum absorption, excretion, and retention studied with stable isotopes in young men at five intakes of dietary molybdenum. Am J Clin Nutr, Oct 1995, 62(4):790-6.* A study of molybdenum absorption, excretion, and balance was conducted in four young men fed five amounts of dietary molybdenum, ranging from 22 to 1490 micrograms/d, for 24 d each. The study was conducted to obtain scientific data on which to base a recommendation on dietary molybdenum intake for healthy young men. Stable isotopes of

molybdenum were used as tracers. <sup>100</sup>Mo was fed five times during the study and <sup>97</sup>Mo was infused three times. <sup>94</sup>Mo was used to quantify the molybdenum isotopes and total molybdenum in urine, fecal collections, and diets by isotope dilution. Adverse effects were not observed at any of the dietary intakes. Molybdenum was very efficiently absorbed, 88-93%, at all dietary molybdenum intakes, and adsorption was most efficient at the highest amounts of dietary molybdenum. The amount and percentage of molybdenum excreted in the urine increased as dietary molybdenum increased, suggesting that molybdenum turnover is slow when dietary molybdenum is low and increases as dietary molybdenum increases. We conclude from these results that dietary intakes between 22 and 1500 micrograms/d by adult men are safe for > or = 24 d and that molybdenum retention is regulated by urinary excretion. Molybdenum is conserved at low intakes and excess molybdenum is rapidly excreted in the urine when intake is high.

## References

- <sup>1</sup> Ziegler EE, Filer LJ. Present Knowledge in Nutrition 7<sup>th</sup> edition (ILSI Press, Washington DC. 1996.) Pg.358.
- <sup>2</sup> Beedham C. Molybdenum hydroxylases as drug metabolizing enzymes. *Drug Metab Rev* 1985;16:119-156.
- <sup>3</sup> Feinstein A. *Healing with Vitamins* (Rodale Press, Pennsylvania 1996). Pp. 34.
- <sup>4</sup> Novotny DJ, Turnlund JR. Molybdenum intake influences molybdenum kinetics in humans. 2007. *Journal of Nutrition* 137:37-42.
- <sup>5</sup> Mills CF, Davis GK Molybdenum. In Mertz W (ed), *Trace elements in human animal nutrition*, Vol 1. (Academic Press, San Diego). Pp. 429-63.