Med Hypotheses. 2004;63(6):1054-6. doi: 10.1016/j.mehy.2003.12.053.

Up-regulatory impact of boron on vitamin D function -- does it reflect inhibition of 24-hydroxylase?

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Affiliations expand

PMID: 15504575 DOI: 10.1016/j.mehy.2003.12.053

Abstract

Nutritional intakes of boron have been shown to lessen the adverse consequences of vitamin D deficiency in rodents. Pilot clinical studies suggest that this effect may be mediated, in whole or in part, by an increase in serum 25-hydroxyvitamin D. We propose that, in concentrations achievable with good diets, boron suppresses the activity of the microsomal enzyme 24-hydroxylase, chiefly responsible for catabolism of this steroid. This inhibition may reflect a direct interaction with the enzyme, or perhaps boron's ability to form a covalent complex with the product of its activity, 24,25-dihydroxyvitamin D. An up-regulatory impact of boron on 25-hydroxyvitamin D is potentially beneficial in light of the fact that the vitamin D status of many individuals is poor during winter months, and traditional supplemental doses of this vitamin are often too low to correct this problem. There is growing evidence that good vitamin D status -- as reflected by 25-hydroxyvitamin D levels -- may reduce risk for a host of prominent disorders; thus, boron may have the ability to potentiate this protection. Clinical studies also suggest that nutritional boron can up-regulate 17beta-estradiol levels in women, including postmenopausal women receiving hormone replacement therapy. The catabolism of this hormone is achieved by microsomal enzymes catalyzing vicinal hydroxylations -- a description that also applies to 24-hydroxylase. This suggests the more general hypothesis that nutritional boron can inhibit a range of microsomal enzymes which insert hydroxyl groups vicinal to existing hydroxyls in steroids -- including the enzymes which catabolize estradiol and 25-hydroxyvitamin D.

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Similar articles

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Henry HL.

J Cell Biochem. 1992 May;49(1):4-9. doi: 10.1002/jcb.240490103.

PMID: 1644853 Review.

Rat renal 25-hydroxyvitamin D3 1- and 24-hydroxylases: their in vivo regulation.

Tanaka Y, DeLuca HF.

Am J Physiol. 1984 Feb;246(2 Pt 1):E168-73. doi: 10.1152/ajpendo.1984.246.2.E168.

PMID: 6538071

Renal and nonrenal 25-hydroxyvitamin D-1alpha-hydroxylases and their clinical significance.

Bell NH.

J Bone Miner Res. 1998 Mar;13(3):350-3. doi: 10.1359/jbmr.1998.13.3.350.

PMID: 9525334 Review. No abstract available.

Normal 24-hydroxylation of vitamin D metabolites in patients with vitamin D-dependency rickets type I. Structural implications for the vitamin D hydroxylases.

Mandla S, Jones G, Tenenhouse HS.

J Clin Endocrinol Metab. 1992 Apr;74(4):814-20. doi: 10.1210/jcem.74.4.1548347.
PMID: 1548347

Role of 24-hydroxylase in vitamin D3 growth response of OVCAR-3 ovarian cancer cells.

Miettinen S, Ahonen MH, Lou YR, Manninen T, Tuohimaa P, Syvälä H, Ylikomi T.

Int J Cancer. 2004 Jan 20;108(3):367-73. doi: 10.1002/ijc.11520.
PMID: 14648702

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Concentration-Dependent Effects of Boric Acid on Osteogenic Differentiation of Vascular Smooth Muscle Cells.

Al Khalif O, Sezer G.

Biol Trace Elem Res. 2024 May 3. doi: 10.1007/s12011-024-04204-6. Online ahead of print.
PMID: 38700634

Zebrafish as a Model to Unveil the Pro-Osteogenic Effects of Boron-Vitamin D3 Synergism.

Sojan JM, Gundappa MK, Carletti A, Gaspar V, Gavaia P, Maradonna F, Carnevali O.

Front Nutr. 2022 Apr 29;9:868805. doi: 10.3389/fnut.2022.868805. eCollection 2022.

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Adarsh V, Dintaran P, Shivakumar GNK, Vijayarangam EA, Kumar DD, Nagaraj K, Eknath JS.

Trop Anim Health Prod. 2021 Aug 21;53(4):444. doi: 10.1007/s11250-021-02878-x.

PMID: 34420099

Boron improves cardiac contractility and fibrotic remodeling following myocardial infarction injury.

Bouchareb R, Katz M, Saadallah N, Sassi Y, Ali S, Lebeche D.

Sci Rep. 2020 Oct 13;10(1):17138. doi: 10.1038/s41598-020-73864-w.

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Biol Trace Elem Res. 2019 Mar;188(1):11-25. doi: 10.1007/s12011-018-1550-4. Epub 2018 Oct 20.

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Vitamin D3 24-Hydroxylase

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