

# Abstract

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## Is there convincing biological or behavioral evidence linking vitamin D deficiency to brain dysfunction?

McCann JC, Ames BN.

Nutrition and Metabolism Center, Children's Hospital Oakland Research Institute, 5700 Martin Luther King Jr. Way, Oakland, CA 94609, USA.

**BACKGROUND AND OBJECTIVE:** Vitamin D insufficiency is common in the United States; the elderly and African-Americans are at particularly high risk of deficiency. This review, written for a broad scientific readership, presents a critical overview of scientific evidence relevant to a possible causal relationship between vitamin D deficiency and adverse cognitive or behavioral effects.

**DISCUSSION:** Topics discussed are 1) biological functions of vitamin D relevant to cognition and behavior; 2) studies in humans and rodents that directly examine effects of vitamin D inadequacy on cognition or behavior; and 3) immunomodulatory activity of vitamin D relative to the proinflammatory cytokine theory of cognitive/behavioral dysfunction.

**CONCLUSION:** We conclude there is ample biological evidence to suggest an important role for vitamin D in brain development and function. However, direct effects of vitamin D inadequacy on cognition/behavior in human or rodent systems appear to be subtle, and in our opinion, the current experimental evidence base does not yet fully satisfy causal criteria. Possible explanations for the apparent inconsistency between results of biological and cognitive/behavioral experiments, as well as suggested areas for further research are discussed. Despite residual uncertainty, recommendations for vitamin D supplementation of at-risk groups, including nursing infants, the elderly, and African-Americans appear warranted to ensure adequacy.

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