

Perspectives on Vitamin D and Human Nutrition

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Vitamin D is an unusual vitamin because of its hormonal actions and the fact it can be synthesized by the body after exposure to sunlight. Vitamin D helps the body use calcium and phosphorus to make bones and teeth. Vitamin D deficiency causes rickets in children and osteomalacia (softening of the bones) or osteoporosis (fragile bones) in adults. Excess vitamin D can cause calcification of soft tissues (kidneys, heart, lungs and blood vessels).

Less than one hundred years ago (1), in 1919, Edward Melanby discovered cod-liver oil prevented rickets in puppies. In 1925, JS Colwell learned irradiating milk to convert ergosterol to vitamin D₂ helped prevent rickets. In 1932, vitamin D 'fortified' milks to prevent rickets began to be sold in the United States even though the structure of vitamin D was not discovered until 1936.

Vitamin D is consumed in two dietary forms: ergocalciferol (D₂) from mushrooms and cholecalciferol (D₃) found in animal products (liver, cheese, egg yolks) and produced in the skin. In both cases, dietary vitamin D is biologically inert and needs to be converted to 25(OH)D by the liver and then to the physiologically active 1,25(OH)₂D by the kidney. Serum 25(OH)D concentrations are the best indicator of vitamin D status (biomarker of exposure).

The National Institute of Standards and Technology (NIST) in collaboration with the National Institutes of Health's Office of Dietary Supplements (NIH ODS)(2) released a standard reference material for 25(OH)D July 2009 that has transformed vitamin D research. In 2011, the Dietary Reference Intakes for Vitamin D were increased (3) because of evidence linking serum 25(OH)D concentrations with health risk. The Institute of Medicine set 30 nmol/L (12 ng/mL) as the cutoff for deficiency and recommended maintaining levels of at least 50 nmol/L (20 ng/mL).

The majority of Americans still do not consume enough dietary vitamin D or get enough sun exposure to maintain healthy 25(OH)D concentrations (>50 nmol/L). Not all dietary forms are equal so studies comparing different vitamin D forms will be summarized. In addition, the latest research on the importance of maintaining blood vitamin D levels between 50-80 nmol/L will be reviewed.

Citations

1. Berner LA, Keast DR, Bailey RL, Dwyer JT. Fortified Foods Are Major Contributors to Nutrient Intakes in Diets of US Children and Adolescents. *J Acad Nutr Diet*. 2014;114:1009–22.
2. National Institute of Standards and Technology. NIST Releases Vitamin D Standard Reference Material [Internet]. NIST. 2009 [cited 2017 Nov 13]. Available from: <https://www.nist.gov/news-events/news/2009/07/nist-releases-vitamin-d-standard-reference-material>
3. Ross AC, Institute of Medicine (U. S.), editors. Dietary reference intakes: calcium, vitamin D. Washington, DC: National Academies Press; 2011. 536 p.