

Editorial

STATUS OF VITAMIN D DEFICIENCY IN INDIA

Introduction

Vitamin D status has a profound effect on the growth and development of children and has major implications for adult bone health. Optimal calcium and vitamin D nutrition for bone mineral health during childhood and adolescence leads to adequate peak bone mass, which acts as a safeguard against osteoporosis and susceptibility to fractures at later age. In view of the above, industrialized countries have made fortification of milk and other food products with vitamin D, a routine practice. In contrast, food fortification with vitamin D was never considered in India due to widely held belief that adequate sunshine is available throughout the year (8.4° and 37.6° N latitude). However, recent literature on bone mineral health from different parts of India shows evidence to the contrary. Widespread deficiency with serum levels below 20 ng/ml (50 nmol/L) in all ages, genders, pregnancy/lactating women, and socioeconomic groups is evident in more than 80% of the population residing in rural/urban India. Poor vitamin D formation in Indians is probably as a result of poor sun exposure, due to cultural avoidance of skin exposure, crowded houses with limited sun exposure, and work culture of staying indoors, vegetarian food habits, dark skin complexion, atmospheric pollution sedentary lifestyle, and lack of vitamin D food fortification program.^{1,2}



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There is presently disagreement regarding the levels of serum 25 (OH)D that provide maximum health benefits to the general public at large. The Institute of Medicine committee convened in 2011, based on available literature on calcium absorption, bone mineral density (BMD), rickets and osteomalacia, showed no additional benefits on bone health with serum levels of 30 ng/ml over 20 ng/ml as recommended by Endocrine Society Task Force guidelines. In fact, dose-response relationship between serum 25 (OH)D and bone mineral parameters showed that 97.5% of general population are assured of sound bone health with serum 25 (OH)D levels of 20 ng/ml.³ We tend to agree with their assessment as the peak bone density of active healthy Indian men with adequate nutrition and no constraints to bone mineralization was comparable to that reported in white US males with the mean serum levels of 25 (OH)D ranging between 22.5 and 93.5 nmol/L.⁴

Most studies in apparently healthy Asian Indians have revealed lower BMD and higher prevalence of osteoporosis than white Caucasians.⁵⁻⁷ Recent large scale study on healthy Indians >50 years of age also revealed significantly higher prevalence of osteoporosis (35.1%, F-42.5%, M-24.8%) in comparison to US caucasians (F18%, M-6%), Europeans (F-21%, M-6%), Taiwanis (F-11.4%, M-1.6%) and Sri-Lankans (F/M-5.8%) but similar to Chinese (F-50.1%, M-22.5%).⁸

In view of chronic vitamin D deficiency, low BMD, high prevalence of osteoporosis and the projection that 50% of all osteoporotic hip fractures in the world by the year 2050, will occur in Asia,⁹ sound urgent corrective measures need to be undertaken to deal with this major public health issue of vitamin D deficiency. A multiprong attack through (1) advocacy for regular sun exposure, (2) consumption of foods rich in vitamin D, (3) daily or monthly intake of vitamin D supplements, and (4) food fortification strategies would be ideal. However, dietary measures, sun exposure and supplementation strategies are unlikely to be effective, as majority of Indians are vegetarians, changes in lifestyle has led to poor sun exposure, and proportion of Indians consuming vitamin D supplements are very few. A systemic review¹⁰ evaluating several randomized control intervention studies with vitamin D fortification in community dwelling adults show that 14/15 studies observed significant effect of fortified food on serum 25 (OH)D concentration. Our two recent studies evaluating the impact of vitamin D fortified milk supplement on vitamin D status of healthy school children aged 10 to 14 years have shown to be a safe and effective strategy.^{11,12} Since food fortification strategies have consistently shown significant beneficial effects on serum 25 (OH)D, many countries have opted for mandatory or voluntary food fortification with vitamin D.^{10,13} Although, the adopted strategies for vitamin D fortification include both dairy as well as nondairy foods, but dairy products have been most commonly used. It is time that the regulatory authorities, Government of India, seriously consider fortification of commonly consumed food products in India which will pay rich dividends in the long run.

REFERENCES

1. Marwaha RK, Goswami R. Vitamin D deficiency and its health consequences in India. In: Holick MF, editor. Vitamin D: Physiology, molecular biology and clinical applications. 2nd ed. New York: Humana Press; 2010 p. 529-542.
2. Mithal A, Dhingra V, Lau E. International Osteoporosis Foundation (2009). The Asian Audit: Epidemiology, cost and burden of osteoporosis in Asia 2009. Available at: www.iofbonehealth.org/asian-audit
3. Rosen CJ, Abrams SA, Aloia JF, Branhon PM, Clinton SK, Durazo-Arizu RA, Gallagher JG, Gallo RL, Jones G, Kovacs CS, et al. IOM committee members respond to Endocrine Society vitamin D guideline. *J Clin Endocrinol Metab* 2012 Apr;97(4): 1146-1152.
4. Marwaha RK, Tandon N, Shivaprasad C, Kanwar R, Mani K, Aggarwal R, Bhadra K, Singh S, Sharma B, Tripathi RP. Peak bone mineral density of physically active healthy Indian men with adequate nutrition and no known constraints to bone mineralization. *J Clin Densitom* 2009 Jul-Sep;12(3):314-321.
5. Arya V, et al. Vitamin D status and its relationship with bone mineral density in healthy Asian Indians. *Osteoporos Int* 2004 Jan;15(1):56-61.
6. Paul TV, et al. Prevalence of osteoporosis in ambulatory postmenopausal women from a semiurban region in Southern India: relationship to calcium nutrition and vitamin D status. *Endocr Pract* 2008 Sep;14(6):665-671.
7. S Teotia SP, Teotia M. Nutritional bone disease in Indian population. *Indian J Med Res* 2008 Mar;127(3):219-228.
8. Marwaha RK, Tandon N, Garg MK, Kanwar R, Narang A, Sastry A, Saberwal A, Bhadra K, Mithal A. Bone health in healthy Indian population aged 50 years and above. *Osteoporos Int* 2011 Nov;22(11):2829-2836.
9. Johnell O, Kanis J. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. *Osteoporosis Int* 2006 Dec;17(12):1726-1733.
10. Black LJ, Seamans KM, Cashman KD, Kiely M. An updated systemic review and meta-analysis of the efficacy of vitamin D food fortification. *J Nutr* 2012 Jun;142(6):1102-1108.
11. Khadgawat R, Marwaha RK, Garg MK, Ramot R, Oberoi AK, Sreenivas V, Gahlot M, Mohan N, Mathur P, Gupta N. Impact of vitamin D fortified milk supplementation on vitamin D status of healthy school children aged 10-14 years. *Osteoporos Int* 2013 Aug;24(8):2335-2343.
12. Garg MK, Marwaha RK, Khadgawat R, Ramot R, Obroi AK, Mohan N, Gupta N, Madan R. Efficacy of vitamin D loading doses on serum 25-hydroxy vitamin D levels in school going adolescents: an open label nonrandomized prospective trial. *J Pediatr Endocrinol Metab* 2013;26(5-6):515-523.
13. Calvo MS, Whiting SJ, Barton CN. Vitamin D intake: a global perspective of current status. *J Nutr* 2005 Feb;135(2): 310-316.

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