

TREND SHIFT IN VITAMIN-D DEFICIENCY AND SUPPLEMENTS IN LAST DECADE IN INDIA

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ABSTRACT

Vitamin D deficiency is a prevalent public health issue in India, with significant implications for bone health, immune function, and overall well-being. This abstract reviews trends in vitamin D status across various demographics in India in last decade. It highlights the widespread prevalence of deficiency and insufficiency, driven by factors such as limited sun exposure, dietary insufficiency, and socioeconomic disparities. Emerging data indicates an increasing awareness and intervention strategies, including fortified foods and supplements. Despite these efforts, gaps in public health policies and awareness remain, necessitating more comprehensive approaches to vitamin D management. The review underscores the need for targeted public health initiatives, improved dietary guidelines, and greater emphasis on preventive care to address the growing concern of vitamin D deficiency in India. Future research should focus on longitudinal studies to better understand the evolving trends and effectiveness of current interventions.

KEYWORDS: Vitamin D deficiency, Bone health, Dietary guidelines.

INTRODUCTION

Vitamin-D deficiency has been noted very frequent nutritional deprivation in India as well as globally.^[1] Vitamin-D synthesized in our body via skin and liver following sunshine exposure. Foods containing vitamin d are also natural source while exogenous supplementation is popular in current scenario. 25-hydroxyvitamin D (25(OH)D) is predominant metabolite of vitamin-D and is recorded as vigorous and reliable marker of vitamin D status.^[2,3] Serum vitamin-D level in form of 25-OH vitamin d is easily available in pathological labs over two decades. Plenty of studies are published over 2 decades measuring 25(OH) vitamin d level and estimating prevalence of vitamin d deficiency in India.^[4-13] Most of the studies are hospital based and few are from community. Vitamin-D deficiency is widely reported from every region of India despite having sunlight throughout the year. It could be attributed to several factors like darkening of skin, increased pigmentation and covered clothing habits in few communities and lack of sufficient dietary intake of vitamin-D. After availability of serum vitamin-D assay, it become popular among health care providers to check serum levels and supplementation of vitamin-D in the form of injections, capsules and syrup forms.

It is noted that vitamin-D deficiency trend is improving in studies from from the USA (2007–2017), Ireland (1993–2013), Norway (1994–2008), and Canada (over 10 years of follow-up).^[14-17] Seasonal variability of serum vitamin-D should also be addressed because it also affects overall vitamin-D level as well as health status of person. Few of the studies also drawn attention towards hypervitaminosis-D. and this is also reported increasingly over last decade.

Role of vitamin-D in various disorders

In last 2 decades there is surge in vitamin-D deficiency related studies in various disorders, especially focussing on chronic diseases and metabolic disorders.

Metabolic Syndrome

Vitamin D in obesity reduces the risk of chronic inflammation in adipose tissue and has an inverse relationship with the risk of abdominal obesity. Hence, vitamin D supplementation appears to be helpful for obese patients. It is already known that obese patients with low serum vitamin-D levels have altered vitamin-D metabolism; conversely, weight loss associated with reduced adipose tissue in obese individuals is linked to elevated circulation 25-OH vitamin-D levels. In order to maintain serum 25-OH vitamin-D levels, patients with intestinal malabsorption syndrome and obesity require vitamin D supplements that are two to three times higher.^[18] It has also been suggested that obesity may have muddled the relationship between vitamin D and metabolic disorders.^[19]

Hypertension

Vitamin D has been found to lower blood pressure and lipid levels in people with metabolic syndrome. A lack of vitamin D may make metabolic syndrome more severe. Based on the findings of randomized control trials (RCTs), vitamin D supplementation appears to have a beneficial effect on both blood pressure and abdominal obesity. Nevertheless, the majority of studies have shown that vitamin D administration is ineffective in treating chronic heart failure, lowering myocardial cardiovascular events, heart attacks, or deaths related to cardiovascular disease. Regarding this issue, a 1-year course of 4000 IU/day vitamin D3 therapy decreased triglyceride levels but had no effect on cardiovascular disease, lipid profiles, or C-reactive protein levels in individuals with type 2 diabetes. Another study found that giving patients with metabolic syndrome a 150,000 IU bolus of vitamin D every three months did not change their lipid profiles or inflammatory markers. Furthermore, compared to placebo or no intervention, a Cochrane review of 159 RCTs indicated that vitamin D supplementation might lower all-cause mortality; however, vitamin D supplementation had no discernible impact on mortality from cardiovascular events.^[20]

Diabetes Mellitus

Vitamin D functions as an anti-inflammatory in Type 2 diabetes mellitus, preventing the generation of cytokines, which are important in reducing inflammation. By attaching to vitamin D receptors on pancreatic beta cells, vitamin D also controls the release of insulin. Because of the activation of insulin receptors on the human insulin receptor gene promoter, vitamin D also increases insulin sensitivity. It modifies the metabolism of fatty acids and activates transcription factors in tissues responsive to insulin. Vitamin D administration enhanced insulin sensitivity, reduced insulin resistance, and reduced systemic inflammation in pre-diabetic patients.^[20]

Rheumatoid arthritis

An autoimmune condition called rheumatoid arthritis causes inflammation of the synovium in joints, which destroys bone and cartilage. Numerous observational studies have demonstrated a connection between the severity of rheumatic illnesses and a lower serum 25-OH vitamin-D level.^[18]

Sexual dysfunction

A 2019 Turkish study by Culha et al. found that 42 patients receiving tadalafil 5 mg as a phosphodiesterase-5 inhibitor to treat erectile dysfunction did not see any improvement in sexual dysfunction. Patients receiving less than 20 ng/ml of blood vitamin D were administered an oral vitamin D3 supplement (100,000 IU/week) for a duration of one month. The participants continued taking 5 mg of tadalafil daily for the duration of this month. Before and after using vitamin D, scores from the international prostate symptom score (IPSS) and the international erectile function index-erectile function (IIEF-EF) were compared.^[21] To measure women's sexual function objectively, the female sexual performance index (FSFI) was used at baseline and six months later. Women with vitamin D deficiency scored worse on the FSFI in the three domains of libido, orgasm, and sexual enjoyment than women with insufficient vitamin D. Vitamin D supplementation increased libido in both intervention groups and improved orgasm, sexual satisfaction, and total FSFI score ($p < 0.05$) in women who were vitamin D deficient.^[22]

Overall, studies show that treating men and women with vitamin D greatly enhanced their sexual function. More research with larger sample sizes is required to show the benefits of measuring serum vitamin D levels and using vitamin D supplements in the treatment of sexual dysfunction in both males and females.^[23]

DISCUSSION

Since serum vitamin D test has become widely accessible, vitamin D insufficiency has become recognized as a major global health issue. Increasing vitamin-D awareness among the general population and medical professionals is another important aspect in the diagnosis of vitamin-D deficiency. In India, the practice of fortifying food and edible ingredients with vitamin D is still relatively new. Pharmacological supplementation may have contributed to the increase in serum vitamin-D levels. Pharmaceutical industry data shows that within the past five years, sales of medicines that supplement with vitamin D have nearly doubled.^[24] An additional fascinating fact was that vitamin D supplementation was more recommended for women.

It might be because medical professionals are more aware of the signs of vitamin D insufficiency in women. In India, it has been observed that women in both rural and urban areas are more likely to be deficient in vitamin D. 50–90% of healthy people also have vitamin D deficiency, according to a number of population-based research.^[4-6] Furthermore, the majority of published studies on vitamin D insufficiency have small sample sizes. In a study conducted on about 5,000 adolescents, Marwah et al. found that the mean serum 25(OH) D level was 11.8 ± 7.2 ng/ml.^[9] Serum 25(OH)D levels were reported by Shukla et al. in 26,346 seemingly healthy people who visited for a standard physical examination between 2011 and 2014.

Of the subjects, they found that 59% (61% of the men and 31% of the women) lacked vitamin D. 5,527 patients' worth of data from a north Indian tertiary care hospital were provided by Sharma et al. 59.4% of the patients had vitamin D insufficiency, with a declining trend from 2011 to 2016. In a rural population in north India, Sahu et al.'s study on the impact of seasonal fluctuation found that mean serum vitamin D levels were nearly twice as high in the summer as they

were in the winter.^[11] Summertime increases in vitamin D production and sunshine exposure are related to the seasonal fluctuation in serum 25(OH)D. Because of the increased solar zenith angle, the decreased sunlight exposure from wool clothes, and the increased atmospheric pollution.

CONCLUSION

Lack of vitamin D is a global health issue. But over the past ten years, the pattern has changed. In clinical practice, vitamin-D supplementation is widely utilized. The availability of serum vitamin-D assays in rural and small towns has a role in the diagnosis of this illness and the recommendation of supplements for it. Social structure makes women more vulnerable to vitamin-D insufficiency. One of the most important steps in reducing vitamin D insufficiency in the population is the fortification of food and edible goods with the vitamin-D.

Learning pearls

- Vitamin-D deficiency is a global health issue.
- Easy availability of Serum 25(OH) vitamin-d assay is a major trend changer.
- Last decade has witnessed major change in vitamin-D deficiency related studies.
- Females are more vitamin-D deficient due to social structure of our society.
- Use of vitamin-D supplementation exponentially increased in last 5 years.
- Fortification of food and edible items with vitamin-D may be a major step to curb vitamin-D deficiency.

REFERENCES

1. Holick MF. Vitamin D: Extraskeletal health. *Rheum Dis Clin North Am*, 2012; 38: 141-60.
2. Joshi K, Bhatia V. Vitamin D deficiency in a tropical country-treatment and prevention in children. *Indian J Pediatr*, 2012; 81: 84-9.
3. Cashman KD, van den Heuvel EG, Schoemaker RJ, Prévéraud DP, Macdonald HM, Arcot J. 25-Hydroxyvitamin D as a biomarker of vitamin D status and its modeling to inform strategies for prevention of vitamin D deficiency within the population. *Adv Nutr*, 2017; 8: 947-57.
4. Goswami R, Kochupillai N, Gupta, N, Goswami D, Singh N, Dudha A. Presence of 25(OH)D deficiency in a rural North Indian village despite abundant sunshine. *J Assoc Physicians India*, 2008; 56: 755-7.
5. Harinarayan CV. Prevalence of Vitamin D insufficiency in postmenopausal South Indian women. *Osteoporos Int*, 2005; 16: 397-402.
6. Misra P, Srivastava R, Misra A, Kant S, Kardam P, Vikram NK. Vitamin D status of adult females residing in Ballabgarh health and demographic surveillance system: A community-based study. *Indian J Public Health*, 2017; 61: 194-8.
7. Kapil U, Pandey RM, Goswami R, Sharma B, Sharma N, Ramakrishnan L. Prevalence of Vitamin D deficiency and associated risk factors among children residing at high altitude in Shimla district, Himachal Pradesh, India. *Indian J Endocrinol Metab*, 2017; 21: 178-83.
8. Srimani S, Saha I, Chaudhuri D. Prevalence and association of metabolic syndrome and Vitamin D deficiency among postmenopausal women in a rural block of West Bengal, India. *PLoS One*, 2017; 12: e0188331.
9. Marwaha RK, Tandon N, Garg MK, Kanwar R, Narang A, Sastry A, et al. Vitamin D status in healthy Indians aged 50 years and above. *J Assoc Physicians India*, 2011; 59: 706-9.

10. Marwaha RK, Tandon N, Reddy DR, Aggarwal R, Singh R, Sawhney RC, et al. Vitamin D and bone mineral density status of healthy schoolchildren in northern India. *Am J Clin Nutr*, 2005; 82: 477-82.
11. Sahu M, Bhatia V, Aggarwal A, Rawat V, Saxena P, Pandey A, et al. Vitamin D deficiency in rural girls and pregnant women despite abundant sunshine in northern India. *Clin Endocrinol (Oxf)*, 2009; 70: 680-4.
12. Sachan A, Gupta R, Das V, Agarwal A, Awasthi PK, Bhatia V. High prevalence of vitamin D deficiency among pregnant women and their newborns in northern India. *Am J Clin Nutr*, 2005; 81: 1060-4.
13. Shivane VK, Sarathi V, Bandgar T, Menon P, Shah NS. High prevalence of hypovitaminosis D in young healthy adults from the western part of India. *Postgrad Med J*, 2011; 87: 514-8.
14. Galior K, Ketha H, Grebe S, Singh RJ. 10 years of 25-hydroxyvitamin D testing by LC-MS/MS-trends in vitamin D deficiency and sufficiency. *Bone Rep*, 2018; 8: 268-73.
15. McKenna MJ, Murray BF, O'Keane M, Kilbane MT. Rising trend in vitamin D status from 1993 to 2013: Dual concerns for the future. *Endocr Connect*, 2015; 4: 163-71.
16. Berger C, Greene-Finestone LS, Langsetmo L, Kreiger N, Joseph L, Kovacs CS, et al. Temporal trends and determinants of longitudinal change in 25-hydroxyvitamin D and parathyroid hormone levels. *J Bone Mineral Res*, 2012; 27: 1381-9.
17. Jorde R, Sneve M, Hutchinson M, Emaus N, Figenschau Y, Grimnes G. Tracking of serum 25-hydroxyvitamin D levels during 14 years in a population-based study and during 12 months in an intervention study. *Am J Epidemiol*, 2010; 171: 903-8.
18. Charoengam, N., Vitamin D and rheumatic diseases: a review of clinical evidence. *Int. J. Mol. Sci.*, 2021; 22(19): 10659. Ewald, E.R., et al., Effect of baseline micronutrient and inflammation status on CD4 recovery post-cART initiation in the multinational PEARLS trial. *Clin. Nutr.*, 2019; 38(3): 1303–1309.
19. Al Anouti, F., et al., Effects of vitamin D supplementation on lipid profile in adults with the metabolic syndrome: a systematic review and meta-analysis of randomized controlled trials. *Nutrients*, 2020; 12(11): 3352.
20. Ganmaa, D., et al., Vitamin D, respiratory infections, and chronic disease: review of meta-analyses and randomized clinical trials. *J. Intern. Med.*, 2021; 291 (2). Gil, Á., Plaza-Diaz, J., Mesa, M.D., Vitamin D: classic and novel actions. *Ann. Nutr. Metab.*, 2018; 72(2): 87–95.
21. Culha M. The effect of vitamin d replacement in pde5 inhibitors-resistant erectile dysfunction patients. *J Sexual Med.*, 2019; 16(5): S54-5.
22. Tirabassi G, Maurizio S, Gianmaria S, Melissa C, Giovanna M, Giovanni C, et al. Vitamin D and male sexual function: a transversal and longitudinal study. *Int J Endocrinol*, 2018; 2018.
23. Samreen, Khan MI, Saxena A, Chakraborty R. Hypovitaminosis-D and sexual dysfunction. *Int J Adv Med*, 2024; 11: 411-4.
24. Market for vitamin D likely to touch \$2.5 billion by 2020, says report. Available from: https://www.business-standard.com/article/companies/market-for-vitamin-d-likely-to-touch-2-5-billion-by-2020-saysreport-118091300915_1.html. [Last accessed on 2019 Dec 05].