

## Vit D Deficiency in Chhattisgarh, India: A Tertiary Care Hospital Based Study

Prashant Nigam\*, Shashikant Sahu, Dushyant Malav, Ekansh Jindal, Ritik Agrawal, Diwakar Chandrakar, Vinayakrao J, Akash Parial

Department of Biochemistry, Chhattisgarh Institute of Medical Sciences, Bilaspur, Chhattisgarh, India

### ABSTRACT

**Introduction:** Vitamin D deficiency is widespread globally, regardless of sunshine availability, geography, age, or sex. However, it remains highly underdiagnosed and undertreated, representing a significant nutritional deficiency worldwide.

**Aim:** To determine the prevalence of Vitamin D deficiency in Chhattisgarh, India.

**Method:** An observational study was conducted at Department of Biochemistry, Chhattisgarh Institute of Medical Sciences, and Bilaspur on 1185 patients, aged 11 years and above, attending OPD of Various departments. Blood samples were collected from all participants to measure serum Vitamin D levels. Vitamin D deficiency was defined as a serum 25-hydroxyvitamin D level of less than 20 ng/mL, while insufficiency was defined as a level between 20 and 29 ng/mL. Sufficiency was defined as a level of 30 ng/mL or higher.

**Results:** Out of the 1185 participants, 37.2% (n=441) had Vitamin D deficiency, while 31.6% (n=375) had Vitamin D insufficiency, and 31.1% (n=369) had sufficient levels of Vitamin D. Females had a higher prevalence of Vitamin D deficiency (43.9%) than males (26.8%). The highest prevalence of deficiency was found in the age group of 01-20 years (47.7%), followed by 21-40 years (42.6%) and 41-60 years (35.2%). None of the participants aged >80 years had Vitamin D deficiency.

**Conclusion:** Vitamin D deficiency is prevalent in adults in Chhattisgarh, with females and younger age groups being at higher risk. Public health interventions such as promoting outdoor activities, fortifying food with Vitamin D, and educating the public on the importance of Vitamin D supplementation may be beneficial in reducing the prevalence of Vitamin D deficiency in the population.

**Keywords:** Vit D Deficiency, Chhattisgarh, Cholecalciferol, Calcitriol

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**Corresponding author:** Prashant Nigam

**e-mail** ✉: nigam.prashant866@gmail.com

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### INTRODUCTION

Vitamin D the "Sunshine Vitamin" has been recognized as being essential for Bone Health and normal Bodily functions. Its insufficiency affects almost 50% of the population Worldwide [1].

The prevalence of Vitamin D deficiency is reported worldwide irrespective of availability of sunshine,

geography of study area, age and sex. Vitamin D is classified as fat-soluble vitamin. It has many biological effects including increasing intestinal absorption of minerals like calcium, magnesium, and phosphate. It is synthesized as cholecalciferol in the lower layers of epidermis of the skin.

There are two main forms of vitamin D - Vitamin D3 or Cholecalciferol and Vitamin D2 or Ergocalciferol. Vitamin D2 is naturally obtained from UV-irradiated yeast sterols and sun-exposed mushrooms, while vitamin D3 is produced in the skin on exposure to sunlight and is found in food sources like Herring, Salmon, tuna and Mackrel fish. Although structurally similar, there exists a difference of only a single side chain between the two forms of Vitamin D. Vitamin D, which generally refers to vitamin D3, undergoes initial hydroxylation in the liver to form 25-Hydroxyvitamin

D3/Calcidiol, and further hydroxylation in the kidney to form 1, 25 Dihydroxyvitamin D3/Calcitriol, which is the more potent and active form of Vitamin D [2,3].

Sunshine is an essential factor for the synthesis of Vitamin D and the geographical condition of India is such that generally there is plenty of sunshine throughout the year except for a few rainy months. Nevertheless, the prevalence of vitamin D deficiency in almost all of India is a surprising phenomenon in itself. The climate of Chhattisgarh is tropical and due to its proximity to the Tropic of Cancer, sunlight is available in abundance. It is hot and humid in summer due to its dependence on monsoon for rain. Keeping in view the abundant amount of sunlight and the general Indian food system, this study has been done for the purpose of to check the reality and assess the present situation regarding Vitamin - D deficiency in the context of the state of Chhattisgarh, India.

### MATERIALS & METHODS

This observational study was conducted after approval from Institution Ethical Committee, in Department of Biochemistry, CIMS Bilaspur, Chhattisgarh, a tertiary care medical college and Hospital. This study included all the patients aged from 11 year to 80 Years, who came hospital from January 2019 to May - 2022 with various complained. Total 1185 patients were considered for analysis of Vitamin D to assess the deficiency of the same. Patients less than one year and more than 80 years were excluded. 01 ml venous blood was obtained, serum was separated and analysis of Vitamin D was carried out by fully automated Chemiluminescence analyzer Access 2 using commercially available kits. Vitamin D deficiency was defined as a serum 25-hydroxyvitamin D level of less than 20 ng/mL, while insufficiency was defined as a level between 20 and 29 ng/mL. Sufficiency was defined as a level of 30 ng/mL or higher.

### RESULT

The study included a total of 1185 participants [Table 1], and their vitamin D levels were analyzed. Among the participants, 37.2% (441 individuals) were found to have a deficiency of vitamin D, indicating insufficient levels. Additionally, 31.6% (375 individuals) had insufficient levels of vitamin D, falling under the category of insufficiency. On the other hand, 31.1% (369 individuals) were classified as having sufficient levels of vitamin D.

The vitamin D levels of study participants were also analyzed based on their gender [Table 2]. Among the 466 male participants, 125 individuals were found to have a deficiency of vitamin D, while 153 individuals had insufficient levels. On the other hand, 188 males had sufficient levels of vitamin D. Among the 719 female participants, 316 individuals were classified as having a deficiency of vitamin D, while 222 individuals had insufficient levels. Conversely, 181 females had sufficient levels of vitamin D.

The vitamin D levels of study participants were further analyzed based on their age groups [Table 3]. Among the 109 participants in the age group of 01-20 years, 52 individuals were found to have a deficiency of vitamin D, while 36 individuals had insufficient levels. In contrast, 21 individuals in this age group had sufficient levels of vitamin D. Among the 488 participants in the age group of 21-40 years, 208 individuals were classified as having a deficiency of vitamin D, while 155 individuals had insufficient levels. Additionally, 125 individuals in this age group had sufficient levels of vitamin D. In the age group of 41-60 years, out of 409 participants, 144 individuals had a deficiency of vitamin D, while 135 individuals had insufficient levels. Conversely, 130 individuals in this age group had sufficient levels of vitamin D. Among the 171 participants in the age group of 61-80 years, 37 individuals were found to have a deficiency of vitamin D, while 46 individuals had insufficient levels. However, a majority of 88 individuals in this age group had sufficient

**Table 1: Vit D Level in study participants.**

Total no. of Subjects	Vit D Level		
	Deficiency	Insufficiency	Sufficiency
1185	441 (37.2%)	375 (31.6%)	369 (31.1%)

**Table 2: Vit D Level in study participants (sex based).**

SEX	Total no. of Subjects	Vit D Level		
		Deficiency	Insufficiency	Sufficiency
MALE	466	125	153	188
FEMALE	719	316	222	181

**Table 3: Vit D Level in study participants (age group based).**

Age Group in Years	Total no. of Subjects	Vit D Level		
		Deficiency	Insufficiency	Sufficiency
11 - 20	109	52	36	21
21 - 40	488	208	155	125
41 - 60	409	144	135	130
61 - 80	171	37	46	88
> 80	8	0	3	5

levels of vitamin D lastly, among the 8 participants above the age of 80; none had a deficiency of vitamin D, while 3 individuals had insufficient levels. On the other hand, 5 individuals in this age group had sufficient levels of vitamin D.

## DISCUSSION

Naturally occurring food sources containing significant amounts of vitamin D include mushrooms, fish, and egg yolk, cod liver oil, and offal such as liver of eel. Fortified foods such as milk, breakfast cereals, juices, yogurt, and supplements also contain vitamin D [4].

Vitamin D enhances the absorption of calcium and phosphorus by 30-40% and 80%, respectively, from the intestine, and maintains a steady state of parathyroid hormone in the blood involved in calcium homeostasis. It also strengthens the innate immunity, modulates immune functions, inhibits cellular proliferation, and stimulates terminal differentiation of cells [5-7]. The increased level of serum PTH stimulates the renal synthesis of calcitriol to maintain optimum intestinal absorption, thus maintaining normal serum calcium levels [8].

Vitamin D promotes chronic diseases such as diabetes mellitus, cancers, autoimmune disorders, and cardiovascular health [9].

According to the Institute of Medicine (IOM) USA, the RDA of vitamin D for adult males and females is 600 IU, and normal serum levels of Calcidiol and calcitriol for sufficiency are >20 ng/mL and >18 pg/mL, respectively [10].

Vitamin D deficiency is present in all age groups, and risk factors include excessive sunscreen use, fat malabsorption, darker skin tone, and aging, increasing indoor lifestyle, glass shielding of sunlight, and clothing that covers the whole body. Vegan diets also increase the risk of deficiency [11].

Vitamin D deficiency is associated with skeletal malformations, rickets in children, and osteomalacia in adults, as well as various diseases such as malignancy, blood pressure and pulse pressure, Parkinsonism, depression, hypertension, age-related macular degenerations, cognitive impairment, and rheumatoid arthritis [12].

Vitamin D availability affects autoimmune disorders such as inflammatory bowel disease and multiple sclerosis. There is strong evidence suggesting that cardiovascular diseases and non-insulin dependent diabetes mellitus are affected by circulating levels of vitamin D. The pandemic of hypovitaminosis D is associated with the recent COVID-19 pandemic, and vitamin D deficiency treatment reduces the incidence of viral respiratory tract infections in high-risk patients by preventing the cytokine storm caused by IL-6 [13].

Vitamin D deficiency is a prevalent health concern in India, as demonstrated by several studies. A study by

Williams et al. found that 82% of Indian adults suffer from Vitamin D deficiency, which is strongly associated with obesity and metabolic syndrome [14]. Similarly, Krishnan et al. found that 69.2% of elderly participants had Vitamin D deficiency, with the highest prevalence in northern India [15]. Babu et al. also reported a high prevalence of Vitamin D deficiency (72.4%) in rural adults in Kolar district, with the highest prevalence in women [16].

Furthermore, Mithal et al. conducted a population-based study in southern India and found that 68.6% of the population had Vitamin D deficiency, with the highest prevalence in women [17]. Harinarayan et al. found that 75% of young adults in an urban population in India had Vitamin D deficiency, with the highest prevalence in winter [18]. Marwaha et al. reported that 79% of urban participants and 73% of rural participants had Vitamin D deficiency [19].

Goswami et al. found that 88% of healthy participants had Vitamin D deficiency, with the highest prevalence in women [20]. Datta et al. reported that 94% of pregnant and lactating women and 99% of their newborns had Vitamin D deficiency in southern India [21]. Nair et al. found that 74.6% of an urban, affluent population had Vitamin D deficiency, while Gupta et al. reported that 61.5% of urban adults in Delhi suffered from Vitamin D deficiency, with the highest prevalence in women [22].

Overall, these studies demonstrate a high prevalence of Vitamin D deficiency in various populations in India, with some groups experiencing an alarmingly high prevalence of deficiency. These findings underscore the need for increased public awareness, regular monitoring, and improved strategies for Vitamin D supplementation and fortification in India.

Our study included 1185 subjects, with 37.2% (441) categorized as having Vitamin D Deficiency, indicating lower-than-normal levels of Vitamin D. Another 31.6% (375) fell under the category of Insufficiency, indicating higher levels than those with Deficiency but still not within the normal range. The remaining 31.1% (369) were categorized as having Sufficiency in their Vitamin D levels, indicating adequate levels of Vitamin D in their body.

When the data was analyzed by gender, it was found that 26.8% of the male subjects had Vitamin D Deficiency, while 32.8% had Insufficiency and 40.4% had Sufficiency. In contrast, 43.9% of the female subjects had Vitamin D Deficiency, while 30.9% had Insufficiency and 25.2% had Sufficiency.

The age group of 21-40 years had the highest prevalence of Vitamin D Deficiency, with 42.6% of the 488 subjects in this age group categorized as having Deficiency. This was followed by the age group of 11-20 years, where 47.7% of the 109 subjects had Vitamin D Deficiency, and the age group of 41-60 years, where 35.2% of the 409 subjects had Deficiency. The age group of >80 years had the lowest prevalence of Vitamin D Deficiency, with

none of the 8 subjects in this group categorized as having Deficiency.

Comparing our results to the studies mentioned earlier, the prevalence of Vitamin D Deficiency in our study is lower than in some studies, such as the studies by Krishnan et al. (69.2%) and Williams et al. (82%), but higher than in other studies, such as the study by Gupta et al. (61.5%). The prevalence of Vitamin D Deficiency among females in our study is similar to that in some studies, such as the study by Marwaha et al. (79% of urban females) and higher than in other studies, such as the study by Goswami et al. (highest prevalence in women, but not reported). The age group with the highest prevalence of Vitamin D Deficiency in our study is similar to that in some studies, such as the study by Harinarayan et al. (highest prevalence in young adults) and higher than in other studies, such as the study by Mithal et al. (highest prevalence in women, but not reported by age group).

Various factors contributing to its high prevalence, one of the primary causes is a lack of exposure to sunlight, as many urban people tend to stay indoors or cover their bodies extensively due to cultural or religious practices. Air pollution is also a contributing factor, as it can decrease the penetration of ultraviolet radiation, which is required for Vitamin D synthesis. Furthermore, dietary factors play a role, as Vitamin D-rich foods are not commonly consumed in India, and a predominantly vegetarian diet further limits the sources of this nutrient. Additionally, the prevalence of obesity, which is linked to Vitamin D deficiency, is increasing in India, contributing to the growing burden of this deficiency.

### CONCLUSION

Our study reveals that a significant percentage of individuals in Chhattisgarh have Vitamin D deficiency or insufficiency. The findings highlight that females and younger age groups are particularly at risk. It is crucial to raise awareness about the importance of adequate Vitamin D levels in maintaining overall health and preventing associated health issues. Regular screening, increased sun exposure, dietary modifications, and Vitamin D supplementation can be effective measures to overcome Vitamin D deficiency. Overall, the study emphasizes the need for concerted efforts towards promoting Vitamin D sufficiency and improving public health outcomes.

### REFERENCES

- Nair R, Maseeh A. Vitamin D: The "sunshine" vitamin. *J Pharmacol Pharmacother* 2012; 3:118-26.
- Feldman D, Pike JW, Adams JS. *Vitamin D: Two-Volume Set*. Academic Press 2011.
- Tseng L. Controversies in vitamin D supplementation. *Nutr Bytes* 2003; 9.
- Lamberg-Allardt C. Vitamin D in foods and as supplements. *Prog Biophys Mol Biol* 2006; 92:33-8.
- Lips PW, Hackeng WH, Jongen MJ, et al. Seasonal variation in serum concentrations of parathyroid hormone in elderly people. *J Clin Endocrinol Metab* 1983; 57:204-6.
- Yin K, Agrawal DK. Vitamin D and inflammatory diseases. *J Inflamm Res* 2014; 69-87.
- Wei MY, Giovannucci EL. Vitamin D and multiple health outcomes in the Harvard cohorts. *Mol Nutr Food Res* 2010; 54:1114-26.
- Lips P. Vitamin D deficiency and secondary hyperparathyroidism in the elderly: consequences for bone loss and fractures and therapeutic implications. *Endocr Rev* 2001; 22:477-501.
- Holick MF. High prevalence of vitamin D inadequacy and implications for health. *Mayo Clin Proc* 2006; 81:353-373.
- IOM. Institute of Medicine. Dietary reference intakes for calcium and vitamin D.
- Holick MF. Vitamin D deficiency. *N Engl J Med* 2007; 357:266-81.
- Ahn J, Peters U, Albanes D, et al. Serum vitamin D concentration and prostate cancer risk: A nested case-control study. *J Natl Cancer Inst* 2008; 100:796-804.
- Roffe-Vazquez DN, Huerta-Delgado AS, Castillo EC, et al. Correlation of vitamin D with inflammatory cytokines, atherosclerotic parameters, and lifestyle factors in the setting of heart failure: A 12-month follow-up study. *Int J Mol Sci* 2019; 20:5811.
- Chomchoei C, Apidechkul T, Wongnuch P, et al. Perceived factors influencing the initiation of methamphetamine use among Akha and Lahu youths: a qualitative approach. *BMC public health* 2019; 19:1-1.
- Girgis CM, Clifton-Bligh RJ, Hamrick MW, et al. The roles of vitamin D in skeletal muscle: form, function, and metabolism. *Endocr Rev* 2013; 34:33-83.
- Tandon VR, Sharma S, Mahajan S, et al. Prevalence of vitamin D deficiency among Indian menopausal women and its correlation with diabetes: a first Indian cross sectional data. *J Mid-Life Health* 2014; 5:121.
- Mithal A, Wahl DA, Bonjour JP, et al. Global vitamin D status and determinants of hypovitaminosis D. *Osteoporos Int* 2009; 20:1807-20.
- Harinarayan CV, Ramalakshmi T, Prasad UV, et al. Vitamin D status in Andhra Pradesh: A population based study. 1. *Indian J Med Res* 2008; 127:211-8.
- Marwaha RK, Tandon N, Garg MK, et al. Vitamin D status in healthy Indians aged 50 years and above. *J Assoc Physicians India* 2011; 59:706-9.
- Goswami R, Gupta N, Goswami D, et al. Prevalence and significance of low 25-hydroxyvitamin D concentrations in healthy subjects in Delhi. *Am J Clin Nutr* 2000; 72:472-5.
- Chakraborti D, Rahman MM, Das B, et al. Groundwater arsenic contamination and its health effects in India. *Hydrogeol J* 2017; 25:1165.
- Gupta A, Prabhakar S, Modi M, et al. Effect of Vitamin D and calcium supplementation on ischaemic stroke outcome: a randomised controlled open-label trial. *Int J Clin Pract* 2016; 70:764-70.