Research Article

Prevalence of Vitamin D Deficiency in Older Patients Visiting Medical OPD in a Tertiary Care Hospital in Kerala

Siju Jose [1*], S Santheev[2]

[1] *Department of General Medicine & Department of Geriatrics, Jubilee Mission Medical College & Research Institute, Thrissur, Kerala, India*
[2] *Department of General Medicine, Sree Gokulam Medical College, Trivandrum, Kerala, India*

(Received: 05-02-2025 Revised: 08-04-2025 Accepted: 14-04-2025)

Corresponding Author: ***Siju Jose***. Email: sijujosekoonan@gmail.com

ABSTRACT

Introduction and Aim: Vitamin D deficiency is a common yet underdiagnosed health issue, particularly among the elderly, leading to various health complications. This descriptive study was conducted to estimate the prevalence of Vitamin D deficiency among older patients visiting the medical outpatient department (OPD) of a tertiary care hospital in Kerala and to assess its association with sun exposure, dietary habits, and common comorbidities.

Materials and Methods: A total of 80 patients aged over 60 years were randomly selected for the study. Participants were assessed for Vitamin D status along with the presence of comorbidities such as diabetes and hypertension. Information on sun exposure and dietary habits, including the intake of green leafy vegetables and dairy products, was collected through structured interviews.

Results: The study found that 46.3% of the patients were Vitamin D deficient, and 16.3% had insufficient Vitamin D levels. There was a significant association between Vitamin D deficiency and limited sun exposure, as well as inadequate dietary intake of green leafy vegetables and dairy products.

Conclusion: The findings emphasize the need for routine screening of Vitamin D deficiency in the elderly population to prevent associated complications such as hypocalcaemia, diabetes, and hypertension. Increased awareness and interventions focusing on adequate sun exposure and dietary modifications are recommended.

Keywords: Vitamin D deficiency; elderly; Kerala; sun exposure; dietary habits; comorbidities.

1. INTRODUCTION

Vitamin D deficiency is a widespread issue in India, with prevalence rates ranging from 70% to 100% in the general population. Despite the availability of abundant sunlight in most parts of the country, various factors contribute to this deficiency, including inadequate fortification of dairy products and cultural practices that limit sun exposure. As a result, subclinical Vitamin D deficiency is highly prevalent across both urban and rural areas. This deficiency is known to play a significant role in the high prevalence of conditions such as rickets, osteoporosis, cardiovascular diseases, diabetes, hypertension, and even infections like tuberculosis. While the fortification of staple foods with Vitamin D has been suggested as an effective countermeasure, Vitamin D deficiency remains one of the most underdiagnosed and undertreated nutritional issues globally [1-3].

Vitamin D is essential for calcium homeostasis, which is critical for biological functions such as muscle contraction, nerve transmission, and blood coagulation. Vitamin D is essential for calcium and phosphorus metabolism and bone health. It also plays a role in muscle strength, immune system modulation, and has been associated with reducing the risk of chronic conditions like diabetes, hypertension, and cardiovascular diseases. In older adults, hypocalcaemia due to Vitamin D deficiency can lead to muscle weakness, recurrent falls, and increased morbidity associated with conditions like diabetes and hypertension [4-7]. Despite its critical role, awareness about Vitamin D supplementation is low, and it affects individuals regardless of age, gender, or geography.

The primary source of Vitamin D is cutaneous synthesis through exposure to ultraviolet B (UVB) radiation [8, 9]. Dietary sources include oily fish (e.g., salmon, mackerel), egg yolks, fortified dairy products, and sun-exposed mushrooms. Serum 25-hydroxyvitamin D [25(OH)D] levels are used to assess Vitamin D status, with sufficiency defined as ≥30 ng/mL, insufficiency as 21–29 ng/mL, and deficiency as <20 ng/mL, according to the Endocrine Society guidelines [9-11].

Beyond its established role in bone health, Vitamin D is intricately involved in multiple metabolic pathways with significant clinical implications. It regulates calcium and phosphorus homeostasis, supports insulin secretion and sensitivity, modulates the renin-angiotensin-aldosterone system (RAAS), and influences immune responses [12,13]. Clinically, Vitamin D deficiency has been associated with a higher risk of developing type 2 diabetes mellitus, hypertension, cardiovascular diseases, muscle weakness, and immune dysregulation. Its active form, 1,25-dihydroxyvitamin D, binds to Vitamin D receptors (VDRs) expressed in various tissues, impacting gene expression related to glucose metabolism, vascular tone, and immune function [14]. Thus, understanding Vitamin D status in older adults is crucial not only for preventing osteoporotic fractures but also for managing a range of metabolic and chronic conditions that commonly affect this population.

Given the aging population and its vulnerability to nutritional deficiencies, evaluating the prevalence and associated factors of Vitamin D deficiency in this group is essential. This study aims to estimate the prevalence of Vitamin D deficiency among older adults visiting the medical OPD of a tertiary care hospital in Kerala and to explore its association with gender, sun exposure, dietary habits, and comorbidities such as diabetes and hypertension.

2. MATERIALS & METHODS

This descriptive, cross-sectional study was conducted at Jubilee Mission Medical College and Research Institute, Thrissur in Kerala, from April 1, 2023 to May 30, 2023. The study aimed to estimate the prevalence of Vitamin D deficiency among older patients (aged 60 years and above) visiting the medical outpatient department (OPD) and to assess its association with gender, sunlight exposure, dietary intake of dairy products, and comorbidities such as diabetes and hypertension.

A sample size of 80 patients was calculated based on a previous study conducted in Wayanad, using a 95% confidence level and 20% relative allowable error. Older patients visiting the OPD were randomly selected, and the following inclusion and exclusion criteria were applied. Patients aged 60 years and above who provided written informed consent were included in the study. Patients on Vitamin D supplements and those diagnosed with chronic kidney disease (CKD) were excluded.

Data were collected using a structured proforma, which recorded demographic information, medical history, and clinical parameters. Key data points included sunlight exposure (hours per day spent outdoors), dietary intake (consumption of green leafy vegetables and dairy products), and the presence of comorbidities like diabetes and hypertension. Clinical measurements such as blood pressure and blood sugar levels were also taken during the patient visit.

For laboratory investigations, blood samples were drawn to assess Vitamin D (25[OH] Vitamin D), serum calcium, and phosphorus levels. Vitamin D status was classified into three categories:

- **Deficient**: 25(OH) Vitamin D < 20 ng/mL
- **Insufficient**: 25(OH) Vitamin D between 20-29 ng/mL
- **Sufficient**: 25(OH) Vitamin D ≥ 30 ng/mL

The data were then analyzed to identify the prevalence of Vitamin D deficiency and its correlation with variables such as gender, dietary habits, sunlight exposure, and comorbidities. Numerical variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages.

The chi-square test was used to assess associations, with a significance level set at $p < 0.05$. Data analysis was performed using Microsoft Excel and statistical software.

The study received approval from the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to their inclusion in the study.

3. RESULTS

The study included 80 older patients, with a mean age of 72.2 ± 8.5 years (range: 60–86 years). Of the total participants, 45% were male (n = 36), and 55% were female (n = 44). Among the 80 patients assessed, 46.3% (n = 37) were Vitamin D deficient, 16.3% (n = 13) had Vitamin D insufficiency, and 37.5% (n = 30) had sufficient Vitamin D levels. Regarding age distribution, 58.8% (n = 47) were ≤70 years old, of which 54.1% (n = 20) had Vitamin D deficiency, 84.6% (n = 11) had insufficiency, and 53.3% (n = 16) had sufficient levels. 16.3% (n = 13) were between 71-80 years old, of which 18.9% (n = 7) were deficient, and 20% (n = 6) were sufficient. 25% (n = 20) were older than 80 years, of which 27% (n = 10) were deficient, 15.4% (n = 2) were insufficient, and 26.7% (n = 8) had sufficient Vitamin D levels (Table 1).

Table1: Age Distribution of Participants (in Years)

Age in years	Frequency	Percent
≤70	47	58.8
71-80	13	16.3
>80	20	25
Total	80	100

Among males, 43.2% (n = 16) had Vitamin D deficiency, 69.2% (n = 9) had insufficiency, and 36.7% (n = 11) had sufficient levels. Among females, 56.8% (n = 21) had Vitamin D deficiency, 30.8% (n = 4) had insufficiency, and 63.3% (n = 19) had sufficient levels. The association between gender and Vitamin D status was not statistically significant ($\chi^2 = 3.972$, $p = 0.137$).

When BMI was compared, 38.8% (n = 31) patients had a BMI between 18.5-23, of which 48.6% (n = 18) were Vitamin D deficient, 15.4% (n = 2) were insufficient, and 36.7% (n = 11) had sufficient Vitamin D. 17.5% (n = 14) had a BMI between 23-25, with 18.9% (n = 7) being deficient and 20% (n = 6) being sufficient. 43.8% (n = 35) had a BMI >25, with 32.4% (n = 12) being deficient, 76.9% (n = 10) being insufficient, and 43.3% (n = 13) having sufficient levels. There was no significant association between BMI and Vitamin D status ($\chi^2 = 8.019$, $p = 0.091$).

When occupation and vitamin D status were compared, among the 80 patients, 85% (n = 68) were unemployed, of which 94.6% (n = 35) had Vitamin D deficiency, 38.5% (n = 5) had insufficiency, and 93.3% (n = 28) had sufficient levels. 7.5% (n = 6) were engaged in business, with 2.7% (n = 1) being deficient, 30.8% (n = 4) being insufficient, and 3.3% (n = 1) being sufficient.7.5% (n = 6) had other occupations, with 2.7% (n = 1) being deficient, 30.8% (n = 4) being insufficient, and 3.3% (n = 1) being sufficient. A statistically significant association was found between occupation and Vitamin D status ($\chi^2 = 26.39$, $p < 0.001$) (table 2).

Table 2: Vitamin D Status by Occupation

Occupation	Vit. D Status						Total	
	Deficiency		Insufficiency		Sufficiency			
	N	%	N	%	N	%	N	%
Unemployed	35	94.6	5	38.5	28	93.3	68	85
Business	1	2.7	4	30.8	1	3.3	6	7.5
Others	1	2.7	4	30.8	1	3.3	6	7.5
Total	37	100	13	100	30	100	80	100

When sun exposure and vitamin D status, among patients who had no sun exposure (n = 37), 75.7% (n = 28) were Vitamin D deficient, and 69.2% (n = 9) were insufficient. None of these patients had sufficient Vitamin D levels. For those with less than 1 hour of sun exposure (n = 10), 24.3% (n = 9) were deficient, and 7.7% (n = 1) were insufficient. For patients with 1-2 hours of sun exposure (n = 14), none had deficiency, but 23.1% (n = 3) had insufficiency, and 36.7% (n = 11) had sufficient Vitamin D levels. Among those with more than 2 hours of sun exposure (n = 19), all had sufficient Vitamin D levels. There was a highly significant association between sun exposure time and Vitamin D status ($\chi^2 = 75.086$, $p < 0.001$) (Table 3).

Table 3: Vitamin D Status by Sun Exposure Time

Sun exposure time	Vit. D Status						Total	
	Deficiency		Insufficiency		Sufficiency			
	N	%	N	%	N	%	N	%
No sun exposure	28	75.7	9	69.2	0	0	37	46.3
<1 hour	9	24.3	1	7.7	0	0	10	12.5
1-2 hour	0	0	3	23.1	11	36.7	14	17.5
>2 hour	0	0	0	0	19	63.3	19	23.8
Total	37	100	13	100	30	100	80	100

When dietary habits and vitamin D status, a total of 78.8% (n = 63) of patients reported inadequate intake of green leafy vegetables or dairy products, and all of these patients were either Vitamin D deficient (n = 37) or insufficient (n = 13).

Among the 21.3% (n = 17) who reported adequate intake, none were Vitamin D deficient or insufficient. There was a strong association between dietary habits and Vitamin D status ($\chi^2 = 35.979$, $p < 0.001$).

When comorbidities and vitamin D status were compared, among patients with diabetes mellitus (DM), 42.5% (n = 34) had diabetes, with 40.5% (n = 15) of them being Vitamin D deficient and 61.5% (n = 8) being insufficient. No significant association was found between diabetes and Vitamin D status ($\chi^2 = 2.404$, $p = 0.301$). Among patients with hypertension (HTN), 70% (n = 56) had hypertension, of which 62.2% (n = 23) were Vitamin D deficient, 76.9% (n = 10) were insufficient, and 76.7% (n = 23) had sufficient levels. No significant association was found between hypertension and Vitamin D status ($\chi^2 = 2.014$, $p = 0.365$). Patients with dyslipidemia (DLP) showed a significant association with Vitamin D status ($\chi^2 = 12.124$, $p = 0.002$) (Table 4).

Table 4: Prevalence of Comorbidities Among Participants

Comorbidities	Frequency	Percent
DM	34	42.5
HTN	56	70
DLP	6	7.5
CAD	9	11.3
CVA	13	16.3

4. DISCUSSION

Our study identified that 46.3% of older patients attending the OPD had Vitamin D deficiency, with an additional 16.3% showing insufficiency, highlighting a considerable burden among the elderly population. These findings are consistent with earlier studies reporting high rates of deficiency in India, where prevalence ranges from 70% to 100% in different age groups and settings (15, 16). Despite adequate sunlight availability, the deficiency persists—likely due to factors such as skin pigmentation, aging-related changes in cutaneous Vitamin D synthesis, and socio-cultural habits limiting sun exposure.

In contrast to some earlier findings, our study did not observe significant gender differences in Vitamin D levels. This contrasts with studies suggesting higher deficiency rates among women, possibly due to traditional clothing and reduced outdoor activity [17]. The absence of a gender difference in our study population could reflect similar lifestyle patterns and sun exposure across genders in this age group.

A significant association was noted between low Vitamin D levels and lack of sun exposure, corroborating findings from a 2017 meta-analysis of healthy Indians, which identified that insufficient sunlight exposure is a major contributor to Vitamin D deficiency, especially in populations with prolonged indoor activity [18]. Furthermore, a lack of dietary intake of green leafy vegetables and dairy products was significantly associated with Vitamin D deficiency, consistent with studies from the US, where milk intake was positively correlated with higher Vitamin D levels [19].

Dietary habits also played a crucial role. Participants with low intake of green leafy vegetables and dairy products had significantly higher rates of deficiency. This is in line with findings from studies in both India and Western populations, where dietary Vitamin D intake—particularly from fortified foods like milk—has shown a positive impact on serum 25(OH) D levels [20, 21]. However, in India, the lack of widespread food fortification and irregular supplementation contributes to the persistence of deficiency.

Interestingly, while our study found a significant association between elevated blood sugar levels and Vitamin D deficiency, similar to findings in studies conducted in Andhra Pradesh [22], there was no significant relationship between Vitamin D deficiency and hypertension, contrary to previous research from the Amrita School of Medicine [23].

Overall, our findings reaffirm the multifactorial etiology of Vitamin D deficiency in older adults and the need for public health strategies focused on screening, dietary improvement, safe sun exposure, and potentially supplementation.

Given the known associations of Vitamin D with metabolic, cardiovascular, and musculoskeletal health, addressing this deficiency is essential to improving the quality of life and clinical outcomes in this vulnerable age group.

Limitations

Small sample size might have affected the determination of association of several variables. Use of single value of Vitamin D level may not be ideal.

5. CONCLUSION

This study found a high prevalence of Vitamin D deficiency in older patients attending a tertiary care hospital in Kerala. Lack of sun exposure and inadequate dietary intake of dairy products and green leafy vegetables were significant contributors to deficiency. Given the role of Vitamin D in preventing complications such as hypocalcemia, diabetes, and myopathy, it is essential to screen and manage Vitamin D levels in older adults, particularly in regions where sun exposure is limited.

Acknowledgement

We express our sincere gratitude to Mridula Vellore, Sr. Research Assistant of Jubilee Center for Medical Research for editing this article.

Conflict of Interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

Funding Information

No Funding was received for this research work.

Ethical Information

The Institutional ethical committee approved the study

REFERENCES

1. VanSchoor N.M., Lips P. Worldwide Vitamin D status. *Best Pract.Res.Clin.Endocrinol.Metab.* 2011;25:671-680
2. Mithal A., Wahl D A., Bonjour J.P., Burckhardt p., et al. Global vitamin D status and determinants of hypovitaminosis D, *Osteoporosis Int.* 2009;20:1807-1820.
3. Van der Meer I.M., Middelkoop B.J., Boeke A.J., Lips P. Prevalence of Vitamin D deficiency among Turkish, Moroccan, Indian and sub-Sahara African populations In Europe and their countries of origin; An overview. *Osteoporosis. Int.* 2011;22:1009-1021
4. Bullamore J R, Wilkinson R, Gallagher J C, Nordin BE, Marshall DH. Effect of age on Calcium Absorption. *Lancet.* 1970;2(7672);535-7.
5. Aldasouqi S, Glassy C M, Glassy M S, Treska A, Caldwell-McMillan M, Gossain V. Asymptomatic severe hypocalcemia secondary to Vitamin D deficiency in an elderly patient. *Case Report Endocrinology* 2011.Nov 2; 2011:830952.
6. Liu C, Tang L, Goel P, Chambers T, Kokot N, Sinha U, et al. A practical mathematic method to predict and manage hypocalcemia after parathyroidectomy. *Ann Otol Rhinol Laryngol.* 2020 Jan;129(1):70-7.
7. Levin A, Bakris GL, Molitch M, Smulders M, Tian J, Williams LA, *et al.*, Prevalence of abnormal serum Vit D, PTH, Calcium and phosphorous in patients with CKD: results of the study to evaluate early kidney disease. *Kidney Int.* 2007;71(1):31-38.
8. Chen TC, Chimeh F, Lu Z, Mathieu J, Person KS, Zhang A, Kohn N, Martinello S, Berkowitz R, Holick MF. Factors that influence the cutaneous synthesis and dietary sources of vitamin D. *Archives of biochemistry and biophysics.* 2007 Apr 15;460(2):213-7.
9. Vitamin D. Fact sheet for health professionals. Natl. Institutes Heal. *Off. Diet. Suppl.* Available online https//ods. od. nih. gov/factsheets/VitaminC-Health Professional. 2017.
10. Vaes AM, Brouwer-Brolsma EM, van der Zwaluw NL, van Wijngaarden JP, Berendsen AA, van Schoor N, van der Velde N, Uitterlinden A, Lips P, Dhonukshe-Rutten RA, de Groot LC. Food sources of vitamin D

and their association with 25-hydroxyvitamin D status in Dutch older adults. *The Journal of steroid biochemistry and molecular biology*. 2017 Oct 1; 173:228-34.

11. Harika RK, Dötsch-Klerk M, Zock PL, Eilander A. Compliance with dietary guidelines and increased fortification can double vitamin D intake: a simulation study. *Annals of Nutrition and Metabolism.* 2017 Jan 7;69(3-4):246-55.
12. Argano C, Mirarchi L, Amodeo S, Orlando V, Torres A, Corrao S. The role of vitamin D and its molecular bases in insulin resistance, diabetes, metabolic syndrome, and cardiovascular disease: state of the art. *International journal of molecular sciences.* 2023 Oct 23;24(20):15485.
13. Secondulfo C, Visco V, Virtuoso N, Fortunato M, Migliarino S, Rispoli A, La Mura L, Stellato A, Caliendo G, Settembre E, Galluccio F. Vitamin D: A Bridge between Kidney and Heart. Life. 2024 May 10;14(5):617.
14. Judd SE, Tangpricha V. Vitamin D deficiency and risk for cardiovascular disease. *The American journal of the medical sciences.* 2009 Jul 1;338(1):40-4.
15. Harinarayan CV, Ramalakshmi T, Prasad UV, *et al.*, High prevalence of low dietary calcium, high phytate consumption, and Vitamin D deficiency in healthy south Indians. *Am J Clin Nutr.* 2007; 85(4):1062–1067.
16. Ritu G, Gupta A. Vitamin D deficiency in India: Prevalence, causalities and interventions. Nutrients. 2014;6(2):729–775.
17. 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(2):472–475.
18. Selvarajan S, Gunaseelan V, Anandabaskar N, Xavier AS, Srinivasamurthy S, Kamalanathan SK, *et al.*, Systematic review on vitamin D level in apparently healthy Indian population and analysis of its associated factors. *Indian J Endocrinol Metab.* 2017;21:765-75.
19. Torres-Gonzalez M, Cifelli CJ, Agarwal S, Fulgoni VL 3rd. Association of milk consumption and vitamin D status in the US population by ethnicity: NHANES 2001-2010 analysis. *Nutrients*. 2020;12:3720.
20. Yetley EA. Assessing the Vitamin D status of the US population. *Am J Clin Nutr*. 2008;88(2):558S–564S.
21. Calvo MS, Whiting SJ, Barton CN. Vitamin D intake: A global perspective of current status. *J Nutr.* 2005;135(2):310-316.
22. Kumar PS, Vinapamula KS, Suchitra MM, Sachan A. Study on the association of Vitamin D with glycaemic control in patients with type 2 diabetes mellitus. *J Clin Sci Res* 2019;8:188-192. [doi: 10.4103/JCSR.JCSR_96_19].
23. Vatakencherry RM, Saraswathy L. Association between vitamin D and hypertension in people coming for health check up to a tertiary care centre in South India. *J Family Med Prim Care.* 2019;8:2061-67