SRYAHWA PUBLICATIONS

Archives of Pulmonology and Respiratory Medicine
ISSN: 2639-362X | Volume 7, Issue 1, 2024
https://doi.org/10.22259/2639-362X.0701003

RESEARCH ARTICLE

Vitamin D3 Level in Patients with Random Respiratory Symptoms in Khulna, Bangladesh

Dr. Shahad Rashid Mohammad Saiful Aziz[1*], Dr. Anjuman Ara[2], Dr. Anika Tabassum Aziz[3]

[1]Ex Assistant Professor, Department of Respiratory Medicine, Khulna Medical College Hospital, Khulna, Bangladesh.

[2]Assistant Professor, Department of Gyn & Obs, Khulna Medical College Hospital, Khulna, Bangladesh.

[3]Trainee Doctor, Khulna City Medical College Hospital, Khulna, Bangladesh.

Received: 01 April 2024 Accepted: 15 April 2024 Published: 16 April 2024

Corresponding Author: Dr. Shahad Rashid Mohammad Saiful Aziz, Ex Assistant Professor, Department of Respiratory Medicine, Khulna Medical College Hospital, Khulna, Bangladesh.

Abstract

Introduction: Common respiratory symptoms like coughing and shortness of breath indicate lung health, with conditions like chronic bronchitis and wheezing affecting millions. Vitamin D deficiency is prevalent and linked to respiratory infections, although conclusive evidence from clinical trials is lacking.

Aim of the Study: This study aims to investigate the relationship between vitamin D3 levels and the severity of random respiratory symptoms.

Methods: A retrospective cohort study conducted at the Department of Respiratory Medicine in Khulna Medical College and Hospital, Khulna, Bangladesh, enrolled 122 patients with respiratory symptoms. Consent was obtained from participants, who were divided into vitamin D insufficiency (below 30ng/mL) and sufficiency (above 30 ng/mL) groups. Inclusion criteria comprised individuals over 15 years with respiratory symptoms, while exclusion criteria included lack of consent, hypersensitivity to vitamin D3, and contraindicated pathologies. Data were analyzed using SPSS and presented in tables and graphs for clarity.

Results: The study involved 122 patients divided into two groups based on their vitamin D3 levels. The majority had levels below 30ng/mL (91.80%), with the remaining (8.20%) above this threshold. Age distribution varied, with most below 30ng/mL falling in the 26-50 range, while those above were more evenly spread. Females dominated the below 30ng/mL category, whereas males were more prevalent above. Urban residents were less likely to have levels above 30ng/mL, while rural residents were higher below. The correlation between random respiratory symptoms and vitamin D3 levels showed various chronic pain symptoms prevalent in those below 30ng/mL.

Conclusion: The study highlights a significant association between vitamin D3 levels and random respiratory symptoms. Patients with vitamin D3 levels above 30 ng/mL exhibited various respiratory symptoms, suggesting a potential correlation between vitamin D sufficiency/insufficiency and lung function.

Keywords: Vitamin d3, Insufficiency, Sufficiency and Random Respiratory Symptoms.

1. Introduction

The human body relies on a consistent intake of oxygen to sustain vital metabolic functions essential for life. Collaborating closely with the circulatory system, the respiratory system ensures the delivery of oxygen and the elimination of metabolic waste products. Additionally, it plays a crucial role in maintaining the blood's pH balance [1]. Respiratory symptoms encompass a spectrum of signs indicative of the health of the lungs and respiratory system.

Citation: Dr. Shahad Rashid Mohammad Saiful Aziz, Dr. Anjuman Ara, Dr. Anika Tabassum Aziz. Vitamin D3 Level in Patients with Random Respiratory Symptoms in Khulna, Bangladesh. Archives of Pulmonology and Respiratory Medicine. 2024;7(1): 11-15.

These manifestations can be diverse, potentially indicating various conditions that affect breathing and overall respiratory well-being. Common respiratory symptoms include coughing, shortness of breath (dyspnea), chest discomfort or pain, coughing up blood (hemoptysis), among others [2,3].

Respiratory symptoms are widespread and linked to unfavorable consequences. For instance, dyspnea, experienced by approximately a quarter to a third of adults, typically occurs during exertion and is correlated with increased disability and elevated mortality risk [4,5]. Chronic bronchitis (CB) affects between 5% to 25% of adults and is linked with declines in lung function, restrictions in physical activity, and exacerbations of chronic obstructive pulmonary disease (COPD) [6,7].

Wheezing affects between 5% to 16% of adults and is correlated with restrictions in physical activity [7,8]. The presence of respiratory symptoms frequently initiates an assessment for potential respiratory diseases [9]. As obtaining confirmation through pathology is invasive and not commonly accessible, respiratory diseases are often diagnosed using spirometry to identify airflow obstruction or restrictive patterns, collectively termed spirometric respiratory impairment [9,10].

Airflow obstruction encompasses conditions like asthma and COPD, whereas restrictive patterns involve diseases affecting the chest wall, respiratory muscles, pleura, or lung parenchyma [9]. Typically, the biologically active form of vitamin D is 1,25-dihydroxyvitamin D3 [1,25(OH)2D3], primarily synthesized from precursors in the skin via the influence of ultraviolet B(UVB) radiation acting on 7-dehydrocholesterol. Additionally, vitamin D can be obtained from dietary sources, including fortified dairy products and cereals, as well as oily fish and fish liver oils, albeit to a lesser extent [11].

However, studies have indicated that vitamin D deficiency affects approximately 30-50% of both children and adults across regions such as the United States, Canada, Europe, Australia, New Zealand, and Asia [12]. Reduced levels of 25-hydroxyvitamin D3 have been linked to a higher susceptibility to respiratory tract infections.

While the exact mechanism remains unclear, vitamin D3 has been demonstrated to stimulate the production of antimicrobial peptides in immune cells [13]. Furthermore, active vitamin D3 (1,25(OH)D3) exerts extensive anti-inflammatory effects on the adaptive immune system by altering the balance of T helper cell populations, favoring a shift from a Th1/Th17-response to a Th2/Treg-dominated response [14]. Vitamin D3 has demonstrated the ability to suppress the Th2-response in allergic bronchopulmonary aspergillosis. Therefore, it is evident that vitamin D3 influences both the adaptive and innate immune systems [13,15].

The majority of evidence regarding vitamin D3 and its effects on infections comes from in vitro experiments and retrospective observational studies. However, findings from randomized controlled trials (RCTs) investigating the impact of vitamin D3 on infections are inconclusive. Therefore, larger clinical trials are needed to provide more definitive conclusions on this matter [16]. This study aims to investigate the relationship between vitamin D3 levels and the severity of random respiratory symptoms.

2. Methodology and Materials

This was a retrospective cohort study conducted at the Department of Respiratory Medicine in Khulna Medical College and Hospital, Khulna, Bangladesh. A total of 122 patients with respiratory symptoms were enrolled and analyzed. Before collecting data, consent was obtained from every participant. Patients were categorized into the vitamin D insufficiency group (plasma 25-OH vitamin D <30 ng/mL) and the vitamin D3 sufficiency group (plasma 25-OH vitamin D ≥30 ng/mL).

Inclusion criteria:

- Patients more than 15 years.
- Both males and females.
- Patients with random respiratory symptoms.

Exclusion criteria:

- Patients who did not have informed consent from their parents, or guardians.
- Patients with a history of hypersensitivity to VD3.
- Patients with pathologies in which VD3 administration is contraindicated.

3. Statistical Analysis

All data were presented in a suitable table or graph according to their affinity. A description of each table and graph was given to understand them clearly. All statistical analysis was performed using the statistical package for social science (SPSS) program, and Windows.

4. Results

In this study, 122 patients were enrolled and analyzed into two groups, where the majority of participants had D3 levels below 30ng/mL (91.80%), and the rest of the 10(8.20%) patients were above 30ng/mL (Figure 1). The distribution of age groups according to their vitamin D3 levels is outlined in Table 1.

Among those with levels below 30ng/mL, the majority (47.32%) fell within the 26-50 age range, followed by 41.96% above 50 and 10.71% aged under 15-25 years. Conversely, in patients with D3 levels above 30ng/mL, seven patients were aged under 15-25 years, 20.00% were above 50 years, and only one patient was under 26-50. Gender distribution across different vitamin D3 levels is summarized in Table 2. Females dominated the below 30ng/mL category (61.61%) compared to males (38.39%), while in the above 30ng/mL group, 80.00% were males and 20.00% were females. Residency distribution concerning vitamin D3 levels is illustrated in Table 3.

Urban residents above 30ng/mL notably exceeded rural residents (67.86% vs. 32.14%). Conversely, in the below 30ng/mL category, rural residents were higher (80.00%) than urban residents (20.00%).Table 4 exhibits the correlation between random respiratory symptoms and vitamin D3 levels. Among individuals with levels above 30ng/mL, low back pain was prevalent in 26.67%, extremities in 26.67%, and 46.67% reported other chronic pain symptoms.

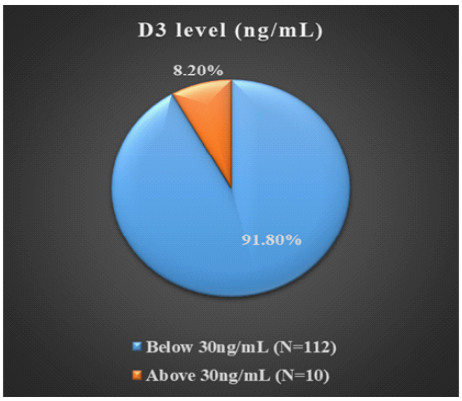

Figure 1. *Vitamin D3 level status (N=122).*

Table 1. *Age distribution based on vitamin D3 level.*

Age range (in year)	Below 30ng/mL (N=112)		Above 30ng/mL (N=10)	
	n	%	n	%
15-25	12	10.71	7	70.00
26-50	53	47.32	1	10.00
Above 50	47	41.96	2	20.00

Table 2. *Gender distribution based on vitamin D3 level.*

Gender	Below 30ng/mL (N=112)		Above 30ng/mL (N=10)	
	n	%	n	%
Male	43	38.39	8	80.00
Female	69	61.61	2	20.00

Table 3. *Residencydistribution based on vitamin D3 level.*

Residency	Below 30ng/mL (N=112)		Above 30ng/mL (N=10)	
	n	%	n	%
Rural	36	32.14	8	80.00
Urban	76	67.86	2	20.00

Table 4. *Correlation between random respiratory symptoms with vitamin D3 level.*

Symptoms	Below 30ng/mL (N=112)		Above 30ng/mL (N=10)	
	n	%	n	%
Extremities	26	17.45	4	26.67
Low back pain	60	40.27	4	26.67
Other chronic pain	63	42.28	7	46.67

5. Discussion

In this study, patients with vitamin D3 levels above 30 ng/mL exhibited random respiratory symptoms. Additionally, Vitamin D levels correlated positively with lung function, as measured by FEV1. Further analysis of each CAT item based on vitamin D status revealed associations not only with respiratory symptoms, such as the amount of phlegm, chest tightness, and breathlessness when walking upstairs, but also with non-respiratory symptoms, suggesting that differences in vitamin D3 levels might reflect the overall poor health status of COPD patients [17].

Our findings demonstrated an association between vitamin D3 sufficiency/insufficiency and random respiratory symptoms. Interestingly, Burkes et al. demonstrated a link between vitamin D levels and respiratory symptoms in middle-aged COPD patients [18]. This disparity could be explained by variations in D3 levels among patients aged 15-25 years, 26-50 years, and above 50 years. The Burkes study primarily included middle-aged patients, while the majority of our study's participants were under 15-25 years old.

Thus, we hypothesized that the association between vitamin D3 levels and respiratory symptoms might be more pronounced relative to COPD severity rather than age itself. Regarding vitamin D3 levels below 30ng/mL, our study revealed a female predominance, while patients with levels above 30ng/mL showed a male predominance. Young's study reported that over 90% of their participants with levels above 30ng/mL were male [17].

Besides respiratory symptoms, non-respiratory symptoms were significantly more prevalent in patients with vitamin D insufficiency/deficiency compared to those with sufficiency. However, due to the cross-sectional nature of the study, causality between vitamin D and these symptoms cannot be determined conclusively, though lower vitamin D3 levels may contribute to respiratory impairment [19].

Vitamin D exhibits antibacterial and antiviral effects, with various studies suggesting a clinical association between vitamin D insufficiency and respiratory infections. For instance, a Finnish study on 800 healthy men found that those with 25-OH vitamin D levels <40 mol/L had significantly more days of absence from duty due to respiratory infections [20]. Furthermore, vitamin D has diverse immunomodulatory effects [21-24], and dysregulated immune responses associated with vitamin D3 insufficiency/sufficiency can lead to chronic inflammation and worsen clinical symptoms.

In our current study, we observed that among patients with vitamin D3 levels above 30ng/mL, respiratory symptoms such as extremity and low back pain were reported by 26.67% of participants, while 46.67% experienced other chronic pain. Conversely, patients with D3 levels below 30ng/mL reported a higher prevalence of low back pain.

Limited literature is available on the relationship between vitamin D3 insufficiency/sufficiency and random respiratory symptoms. Limitations of the study:Limitations of the study include its retrospective design, which may introduce selection bias and hinder the establishment of causal relationships. Additionally, the study's focus on random respiratory symptoms without specific diagnostic criteria for respiratory diseases may lead to variability in symptom interpretation and diagnosis.

Finally, the cross-sectional nature of the study prevents establishing temporality and causality between vitamin D3 levels and respiratory symptoms accurately.

6. Conclusion

In conclusion, our study highlights a significant association between vitamin D3 levels and random respiratory symptoms among patients in Khulna, Bangladesh. Patients with vitamin D3 levels below 30 ng/mL exhibited various respiratory symptoms, suggesting a potential correlation between vitamin D sufficiency/insufficiency and lung function. While causality cannot be definitively determined due to the study's cross-sectional nature, lower vitamin D3 levels may contribute to respiratory impairment and exacerbate clinical symptoms. Further research, including more extensive clinical trials, is warranted to elucidate the mechanisms underlying this relationship and inform potential interventions.

7. References

1. Ward JP, Ward J, Leach RM. The respiratory system at a glance. John Wiley & Sons; 2010 Sep 20.
2. Doležalová K, Fajt M, Leová L, Heinige P. Dyspnea, hemoptysis, and fever progressing to acute respiratory failure: A didactic story with a happy ending. Pediatric Pulmonology. 2023 Sep;58(9):2456-61.
3. Simon LM, Jaqua EE, Nguyen V, Tran MN. Respiratory Symptom Evaluation in Adults: Chronic Cough. FP essentials. 2023 May 1;528:7-11.
4. Mark B, Parshall MR, Schwartzstein AL, Banzett B, Harold L, Manning BJ, Peter M, Calverley AG, Meek M. American Thoracic Society Statement: Update

on the Mechanisms. Assessment and Management of Dyspnoea on behalf of the ATS Committee on Dyspnoea October. 2011.

5. Huijnen B, van der Horst F, van Amelsvoort L, Wesseling G, Lansbergen M, Aarts P, Nicolson N, Knottnerus A. Dyspnea in elderly family practice patients. Occurrence, severity, quality of life and mortality over an 8-year period. Family practice. 2006 Feb 1;23(1):34-9.
6. de Oca MM, Halbert RJ, Lopez MV, Perez-Padilla R, Tálamo C, Moreno D, Muino A, Jardim JR, Valdivia G, Pertuzé J, Menezes AM. The chronic bronchitis phenotype in subjects with and without COPD: the PLATINO study. European Respiratory Journal. 2012 Jul 1;40(1):28-36.
7. Marcus BS, McAvay G, Gill TM, Vaz Fragoso CA. Respiratory symptoms, spirometric respiratory impairment, and respiratory disease in middle-aged and older persons. Journal of the American Geriatrics Society. 2015 Feb;63(2):251-7.
8. Arif AA, Delclos GL, Lee ES, Tortolero SR, Whitehead LW. Prevalence and risk factors of asthma and wheezing among US adults: an analysis of the NHANES III data. European Respiratory Journal. 2003 May 1;21(5):827-33.
9. Vaz Fragoso CA, Gill TM. Respiratory impairment and the aging lung: a novel paradigm for assessing pulmonary function. Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences. 2012 Mar 1;67(3):264-75.
10. Pellegrino R, Viegi G, Brusasco V, Crapo RO, Burgos F, Casaburi RE, Coates A, Van Der Grinten CP, Gustafsson P, Hankinson J, Jensen R. Interpretative strategies for lung function tests. European respiratory journal. 2005 Nov 1;26(5):948-68.
11. van Etten E, Mathieu C. Immunoregulation by 1, 25-dihydroxyvitamin D3: basic concepts. The Journal of steroid biochemistry and molecular biology. 2005 Oct 1;97(1-2):93-101.
12. Hovsepian S, Amini M, Aminorroaya A, Amini P, Iraj B. Prevalence of vitamin D deficiency among adult population of Isfahan City, Iran. Journal of health, population, and nutrition. 2011 Apr;29(2):149.
13. Bergman P, Norlin AC, Hansen S, Rekha RS, Agerberth B, Björkhem-Bergman L, Ekström L, Lindh JD, Andersson J. Vitamin D3 supplementation in patients with frequent respiratory tract infections: a randomised and double-blind intervention study. BMJ open. 2012 Jan 1;2(6):e001663.
14. Daniel C, Sartory NA, Zahn N, Radeke HH, Stein JM. Immune modulatory treatment of trinitrobenzene sulfonic acid colitis with calcitriol is associated with a change of a T helper (Th) 1/Th17 to a Th2 and regulatory T cell profile. Journal of Pharmacology and Experimental Therapeutics. 2008 Jan 1;324(1):23-33.
15. Hewison M. Vitamin D and immune function: an overview. Proceedings of the Nutrition Society. 2012 Feb;71(1):50-61.
16. Yamshchikov AV, Desai NS, Blumberg HM, Ziegler TR, Tangpricha V. Vitamin D for Treatment and Prevention of Infectious Diseases; A Systematic Review of Randomized Controlled Trials. Endocrine Practice. 2009 Jul 1;15(5):438-49.
17. Lee CY, Shin SH, Choi HS, Im Y, Kim BG, Song JY, Lee D, Park HY, Lim JH. Association between vitamin D level and respiratory symptoms in patients with stable chronic obstructive pulmonary disease. International Journal of Chronic Obstructive Pulmonary Disease. 2022 Mar 17:579-90.
18. Burkes RM, Couper DJ, Barjaktarevic IZ, et al. Age-dependent associations between 25-hydroxy vitamin D levels and COPD symptoms: analysis of SPIROMICS. J COPD Foundation. 2021;8(2):277. doi:10.15326/jcopdf.2020.0180
19. Girgis CM, Clifton-Bligh RJ, Hamrick MW, Holick MF, Gunton JE. The roles of vitamin D in skeletal muscle: form, function, and metabolism. Endocr Rev. 2013;34(1):33–83. doi:10.1210/er.2012-1012
20. Laaksi I, Ruohola JP, Tuohimaa P, et al. An association of serum vitamin D concentrations < 40 nmol/L with acute respiratory tract infection in young Finnish men. Am J Clin Nutr. 2007;86(3):714–717. doi:10.1093/ajcn/86.3.714
21. Prietl B, Treiber G, Pieber TR, Amrein K. Vitamin D and immune function. Nutrients. 2013;5(7):2502–2521. doi:10.3390/nu5072502
22. Rahman A, Hershey S, Ahmed S, Nibbelink K, Simpson RU. Heart extracellular matrix gene expression profile in the vitamin D receptor knockout mice. J Steroid Biochem Mol Biol. 2007;103(3–5):416–419. doi:10.1016/j.jsbmb.2006.12.081
23. Greiller CL, Martineau AR. Modulation of the immune response to respiratory viruses by vitamin D. Nutrients. 2015;7(6):4240–4270. doi:10.3390/nu7064240
24. Greiller CL, Suri R, Jolliffe DA, et al. Vitamin D attenuates rhinovirus-induced expression of intercellular adhesion molecule-1 (ICAM-1) and platelet-activating factor receptor (PAFR) in respiratory epithelial cells. J Steroid Biochem Mol Biol. 2019;187:152–159. doi:10.1016/j.jsbmb.2018.11.013